STUDIES IN THE HISTORY AND ARCHAEOLOGY OF JORDAN
V

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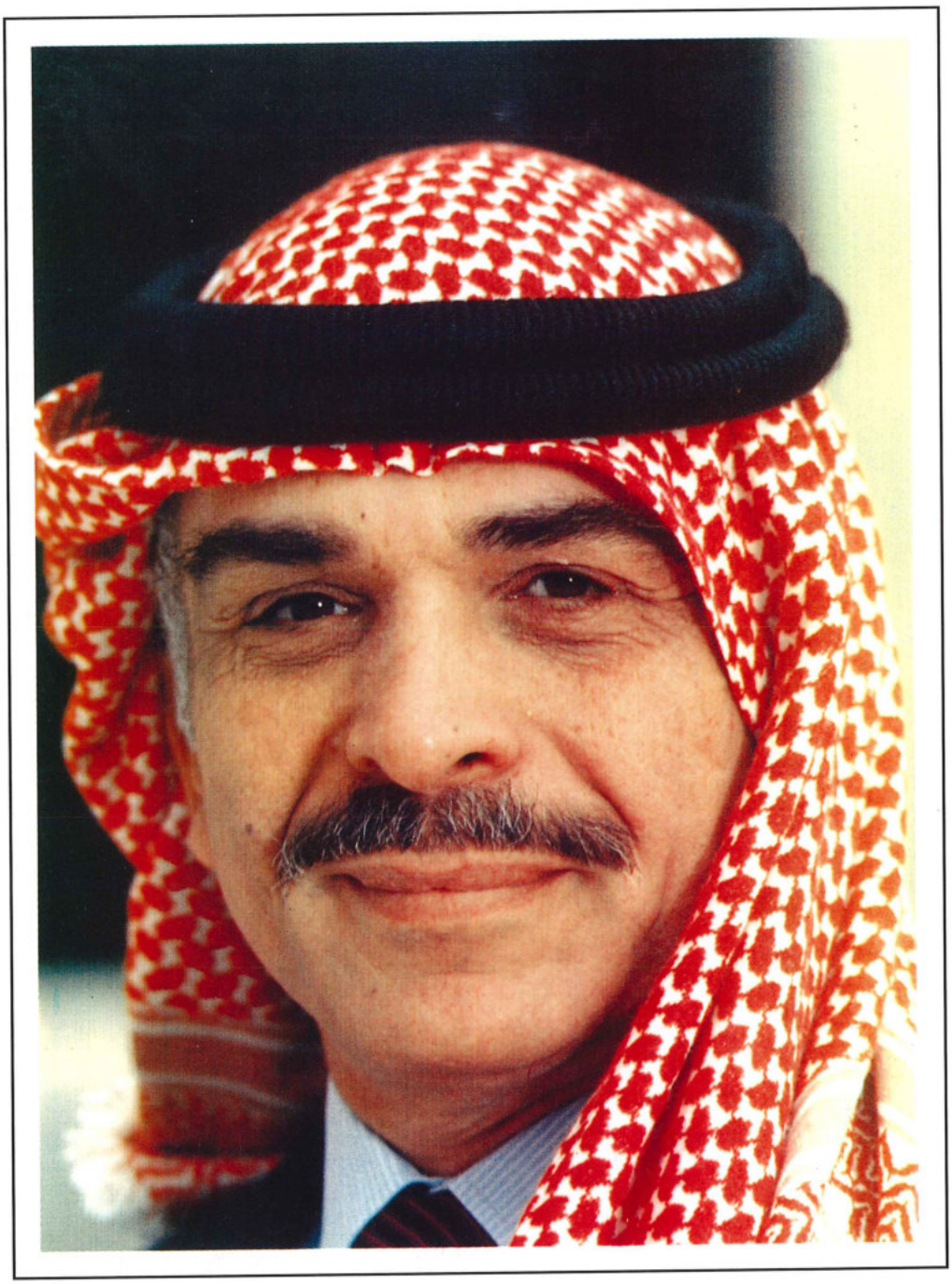
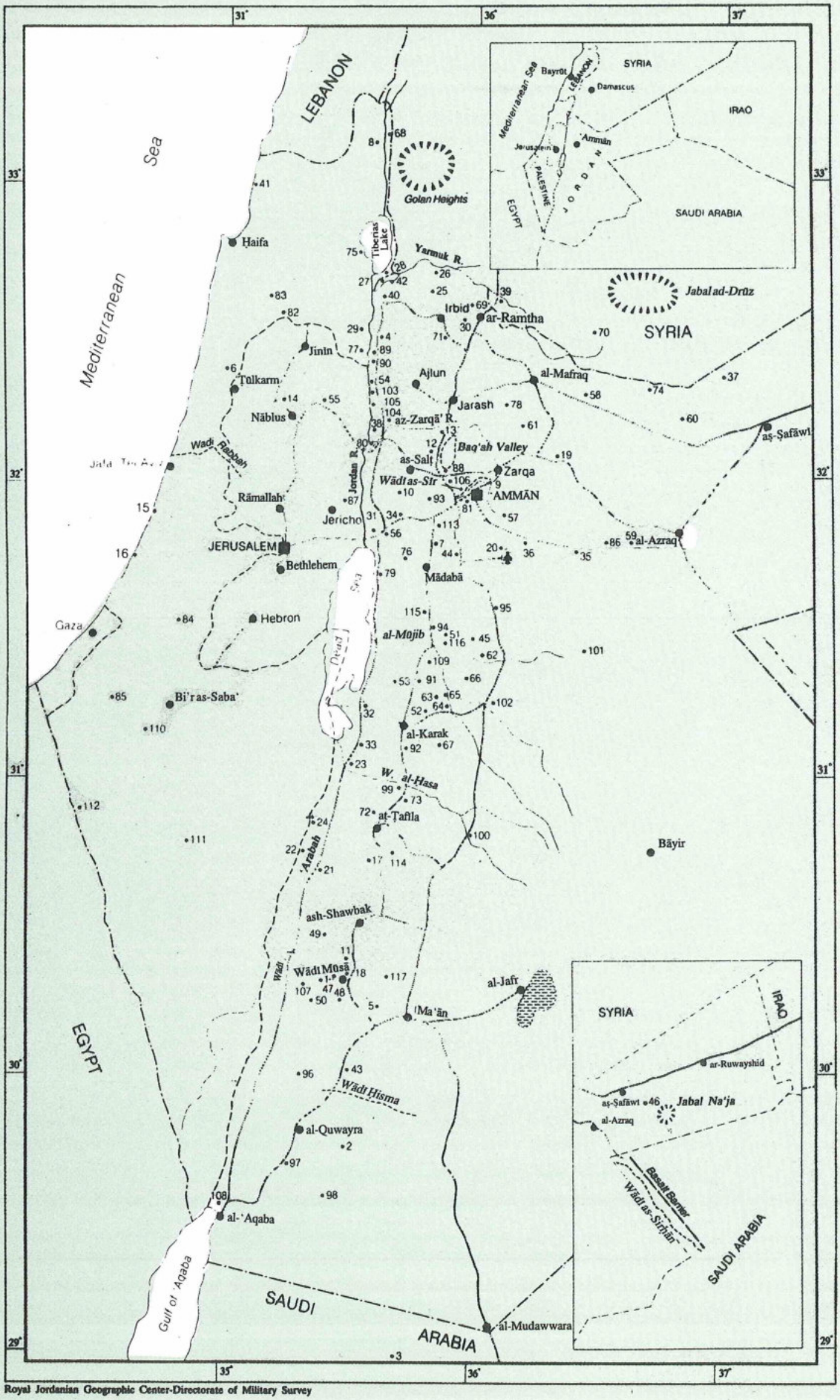


**His Majesty King Hussein**
**of the Hashemite Kingdom of Jordan**



**His Royal Highness**
**Crown Prince Hassan**

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KEY

1 Petra
2 Wādī Ramm
3 Madā'in Ṣāliḥ (Ḥegra)
4 Ṭabaqat Faḥl (Pella)
5 Basṭa (al-Basṭa)
6 Qāqūn
7 Ḥisbān
8 Baysamūn
9 'Ayn Ghazāl
10 Wādī Shu'ayb (site)
11 Bayḍa
12 Khirbat Umm ad-Danānīr
13 Abū Thawwāb
14 Samaria
15 Ashdūd
16 'Asqalān
17 Buṣayra
18 Ṭawīlān
19 Qaṣr al-Ḥallābāt
20 Qaṣr al-Mushatta
21 Faynān
22 Khirbat an-Nuḥās
23 aṣ-Ṣāfī
24 Khirbat al-Jāriya
25 Bayt Rās
26 Quwayliba (Abila)
27 al-Ḥammah (al-Ḥimma)
28 al- Qahwānah
29 Munḥaṭṭa
30 'Ayn Rāḥūb
31 Ghrubba
32 Bāb adh-Dhrā'
33 Numayra (an-Numayra)
34 Tall Iktanū
35 Qaṣr al-Kharrāna
36 al-Muwaqqar
37 Jāwā
38 Tall Umm Ḥammād
39 Dar'ā (Adhrī'āt, Adraa)
40 ash-Shūna ash-Shamāliyya
41 'Akka (Acre)
42 Umm Qays (Gadara)
43 Rās an-Naqab
44 al-Qasṭal
45 Umm ar-Raṣāṣ
46 Dhuwayla
47 al-Wu'ayra
48 Ṣabra
49 Ba'ja
50 Umm al-'Amad
51 'Arā'ir
52 Adir
53 Khirbat Fāris
54 Tall Abū Ḥāmid
55 Tall al-Fār'a (North)
56 Tulaylāt al-Ghassūl
57 Saḥāb
58 Umm al-Jimāl (Umm aj-Jimāl)
59 Qaṣr al-'Uwaynid
60 Dayr al-Kahf
61 Khirbat as-Samra (as-Samrā')
62 Qaṣr ath-Thurayya
63 Khirbat al-Fityān
64 Rujm Banī Yāsir
65 al-Lajjūn
66 Qaṣr Bshīr
67 Qaṣr Abū Rukba
68 Tall 'Anafa
69 Khirbat az-Zayraqūn (az-Zarāqūn)
70 Buṣra
71 Aydūn
72 'Aymā
73 Khirbat adh-Dharīḥ
74 Umm al-Quṭṭayn
75 Ṭabariyyah (Tiberias)
76 Ṣiyagha (Mount Nebo)
77 Baysān
78 Riḥāb
79 'Ayn az-Zāra
80 Katārit as-Samrā'
81 Umm Udhayna
82 Ṭa'annak
83 Megiddo
84 Lachish
85 Tall al-Fār'a (South)
86 Quṣayr 'Amra
87 Khirbat al-Mafjar
88 Tall Ṣāfūṭ
89 Tall al-Ḥayyāt
90 Tall Abū an-Ni'āj
91 al-Qaṣr
92 Mu'ta
93 'Irāq al-Amīr
94 Dhībān
95 Ḍab'ah
96 Ḥumayma
97 Khirbat al-Khāldī
98 Ramm
99 Khirbat at-Tannūr
100 al-Ḥasa
101 Qaṣr aṭ-Ṭūba
102 al-Qaṭrāna
103 Tall as-Sa'īdiyya
104 Tall Dayr 'Allā
105 Tall al-Mazār
106 Tall Sīrān
107 Umm al-Biyāra
108 Tall al-Khalayfī
109 al-Bālū'
110 al-Khālṣa
111 'Abda (Oboda)
112 'Auja al-Ḥafīr (Nessana)
113 Tall al-'Umayrī
114 Gharandal (Arindela)
115 Khirbat Iskandar
116 al-Lāhūn
117 Udhruḥ



THE HASHEMITE KINGDOM OF JORDAN

# STUDIES IN THE HISTORY AND ARCHAEOLOGY OF JORDAN V

## List of Abbreviations

| | |
|---|---|
| *AA* | American Antiquity |
| *AAA* | Annals of Archaeology and Anthropology |
| *AAAS* | Annales Archéologiques Arabes Syriennes |
| *AASOR* | Annual of the American Schools of Oriental Research |
| *ADAJ* | Annual of the Department of Antiquities of Jordan |
| *AfO* | Archiv für Orientforschung |
| *AJ* | Antiquaries Journal |
| *AJA* | American Journal of Archaeology |
| *ANRW* | Aufstiegh und Niedergang der Römischen Weolt |
| *ASAE* | Annales du Service des Antiquités de l'Égypte |
| *AUSS* | Andrews University Seminary Studies |
| *BA* | Biblical Archaeologist |
| *BASOR* | Bulletin of the American Schools of Oriental Research |
| *BEO* | Bulletin d'Études Orientales |
| *BIA* | Bulletin of the Institute of Archaeology, University of London |
| *BIES* | Bulletin of the Israel Exploration Society |
| *CRAI* | Comptes Rendus de l'Académie des Inscriptions et Belles Lettres |
| *EI* | Encyclopaedia of Islam |
| *IEJ* | Israel Exploration Journal |
| *JAOS* | Journal of the American Oriental Society |
| *JARCE* | Journal of the American Research Center in Egypt |
| *JDAI* | Jahrbuch des Deutschen Archäologischen Instituts |
| *JbRGZM* | Jahrbuch des Römisch-Germanischen Zentral Museums |
| *JNES* | Journal of Near Eastern Studies |
| *JRA* | Journal of Roman Archaeology |
| *JRAS* | Journal of the Royal Asiatic Society |
| *JRS* | Journal of Roman Studies |
| *JSS* | Journal of Semitic Studies |
| *LA* | Liber Annuus |
| *PEFA* | Palestine Explortion Fund Annual |
| *PEFQS* | Palestine Explortion Fund, Quarterly Statement |
| *PEQ* | Palestine Exploration Quarterly |
| *PSAS* | Proceedings of the Seminar for Arabian Studies |
| *QDAP* | Quarterly of the Department of Antiquities in Palestine |
| *RB* | Revue Biblique |
| *RDAC* | Reports of the Department of Antiquities of Cyprus |
| *REA* | Revue des Études Anciennes |
| *REI* | Revue des Études Islamiques |
| *WA* | World Archaeology |
| *ZDPV* | Zeitschrift des Deutschen Palästina-Vereins |

# Foreword and Acknowledgements

This volume presents the papers submitted to the fifth International Conference on the History and Archaeology of Jordan, which was held at the Jordan University of Science and Technology in Irbid between 12-17 April, 1992, under the patronage of H.R.H. Crown Prince Hassan. The theme of the conference, "Art and Technology in Jordan Throughout the Ages" is a vast subject embracing a wide spectrum of activities carried out over the millennia by many peoples. It covers subjects ranging from lithics, pottery and glass, to architecture and city planning, through the areas of agriculture and food production, irrigation, fortifications and mining, as well as many other facets of human activity. Monuments which testify to people's achievements in art, architecture and technology during the various periods dot the landscape of Jordan as wild flowers grace the hills of the country on a Spring day. These are a segment of the remote but lively saga of Jordan's history which is closely linked to the great civilisations of the Near East.

In the opening speech to the first International Conference on the History and Archaeology of Jordan, held at Oxford University, H.R.H. Crown Prince Hassan noted that, "we speak so much today of the need for technological advance, but in terms of the need for a new humanitarian order, it is hoped that as we look at the humanitarian requirements of identifying our past, present, and future, that archaeology and history will serve to identify areas of commonality: common ground between civilisations." The international character of the conference, with participants from many countries, demonstrates not only the high interest enjoyed by the archaeology of Jordan among scholars in many parts of the world, but also can help in identifying the areas of commonality to which His Royal Highness has alluded.

The papers presented in this volume show clearly the extent to which the various scientific disciplines have become involved in archaeological research. Geologists, geographers, palaeobotanists, and physical and cultural anthropologists are frequently found on excavation staffs. Thus archaeology has become a team project rather than the province of the individual specialist.

A conference of the kind held at the Jordan University of Science and Technology would not have been possible without the support, help, and cooperation of many academic institutions and individuals. It is my pleasant duty to acknowledge some of them here.

To H.R.H. Crown Prince Hassan, who initiated the idea of triennial conferences to promote active research in the history and archaeology of Jordan, we

are particularly grateful for his unfailing support and continuous interest. Our sincere thanks are also extended to H.E. Dr. Kamil Ajlouni, President of the Jordan University of Science and Technology for his considerable help and for putting the excellent facilities of this prestigious institution at the disposal of the Department of Antiquities. I would also like to thank Dr. Safwan Tell, former director of the Department of Antiquities, for his efforts that have gone into the preparation and organisation of the conference. Those responsible for editing, compiling and laying out the book have in certain cases worked under considerable difficulties; a special word of thanks is due to them. I should not omit to record my deep appreciation to the employees of the Department of Antiquities, the national academic institutions, and the various archaeological centres in Amman whose participation, support, and help contributed to the success of the conference.

*Dr. Ghazi Bisheh*
*Director General of Antiquities*
*Ministry of Tourism and Antiquities, Amman*

# Speeches

**Monsieur le Ministre,**
**Monsieur le Président,**
**Monsieur le Directeur Général,**
**Chers Collègues,**

Comme vous le savez, l'année 1992 est une année olympique, et à cette occasion la flamme, partie de Grèce, gagne le pays organisateur. De la même manière, je rapporte aujourd'hui en Jordanie la flamme qui avait été confiée à la France, pour la 4ème conférence. La France, l 'Université Lumière Lyon 2 et la Maison de l'Orient ont été très sensibles à l'honneur qui leur avait été fait d'organiser cette manifestation. Un éclat particulier lui avait été donné, avec, outre le congrès, I'exposition de mosaïques jordaniennes inaugurée par sa Majestèe la Reine Nur.

Les liens tissés dans le domaine de l'archéologie entre la Jordanie et la France sont nombreux, même s'ils ne sont pas les plus anciens. Les pionniers dans ce domaine sont le regretté Père Starcky et le Professeur Will, présent aujourd'hui. Ces liens ont pris une tournure plus institutionnelle avec la création en 1978 à 'Ammān de l'IFAPO qui venait s'ajouter aux autres Instituts étrangers.

De nombreuses opérations conduites par l'IFAPO ou d'autres équipes françaises ont été réalisées ou sont en cours dans le domaine de la préhistoire, de l'archéologie plus récente, de l'épigraphie grecque et arabe, de l'ethnoarchéologie. L'énumération des sites donnera une idée de cette diversité: Azraq, Petra, 'Irāq al- Amīr, 'Ammān, Jarash, Quwayliba, Khirbat adh-Dharīḥ, Ḥallābāt, Quṣayr 'Amra, Mafraq, Samra, Smākiyya, 'Ayma. Certaines de ces opérations s'effectuent en collaboration avec le Département des Antiquités où travaille depuis longtemps notre ami Fawzi Zayadine. D'autres opérations ont lieu avec l'Université du Yarmouk, comme la fouille d'Abū Ḥāmid, ainsi que de nombreux échanges d'enseignants et d'étudiants. D'autres projects sont prévus avec l'Université de Jordanie à 'Ammān.

Il est peu de pays où l'activité archéologique soit aussi judicieusement répartie entre équipes nationales et missions étrangères et où la collaboration soit aussi féconde. II est peu de pays, aussi, où l'on se donne le temps et les moyens d'organiser à intervalles réguliers de telles rencontres, où circule l'information, où s'élaborent les résultats de la recherche archéologique, où s'ébauchent les collaborations de demain.

Que, pour toutes ces raisons, les autorités jordaniennes reçoivent l'expression de notre gratitude. Et je souhaite maintenant un plein succès à la 5ème conférence.

*Olivier Aurenche*
*Directeur de la Maison de l'Orient*

The present conference on the History and Archaeology of Jordan is the fifth in a series that presents evidence for the fascination of the international academic community with the vast record of past Jordanian cultures, so diverse and so rich with human experience.

I would like to welcome our distinguished guests from abroad and to express Jordan's gratitude for their enthusiastic response to our invitation to share their valuable findings about the history and culture of Jordan. Equally praise worthy are the efforts of Jordanian scholars contributing to this conference. I certainly do understand the burden of maintaining academic excellence in a developed country like Jordan.

The topic of this conference "Art and Technology in Jordan Throughout The Ages" was carefully and deliberately chosen because of its relevance not only to Jordan's past but also to its present and future.

The great wealth of findings unearthed by numerous excavations have disclosed the existence of cultures with advanced technical skills and entrepreneurship in agriculture, architecture, industry and water management. Throughout history Jordanians had no trouble utilizing, adopting and perhaps discovering new technologies. I have previously alluded to the confidence building in Jordan's ability to adopt and adapt to modern day technologies through a study of the past. I have specifically asked for the organization of the exhibition to go along with the conference for this very purpose.

Our awareness of the importance of the past has allowed us to capitalize on this concept in a very effective manner. Close examination of the largely under-populated eastern region of Jordan reveals the threat of desertification and a rapid loss of the Fauna and Flora. However, archaeological findings give clear evidence of the numerous human settlements, agricultural or otherwise, that have existed in the eastern Bādiya region. More than 100 ruins of palaces, dams, reservoirs, cisterns and canals are known there. The Bādiya project, run by the Higher Council for Science and Technology of Jordan, aims at promoting modern human settlements in, and curbing down rural migration from the region. To achieve this, research is being carried out in water harvesting, pasture improvement, combating desertification, and re-introducing extinct Fauna and Flora species. Development of human resources in these areas is one of the main goals of the project.

As another example, a project has been recently launched to study the

Nabataean Water Management System in Petra. The "Electricité de France" in collaboration with Jordanian authorities will study the region with modern techniques to plan for water harvesting and building dams and dikes, with full consideration given to the older Nabataean system. Apart from the large quantity of fresh water that could be made available to the inhabitants round Petra, the new system will be designed with the purpose of protecting the ancient site and tourists against the seasonal floods during wintertime.

If excavations bear such relevance to our present and future, then their importance, not only from the point of view of the historian, cannot be denied. I have witnessed the rapid growth in excavation activities in many historic sites in Jordan; I have also witnessed the growing number of Jordanians involved in, or even leading, such an endeavor. To this I give my full support. The effort must continue and must be sustained.

Within the efforts towards protection of our monuments, the Jarash Restoration Project has been the major activity for the last ten years. The Petra Preservation Project is picking up pace. I was particularly pleased by the extent of Jordanian participation in the recent exhibition arranged by the (IFAPO), "Institut Française d'Archaeologie du Proche-Orient". Equally gratifying is the international enthusiasm both in research and funding to support the project. We are still a long way, though, from effective intervention due to the lack of appropriate financial and human resources. The fight against natural weathering in this site adds a particularly troublesome dimension to the conservation efforts.

The Petra Preservation Project must not be restricted to saving the stone monuments. Touristic and socio-economic development of the Wādī-Mūsā region around the site is equally important. Could the inhabitants of the region be taught to develop small industries producing folklore artifacts? Semi-precious stones are abundant in the region and could be polished for sale to the tourist. Could the inhabitants be taught to use modern methods to imitate the fine Nabataean ceramic articles? since such an imitation has recently succeeded at Yarmouk University, I see no reason why the skill cannot be passed on to the "Nabataeans" of this day and age.

The major obstacle for facing the preservation of Petra is probably the development of a Master Plan, which should encompass the concept of a National Park within the concept of sustainable development that I have refered to. Fortunately, UNESCO has just allocated a fund to support an expert mission to lay out such a Master Plan. I do hope that the Jordanian contribution to this plan will be substantial and effective. Our scientists, architects and engineers must share their experiences with the foreign team and must give their input towards preparing a carefully laid out plan. Their contribution will eventually mean a commitment to the support, coordination and implementation of the plan. I am particularly encouraged by the superb coordination and cooperation between all the concerned Jordanian institutions.

Given the large cost that excavations incur, and the financial difficulties that Jordan faces, a new way of thinking is needed within the concept of sustainable development that we subscribe to. The large number of artifacts and monuments that excavations unearth, must be restored, conserved and protected against the ravages of man and nature. The excavation site, with the riches it holds, must be turned into a touristic attraction within a plan that keeps a good balance between protection of the site and the economic benefits of tourism.

Jordan's efforts in the Preservation of Monuments and historic artifacts seems to lag behind vis a vis the more rapid pace of excavation. Thus, there is a definite need to develop indigenous human resources in this important area, just as there is a need for the National Museum which we are planning for. Large strides in upgrading our museums system will greatly improve our conservation efforts.

I would like to leave you here with the thought that all our efforts and endeavors are about man. In Jordan, we believe that human resources are our best asset, and man's well being foremost in our priorities.

Archaeology should be a study of Man's past for the benefit of today's Man. The protection of our cultural heritage constitute an important corner stone in our strife to achieve sustainable development for the benefit of the modern Jordanian and generations to come.

*Opening address by His Royal Highness, Crown Prince Hassan (delivered in his absence by His Excellency Mr. Yanal Hikmat, Minister of Tourism and Antiquities ).*

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**Patrick E. McGovern**

# Technological Innovation and Artistic Achievement in the Late Bronze and Iron Ages of Central Transjordan

It has been claimed that "the motive power of a culture...lies in its technology, for here it is that energy is harnessed and put to work" (White 1949). If so, then adopting the best technology available, from whatever source, or developing it locally is of supreme importance for any culture.

In our pragmatic world, technology is divorced from art, with rare exceptions (e.g. computer graphics). In antiquity, by contrast, art and technology were intimately associated. Cyril Stanley Smith (1970), a metallurgist and historian of science, has stressed that technology is the integrated work of man's hand, eye, and mind, individuals being responsible for inventions. An equally important concept, emphasized by Smith, is that technological advance is often motivated by aesthetic as well as practical considerations.

The association of "Art and Technology" and its impetus to cultural development is evident throughout the archaeological record of Jordan — from the Neolithic plaster statues to the monumental stone architecture of the Decapolis cities to the frescoes of the Umayyad desert palaces. To assess adequately such achievements, including the two case studies from the Late Bronze and Iron Ages of central Transjordan that are presented here, a range of theoretical issues need to be addressed.

## A Theoretical Framework

Technology is tied to art, because any artistic expression depends on its medium, viz., the extent to which materials and production methods set specific boundary conditions as to which styles are possible and most suitable.

Pottery-making illustrates this close coupling of art to its medium (McGovern 1986b), which also applies to other crafts and industries. In brief, the form and decorative details of a pottery vessel are the end-products of a complex, industrial sequence. Beginning with the selection and preparation of raw materials (clay and tempering materials), the process continues with fabrication (whether by coiling, slab-building, wheel-throwing, etc.), definition of rims, bases, and other features by scraping, smoothing, slipping, and/or painting of the surface, baking the vessels in the sun, and finally firing them in a kiln or an open fire.

There is nothing special *per se* about this sequence of pottery-making operations; potters the world over go through essentially the same steps. Pottery industries, however, will differ because of raw material quality — some potters have access to better clays or are more adept at preparing their clays — or equipment availability (power-driven turntables and high-temperature kilns, for example, enable a better product to be produced more efficiently).

Because of the close association between art and its medium, the emergence and subsequent development of a stylistic tradition is very much dependent on the underlying technological traditions. In general, any stage in the industrial sequence may impact on another stage in the same sequence. For example, the beautifully contoured and painted Chocolate-on-White/White Slip vessels, dating to Late Bronze IA and concentrated at many sites in the Jordan Valley and on the plateau, could only be achieved within a wheel-throwing tradition which employed fine clays, slips, and paints.

Once a stylistic tradition, which is well adapted to underlying technological traditions, has been established, some variations will occur within the constraints of materials and methods. A strong conservative tendency is partly due to the repetitive tasks of pottery-making, which require complex hand-eye coordination and are often learned at a young age. Fixed motor habits are needed to make numerous pottery vessels of the same type. But, stylistic changes are made intentionally (if only to relieve the boredom!), and others occur unconsciously, as it were, over extended time periods (and are particularly valuable in the archaeological seriation and dating of pottery types). But what does it take to introduce a major change in materials, techniques, and ultimately styles?

Cross-cultural contacts can have a major impact on how native industries change and develop (McGovern

1989a). These contacts can be direct through trade goods, itinerant craftsmen, written records, or native craftsmen being educated abroad; or ideas, whether written or oral, and materials can be transmitted through second-party and more distant purveyors. The contacts can be voluntary or forced. Hands-on, apprenticeship training in a craft is especially effective in transferring technology. Such transferrals generally involve adaptations, even innovations, due to cultural and environmental differences.

The styles and techniques of one craft, however, can also be transferred to or "borrowed" from another craft within the same society, especially if their workshops are near one another. Pyrotechnologies illustrate the point: once fire has been used in making lime plaster or simply cooking food, other materials — clay, metals, silicates — might intentionally or accidentally be treated with it. Firing temperatures for different materials will differ, and modifications and adaptations of kilns, such as the standard double-chambered pottery kiln (with separate firing and baking chambers) in contrast to a small single-chamber unit for smelting metal ore, will be needed.

Lacking adequate textual evidence, some critical factors in the transfer process will never be known. Besides material and technical constraints (raw materials, climate, water regimes, tools, and so forth), which can be assessed to varying extents, very little information may be available about the specific social arrangements (for example, land-tenure and inheritance practices) and other political and economic factors (labor supply, capital formation and investment, craft secrecy, the extent to which artifacts are markers of status, diet, group identity, religious values, etc.).

In the Third World today, the potter may not be able to afford a wheel or a high-temperature kiln, or be able to hire additional assistants to expand his operation. To appeal to the tourist trade or the art market, changes in traditional technology and styles can be a necessity (Graburn 1976). Investment costs, with an uncertain outcome, must consequently be weighed against the economic survival of the craftsman and his/her family.

The low socio-economic status of many craft specialists in societies around the world today, however, need not have been the case in antiquity. Ceramic materials, for example, as among the earliest man-made synthetics, were viewed as almost miraculous replications of naturally occurring minerals, metals, and other substances, often associated with specific deities (McGovern 1989b). Judging from the large percentage of cultic and other special artifacts made from pottery, silicate materials, and metals found in public buildings and tombs, these crafts and industries were often of central cultural significance. Even Egyptian gods were willing "to get their hands dirty"; Khnum, a major god of creation, is often depicted in reliefs as a potter throwing vessels and other divine figures on a turntable. Lesser human practitioners of such crafts might then have risen to higher socio-economic positions and had more opportunity for experimentation in a relatively "open" society — i.e., one that is willing and able to entertain non-traditional religious, artistic, and technological concepts.

As a final theoretical point, if one were to single out the most important long-term, internal cultural factor contributing to technological and artistic change, that would be increasing social stratification and political centralization, often accompanied by increasing population (for references, see McGovern 1989a). This development can markedly alter the supply and demand conditions of production by enlarging markets, creating better transportation systems, concentrating capital formation, and contributing to more diversified tastes and needs within the society. Assuming that rational economic decisions will eventually prevail, any threat to the existing power structure has been minimized, and craftsmen or their organizations have access to capital and are "open" to change, then changes in the craft's organization (for example, from household to mass production), investment structure, and products (by targeting specialized sectors of the market) will be the ultimate outcome. By the multiplier effect, the emergence of a specialized industry, here considered as the independent variable, could propel the culture in the direction of ever greater stratification and centralization.

Because of the numerous permutations of the various environmental, individual, and cultural factors in any given instance of artistic creation or technological innovation, many different outcomes are possible. The dominant matrix of factors leading to a particular outcome can sometimes be reconstructed *ex post facto,* but the predictive power of this "general systems" model is limited. Reconstructing the origins and subsequent development of an ancient style or technique solely on the basis of archaeological evidence is extremely precarious. Archaeological data represent a very small, highly selective fraction of the original technology. Even with written contemporaneous records, which present their own problems of interpretation, it is doubtful that the relative significance of the various factors involved in a given instance of an artistic or technological achievement can be unequivocally demonstrated.

## Two Case Studies from Jordan: Iron/Steel Jewelry and Stone Statuary

These theoretical considerations of how art and technology are interrelated and can change or remain the same through time, set the stage for two instances of innovative developments under very different cultural circumstances during the Late Bronze and Iron Ages of

central Transjordan.

*The Iron/Steel Jewelry of Transjordan*

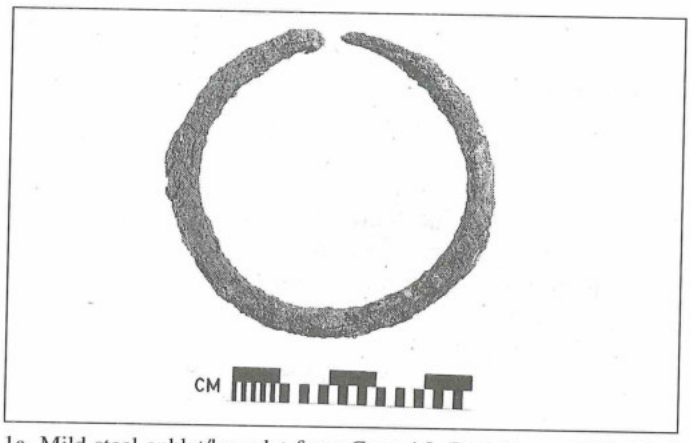
In updating my treatment of a central Transjordanian iron and mild steel industry, beginning toward the end of the Late Bronze Age and continuing into the Iron Age, there is no need to reiterate the stylistic and technological details of the jewelry from the Baq'a Valley here (McGovern 1986a) (FIG. 1a-c). Suffice it to say that the eleven iron/steel anklets, bracelets, and rings, together with forty additional fragments, from the Baq'a Valley, constituted a significant increase in the number of published iron artifacts from Jordan.

Similar iron jewelry artifacts of early Iron date had already been reported from sites within a 10 to 50 km radius of al-Baq'a — in tombs at nearby Mādabā (Harding 1953) and on Jabal an-Nuzha in 'Ammān (Dajani 1966). One weapon — an iron knife — was found in a tomb at Tall as-Sa'īdiyya in the Jordan Valley (Pritchard 1980: 20, FIG. 15.6). Most recently (1987), iron jewelry of the same types as those from al-Baq'a have been reported from a tomb at Pella of early Iron Age date, with over a hundred burials (pers. comm., S. J. Bourke, May 19, 1988). Technical analyses of this jewelry from Pella, as well as Mādabā, Jabal an-Nuzha, and Tall as-Sa'īdiyya, have not yet been published, so it is uncertain whether they are made of iron or a true steel.

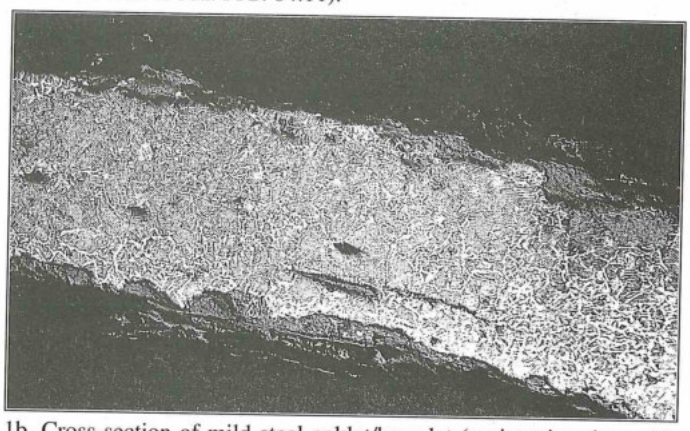
The Pella discovery is intriguing in view of a single piece of steel from the same site, which was first reported to be of Middle Bronze Age date (Smith *et al.* 1984), over 500 years earlier than the early Iron Age group. Not surprisingly, the Middle Bronze piece is now seen as belonging to the end of the Late Bronze Age (Smith 1984: 474). The transitional Late Bronze-Iron Age jewelry at Pella indicates that iron — very likely steel — jewelry was available on a fairly large scale during this period.

Iron or steel artifacts of early Iron Age date, including jewelry, weapons, and tools, have also been excavated at other eastern Mediterranean sites (Waldbaum 1978) — in particular Cyprus and Syria, where large groups are reported. For example, thirty-five iron objects, mainly jewelry, from Period I tombs at Ḥamā have been published. Jordan, however, is now clearly "on the map," and if the Jordanian discoveries of the last fifteen years are any measure, the numbers and relative percentages for Transjordan compared to other regions could become even more pronounced in the future.

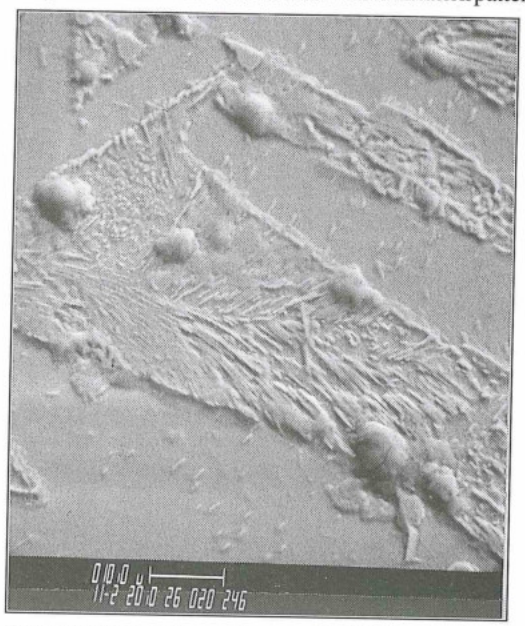
When analyses of Palestinian iron artifacts, with well-preserved intact metal, have been done, they have often turned out to be of a mild steel (Muhly *et al.* 1990). Why is the early iron from these sites so often steel? Is the new metal the result of an intentional, innovative process or simply an accidental accompaniment of ironworking?




1a. Mild steel anklet/bracelet from Cave A2 (Late Bronze IA), Jabal al-Hawāya, Baq'a Valley (registration data with line-drawings in McGovern 1986a: FIG. 84.11).



1b. Cross-section of mild steel anklet/bracelet (registration data with line-drawings in McGovern 1986a: FIG. 84.54) at 24x magnification, showing extensive carburization with Widmanstatten patterning.



1c. Scanning electron micrograph, 1100x, of anklet/bracelet cross-section shown in 1b. Nodular carbides are visible at the interface between pearlite and ferrite regions. (Photographs courtesy of N. Hartmann and H. Moyer).

Although some of the metallographic evidence is open to debate, the prevalence of iron and steel during this period at a number of sites in the eastern Mediterranean points to intentionality, if only at the empirical level — i.e., knowing how to steel iron without being able to explain the process scientifically. The al-Baq'a jewelry thus shows uniform carburization throughout the cross-section of the metal artifacts which were examined.

If steeling iron artifacts were an intentional development, then the question may be posed whether the initial impetus for the innovation of steel at this time necessarily involved the mechanical properties of the metal? If one follows the traditional view that the Philistines, one of the Sea Peoples, introduced ironworking into Palestine near the beginning of the Iron Age (Wright 1939), then it is a short step to proposing that iron and/or steel was of particular importance in conquering the native peoples and environment, i.e., as weapons in war and as axes and ploughs to clear forests and plow fields for agriculture.

Transjordan clearly underwent a major cultural transformation at approximately the same time that the Sea Peoples were establishing themselves in the Levant. The Late Bronze city-state system of Transjordan collapsed, and a dispersed network of small villages emerged, with a much lower standard of living and fewer foreign contacts in the early Iron Age (McGovern 1986a). Except for the single Tall as-Sa'īdiyya knife, however, the mild steel artifacts from the Transjordan are exclusively jewelry items. Their ornamental nature would then suggest that the hardness of the metal was less important to the smith than its aesthetic qualities: color, sheen, and/or the jingling sound of a pair of anklets or bracelets that were worn together. Aesthetic appeal need not involve magic (cf. Muhly *et al.* 1990). Rather, mild steel artifacts could be another example of the adoption of a new form or process, perhaps as visible symbols of a new order. Iron/steel jewelry could also be a repository of wealth. The shift from wheel-thrown to coil-built pottery, with the appearance of several new types in Iron IA, also reflects the artistic and technological change of the period (McGovern 1986a; 1986b).

Where were the steel artifacts made that have been excavated in Transjordan? There is no compelling reason for arguing that these artifacts had to be imported. The pottery found in the tombs at the various sites in central Transjordan are of local types, and other artifacts, apart from marine shells, are of types common enough at many early Iron Age sites on the plateau and elsewhere in Palestine.

It has been argued that the adoption of iron technology in its early stages throughout the eastern Mediterranean area was encouraged by a reduced or inconsistent availability of copper and/or tin (Snodgrass 1971; Maddin *et al.* 1977). As a result of the sociopolitical upheavals that characterized the last two centuries of the second millennium BC, trade routes from Afghanistan, where important tin ores are known to have been exploited in the second millennium, would have been cut off, and craftsmen would have turned to alternative metal ores.

The consistently high tin bronzes of early Iron Age jewelry from al-Baq'a (averaging 10.6% tin), much higher than the tin contents of bronzes of earlier date in the same region (average of 7.8% for the Late Bronze period from c. 1550 to 1200 BC), suggest that this model does not apply to the Transjordanian plateau. A similar phenomenon has recently been documented for early Iron Age Greece (Waldbaum 1989), where high-tin bronze artifacts — often jewelry — are found in association with iron artifacts. Unless they had a means of enriching the tin contents of older bronzes, which is highly unlikely, the local metalsmiths must still have had additional supplies of tin. Other Near Eastern tin sources — in Anatolia, Egypt, and Lebanon — are known, but whether they were exploited in the early Iron Age is unknown. Even if these mines were worked and the ores processed, one would still need to explain how during a period of evident contraction in trade, tin reached Transjordan and Greece.

Waldbaum (1989) interprets these findings in light of Wertime's hypothesis (1982; 1983) that extensive deforestation of the Near East had occurred by the later second millennium. Since iron ore is more efficiently smelted than copper ores (Horne 1982), iron production might then have gradually gained in importance as a response to ecological pressures. In fact, copper smelting need not be more inefficient (see references in Muhly *et al.* 1990), depending upon other variables (type of furnace, beneficiation of ores, etc.). Thus, even if it can be demonstrated that environmental deterioration occurred toward the end of the Late Bronze Age (Waldbaum 1989: 119-120), the ecological model for the shift from copper/bronze to iron/steel is inherently weak.

Another scenario may be proposed for the innovation of iron and steel in Transjordan (McGovern 1987). In the wake of economic and social dislocations at the end of Late Bronze Age, the urban population apparently dispersed into hinterland areas where alternative subsistence strategies were required. Under these circumstances, new ores might have been experimented with and a new technology of ironworking might have been developed, which included the steeling of the metal (cf. Stech-Wheeler *et al.* 1981). Although the necessary impetus for the full development of an iron/steel industry might have come from farther afield, the available archaeological evidence from central Transjordan, where few foreign contacts are evident in the Iron IA period, suggests that a na-

tive iron/steel industry was established near the end of the Late Bronze Age.

Iron ore deposits of limonite and hematite exist north and northwest of al-Baq'a in the Wādī az-Zarqā' and 'Ajlūn regions (Basha 1968). Recent geological investigation has revealed further extensions of these hydrothermally deposited iron ore veins striking southwest toward the Rift Valley (Mikbel *et al.* 1985).

Limited archaeological investigation in the 'Ajlūn, where some roads are literally lined with slag, has thus far uncovered only medieval Islamic smelting operations (Coughenour 1976), but preliminary surveys by the author at a smelting site only 10 km north of al-Baq'a, Dhahrat Abū Thawwāb, has yielded early Iron Age sherds. The chemical composition of one well-fused piece of slag from this site, as determined by proton-induced X-ray emission (PIXE) spectrometry, is similar to that of one of the al-Baq'a iron/steel artifacts, particularly in having an elevated cobalt content (0.3-0.5% by weight). This finding is especially noteworthy, because a small group of red glass beads and a horned eye bead were found in association with the iron/steel artifacts in the al-Baq'a burial cave, and they also show elevated cobalt. Since the glass has a very high iron oxide content (average of 48.7%), it is quite possibly a reworked slag, perhaps a spin-off product of the primary metals industry.

Preliminary archaeological and archaeometallurgical surveys in the vicinity of the other iron ore deposits to the north and west of 'Ammān — e.g. Jil'ad — suggest that medieval smelting is best represented (Gordon *et al.*, nd). Only Tall adh-Dhahab al-Gharbī appears to have had definite smelting activity earlier than the Islamic period — in the late Hellenistic period (Gordon and Villiers 1983).

Sites close to the iron ore deposits, such as Dhahrat Abū Thawwāb and Jil'ad, are in relatively fertile areas, along the watershed at a higher elevation than al-Baq'a, and probably received more rainfall. In a period of climatic deterioration and deforestation such as the Late Bronze-Iron Age transitional period is argued to have been, the iron-ore regions would have been a preferred direction for human populations to move toward and settle. Today, these regions have extensive tracts of oak forests; if similarly well-forested in antiquity, building and fuel needs, the latter a high priority for an iron/steel industry, could have been met.

It may be proposed that native metalsmiths began to exploit local iron ore deposits on a large scale when the Late Bronze culture began to disintegrate and decentralize. It is also possible that metalsmiths from farther south in Wādī 'Arabah — who already had experience in flux copper ores with iron ores (Conrad and Rothenberg 1980) — might have contributed to the development of the new technology. The prevalence of Red Sea molluscs in the al-Baq'a burial caves, which yielded the iron/steel jewelry, points to contacts from this direction.

Until excavations are carried out at several of the iron ore mines and smelting sites, we cannot be certain which, if any, were a source of the al-Baq'a steel or were even in operation during the Late Bronze-early Iron transitional period. West of the Jordan River, some evidence of Late Bronze-early Iron iron smelting has been reported from Khirbat al-Mashāsh in an-Naqab, Kamīd al-Lawz in the Biqā' Valley of Lebanon, and Tel Yin'am in the Lower Galilee (see Muhly *et al.* 1990).

**The Unique Statuary of the Later Iron Age**

The Ammonite culture emerges in this proposed iron-working region later in the Iron Age. It is uniquely characterized by massive circular and rectangular buildings, constructed of unhewn, dry-laid boulders of limestone, sandstone, and flint, which are distributed over a 20 km radius around the 'Ammān citadel. These structures are discussed in detail in the paper that I presented at the fourth International Conference on the History and Archaeology of Jordan (McGovern 1992).

A dramatic native art form is associated with the large-scale architecture that develops in the Iron Age in the 'Ammān area and continues down to at least the Persian period. More than thirty painted limestone and (very occasionally) basalt statues and heads have been found on the Citadel and at several outlying sites (Barnett 1951; Ma'ayeh 1960; Tell 1967-68; Zayadine 1973; 1991: PLS. 38-45; Zayadine *et al.* 1989; Horn 1973; 'Arajān — Khairi 1970; Khirbat al-Ḥajjār and Abū 'Alandā — Ibrahim 1971).

The statues were not recovered from secure archaeological contexts, so they can only be broadly dated to the Iron IIB-C period. Based on associated archaeological material, an eighth-seventh century BC dating has been proposed (Dornemann 1983: 154). The palaeography of the inscription on the Yaraḥ 'Azar statue (below) (FIG. 2), which includes the mention of the Ammonite king Sanipu, very probably the same Sanipu who submitted to Tiglath-pileser III in 733 BC, dates this example to the late eighth century.

Dornemann (1983: 154-160) conveniently summarizes the pertinent stylistic details of the statues and heads, and illustrates many of them. The statues, which are sometimes represented by only a head or torso, were evidently intended to be free-standing. Approximately 50 to 80 cm in height, they are smaller than life-size. Except for one possible female from Khirbat al-Ḥajjār, all are males. When preserved, the statues have heavy, squared-off bases, and show no evidence of attachments at the top or bottom (contrast the double-faced female heads, below).



2. Statue of Yaraḥ 'Azar, from the 'Ammān Citadel (Iron IIB-C). Ht. 48 cm. (Jordan Archaeological Museum; photograph courtesy of F. Zayadine).

The male statues are of a composite Egyptian, Syrian (including Phoenician and Aramaean), and Mesopotamian style. Briefly, Egyptian influence is apparent in the stance, the position of arms at the sides of the body or sometimes with a clenched fist against the chest, a lotus held in one hand, the *atef* crown, and/or possibly a long tunic. Syrian and Mesopotamian stylistic features, which are difficult to distinguish because of Assyrian influence throughout the region, include coiffures (with hair coils, sometimes ending in "corkscrews," and headbands), fringed shawls and sashes, earrings and armbands, heads which are disproportionately large in comparison to their bodies, and/or large (sometimes inlaid) eyes. Some features, such as the beard cut away on each side of the chin to form a point below the mouth on several examples, are unparalleled.

The division of the male statues into "Egyptianizing," "Transjordanian," and "Syrian" groups, as Dornemann proposes, is of doubtful value, since many of the same or similar features are shared by all the examples. The supposed more Egyptian, Transjordanian, or Syrian influences displayed in a group of pieces is difficult to assess, because of the evident synchretism of artistic conventions throughout the Near East at this time. When and if better dated and provenienced examples become available, then the finer typological distinctions might be related to specific cultural spheres.

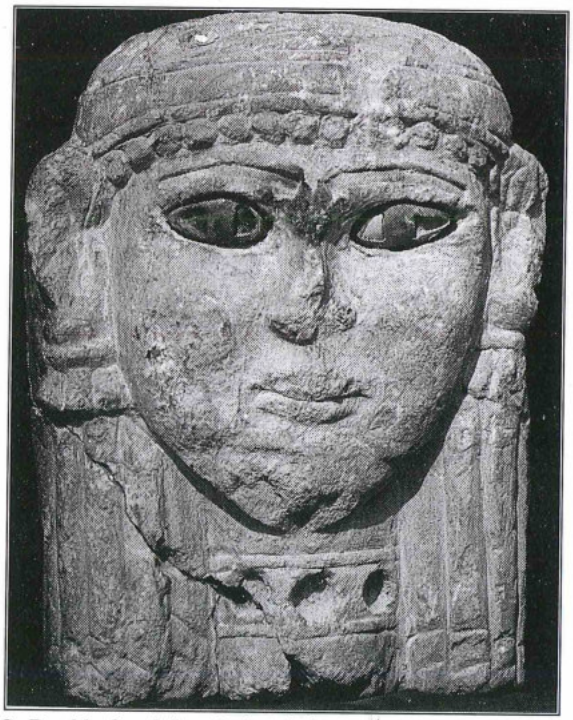
The uniqueness of the statues — in particular, the fact that they were free-standing — marks them as a native central Transjordanian art form. No comparable statues have been found in Iron Age sites in Palestine, nor in Egypt, Syria, and Mesopotamia. The Ammonite inscription on the base of one statue is significant; it has been reconstructed to read [...]*sw yrḥ zr/[br z]kr br snb*, "...of Yaraḥ 'Azar, son of Zakir(?), son of Sanipu" (Barnett 1951: 35, PL. 13; also see Bordreuil 1973). Zayadine's proposal (1974; 1991) that the statue represents an Ammonite king, giving his ancestry from former kings, is in accord with Assyrian records that mention a king of Ammon named Sanipu in the time of Tiglathpileser III. The *atef* crown on several of the heads fits this interpretation, since in Egypt the *atef* crown was associated with the deified pharaoh. *Atef*-crowned, unidentified figures are also known from the Nimrud ivories (Mallowan 1966: FIGS. 469, 470, 504, 525, PL. IX) and Persian figurines (e.g. Negbi 1967: 17, PL. 11.67). These statues could then have served, not unlike similar monumental statues in Egypt and Mesopotamia, to demonstrate in visible form the authority of the Ammonite ruler, albeit as an Assyrian vassal. The possibility, however, that the *atef*-crowned statues might represent deities cannot be excluded.

The origins of such artistic synchretism in Transjordan is unknown. Because of the scarcity of securely dated Iron I and Iron IIA-B remains in Jordan generally, one can only guess at how such a unique art form arose. A nascent Ammonite kingdom, however, might well have emerged by later Iron I, with a concomitant growth of the population in the Greater 'Ammān region. A proliferation of massively constructed buildings and complexes of buildings throughout the region had certainly occurred by the Iron IIC/Persian period. A comparable settlement pattern, with similarly constructed buildings, possibly has its roots in the Late Bronze Age (McGovern 1992). But when did the intensification and expansion of settlement begin? Was it a gradual or relatively fast process? More information about the earlier part of the Iron Age is crucial in assessing how political centralization

and social stratification developed in the area. Architects, stone masons, and other personnel would have been needed for the large-scale building construction, and in time, especially if economic and political contacts with neighboring cultures were established, a local school of sculpture might well have arisen. A local architectural school in Moab might also explain the production of the Balū'a, Jabal Shīḥān, and Mesha basalt stelae.

The unique double-faced female heads from the Citadel pose similar problems of dating, stylistic affinities, production, and purpose as do the free-standing statues. The group of four female heads were found secondarily built into a Hellenistic drain (Tell 1967-68) (FIG. 3). Based on the palaeography of the Ammonite letters incised on the back of the eye inlays, the heads are dated to the eighth century BC (Bordreuil 1973) or the seventh-sixth century ('Amr 1988: 60, with comparisons to Herr 1978: FIGS. 42.31, 42.44, 43.25, 45.31, 45.36). Dornemann (1983: 162) argues for a sixth century date for one of the female heads, based on stylistic peculiarities that appear on later *protomai* from Western Mediterranean sites and on figurines and molds from Iron IIC contexts at 'Ammān and al-Muqābilayn. The female heads are thus approximately contemporaneous with the statues.

Kay Prag (1987) has convincingly argued that the female heads served as ornate balustrades, perhaps together with proto-Aeolic capital elements, in a multi-niched window. The four limestone examples are approximately the same size — about 26 cm in height, and about 21 cm in thickness and width — and share the same stylistic features with minor variations.



3. Double-faced female head, from the 'Ammān Citadel (Iron IIC). Ht. 30 cm. (Jordan Archaeological Museum; photograph courtesy of F. Zayadine).

The famous "Woman at the Window" ivories, which are well-represented at Nimrud, Khorsabad, and Arslan Tash (for references, see Prag 1987), with a single example from Samaria (Crowfoot and Crowfoot 1938: PL. 13.2), are remarkably similar to the 'Ammān female heads. Despite the differences in artistic medium and size, the heads' large eyes which were inlaid with ivory and black stone for the iris and outline of the eye, the long straight hair plaits held with a headband, the earrings comprised of a hoop and three drop pendants (similar to those worn by several of the statues — above), the choker necklace which was also originally inlaid, and the over-all proportions of the face are very comparable to the same features on the ivories. Moreover, the ivories are generally dated to the eighth century, as are most probably the female heads.

One problem stands in the way of the interpretation that the heads were used as balustrades. Assuming that the ivories are based on architectural analogies, as attested by the finding of proto-Aeolic capitals in many Near Eastern sites, why has only 'Ammān thus far yielded such female head sculptures? The heads almost certainly were intended as architectural elements, because cylindrical holes are drilled in the top of each (according to Zayadine 1991, the bottoms were likewise drilled). This has suggested to some investigators (Zayadine 1973: 34-35; Abu-Dayieh 1979: 363-364; Dornemann 1983: 161) that the heads served as column capitals, which are most similar to Hathor capitals in Egypt, Sinai, and contemporaneous Cyprus (viz., the prominent, frontal position of the ears on three of the heads is reminiscent of the cow ears of Hathor). Again, the artistic syncretism of the period precludes a definitive solution.

The broader significance of the female heads has been widely debated. Safwan Tell (1967-68: 9) has argued that they represent Ishtar or 'Ashtoreth, to whom a temple was dedicated on the Citadel. Prag (1987: 125-126) also relates the heads to a religious structure to Atargatis/Ishtar, as based on the identification of the "Woman at the Window" as 'Ashtarte/Atargatis/Aphrodite (see Barnett 1975: 150, 202). Hathor capitals also suggest a temple (Dornemann 1983: 163), since Hathor, as the Egyptian goddess of foreign lands and the "Lady of Turquoise," was often identified with a principal female Canaanite deity, whether 'Ashtarte, 'Asherah, Baalat, or a local equivalent. Most recently, Abdel-Jalil 'Amr (1988) has identified the female heads with the Egyptian tutelary goddesses, Isis and Nephthys. Given the artistic and religious syncretism of the period, and lacking other information, such as inscriptions, inferences about the identity of the female heads are premature (see Abu-Assaf 1982: 59, 83). One should also not rule out a pure-

ly artistic function for the double-faced female heads.

## Conclusions

The Bronze and Iron Ages of the ancient Near East are periods of major advances in many crafts and industries — metallurgy, ceramic production, ivory- and bone-working, seal carving, etc. Central Transjordan shared in these developments, more often absorbing technological advances and artistic idioms from its more powerful neighbors and adapting them to its own needs and circumstances.

Two case studies — the iron/steel industry of the Late Bronze and early Iron Age, and architectural statuary of the late Iron Age — illustrate how central Transjordanian societies could also be innovative. The iron/steel industry very likely developed in response to a cultural and economic reorientation — with the disintegration of the Levantine city-state system and the emergence of small, isolated villages. Craftspeople, who were perhaps originally copper/bronze metalsmiths, were probably thrown out of work during the economic and social upheaval. Under relatively deprived circumstances, they might have experimented with local iron ores, applying known smelting and fabrication technology, to produce a material with special aesthetic and functional properties when steeled. The ornamental nature of the artifacts thus far excavated — anklets, bracelets, and rings — suggests that the utilitarian properties of the iron/steel were less important than its aesthetic qualities.

In contrast to the lower standard of living and limited foreign contacts of the early Iron Age, the Iron IIB-C period in the Greater 'Ammān region was one of the most prosperous periods in Jordan's history. Although the capital of Rabbath 'Ammon was controlled by outside powers during much of this time, an architectural school developed that produced a unique statuary, reflecting the international character of the period in its synchretistic Egyptian, Syrian, and Mesopotamian style.

The significant interrelationships between technology and artistic expression in Bronze and Iron Age central Transjordan have only been broached here. The later Iron Age of Transjordan is characterized by a wide spectrum of technologically and artistically sophisticated artifacts. For example, red and black slipped and burnished, wheel-made bowls (similar to Assyrian "Palace Ware"), intricately carved seals (again with many Assyrian and Babylonian motifs), and painted horse and human figurines of unique types were very likely locally produced in the 'Ammān region. These crafts probably were preceded by developments earlier in the Iron Age. Much more study of each artifactual class — typologically, chronologically, and technologically — is needed, before we can assess the specific Transjordanian elements, and how they were transferred to and/or developed independently within central Transjordan.

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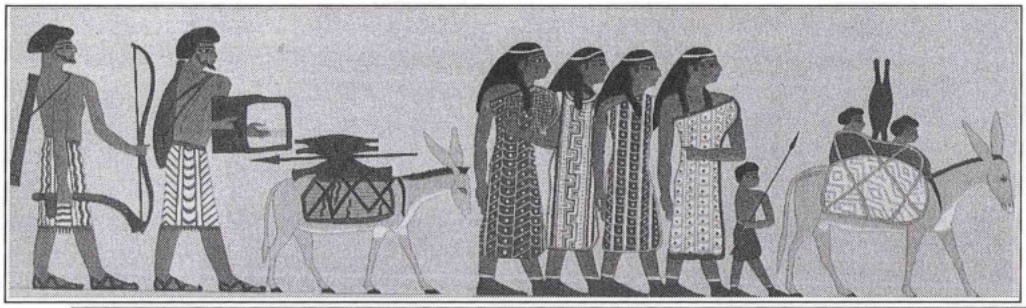
# Artistic and Faunal Evidence for the Influence of the Domestication of Donkeys and Camels on the Archaeological History of Jordan and Arabia

One of the most widely debated theories of W. F. Albright was his argument that domesticated donkeys and donkey caravans dominated the Near Eastern landscape from c. 3000 BC into the first millennium BC, and that domesticated dromedary camels and camel caravans from Arabia appeared only after c. 1300 BC (see, e.g., Albright 1960: 204-210; 1963: 1-9; 1968: 70-73, 179; 1970). As evidence for dating the donkey early, in addition to literary (Near Eastern and Biblical) sources, he cited early artistic representations (see FIG. 1, the famous depiction of a c. 1900 BC Asiatic donkey caravan entering into Egypt), and faunal evidence from many sites. As evidence for dating the camel later, he also noted artistic representations (see, e.g., FIG. 2, the c. seventh cen-



1. Asiatics with donkey caravan entering Egypt. Banī Ḥasan, Egypt, c. 1900 BC. After Pritchard 1969: FIG. 3. Photograph: C. Andrews.



2. The Assyrian forces of Ashurbanipal engaged in conflict with the Arabs, who seek to escape upon their camels. After Pritchard 1969: FIG. 63. Photograph: C. Andrews.

tury BC depiction of the Arabs escaping from the Assyrians), and the absence of faunal remains at most Bronze Age sites. He also argued (1970: 197-198) that some of the wild camel-hunting images from central Arabia, published by Anati (1968-74), were to be dated to the third and early second millennium BC, which supported his view that the domesticated dromedary camel appeared only after that date. In his later career, he became so engrossed with the topic of donkey and camel caravans that many dismissed much of what he wrote on this subject.

But, that has been wrong, because many new projects have been conducted in Arabia, in Jordan, and in Israel, and they support Albright's position on the significance of the introduction of the camel-based trade routes from Arabia. Work by the American Foundation for the Study of Man (AFSM) in Wādī al-Jubah has contributed important faunal evidence in Yemen. It has led me to note the faunal evidence from other nearby sites in Yemen, as well as that from Ḥisbān and the Madaba Plains Project in Jordan.

These and other projects have produced artistic and faunal remains, which are shedding significant new light on how such factors as domestication of animals (especially donkeys and camels as beasts of burden) have influenced the patterns of human settlement and trade in Jordan and Arabia. In their times, changes in the widespread uses of such beasts of burden would have constituted significant technological innovations, and thus this topic is suitable for this International Conference.

The original topic of this paper also included the evidence for the role which climate change played, but since that has already been described by me elsewhere (Sauer 1994a), I will not repeat much of it here.

These topics do have roots in the preceding geological (for Jordan and the Near East see, e.g., Bender 1968; Horowitz 1979; Al-Sayari and Zotl, eds. 1978; Jado and Zotl, eds. 1984; Bowen and Jux 1987) and Palaeolithic (see, e.g., Garrard and Gebel, eds. 1988; Perrot 1968; Horowitz 1979; Cauvin and Sanlaville, eds. 1981; Henry 1989) periods. And they continue into the modern evidence in these regions (see, e.g., Baly 1987; Orni and Efrat 1971; Adler *et al.*, eds. 1985; Zohary 1973).

**Domestication of Beasts of Burden**

The domestication of beasts of burden, especially donkeys and then camels, followed the technological Neolithic revolutions of the domestication of sheep and goats (and cattle), as well as wheat and barley (see, e.g., Ucko and Dimbleby, eds. 1969; Clutton-Brock 1987: 52-70; Stager 1992). Domesticated sheep, goats, and cattle were not very useful for long-distance transport, but cattle were used for draught purposes. The multi-phased transportation revolution being described here was important for the impact which it had on trade routes through time, and on settlement patterns in various regions of the Near East.

*Donkeys (Wild Equus africanus and Domesticated Equus asinus)*

Wild donkeys (*Equus africanus*) are usually assigned a North African origin, but they also did exist in the Levant and Arabia (Clutton-Brock 1987: 92-93, 196; 1992: 33-36; 62-66; Uerpmann 1987: 25-32; Meadow and Uerpmann, eds. 1986; 1991). The evidence for the domesticated donkey (*Equus asinus*) is that it also was present in Africa, Egypt, and the fertile crescent. It was widespread from c. 3500 BC on, but first appeared in the preceding Chalcolithic period (see, e.g., Stager 1992: 27).

Domesticated *Equus asinus* bones have also been found recently in southwestern Arabia, as part of the modest (radiocarbon-dated) third millennium BC Bronze Age villages excavated by de Maigret (1990: 145-185 — see TABLE 1). It should be noted that no camel bones were attested at these Bronze Age sites in Yemen, and the sites themselves were modest in size. They may have been associated with a paleosol which indicated that the climate was slightly wetter at that time (see also Overstreet *et al.* 1988; Sauer 1994a).

Albright (1970) had argued for Bronze Age Midianite donkey caravans in western Arabia, and that remains a likely possibility based on this new evidence from Yemen. The modest nature of the sites in Yemen would not imply major trade routes at this time, but the presence of the donkeys could support some modest trade with the fertile crescent to the north, including Jordan.

When the 14th century BC Kas shipwreck was discovered in the Mediterranean, at first it was suggested that resins contained on the wreck had originated in Arabia or Ethiopia. Now it has been noted that the resins were local to the Mediterranean basin, and nothing on the wreck originated in Arabia (see, e.g., Bass 1987; Haldane 1991). Thus, it is unlikely that widespread trade with Arabia was present in the Late Bronze Age, although in the Late Bronze there could have been some modest trade (Albright 1970).

During the third-first millennia BC, the highly complex urban cultures of the fertile crescent reached their peaks, from Egypt, to Syria-Palestine (including Jordan), to Mesopotamia, to Persia, to India, and beyond; and that was due in part to the existence of these donkey caravans on land, and ship-based trade on the major bodies of water (e.g., Arabian Gulf, Mediterranean).

In Jordan, during the Bronze Age, we do find significant Early Bronze Age sites throughout most of the country (see, e.g., the surveys of Ibrahim *et al.* 1976; Yassine *et al.* 1988; Ibach, Jr. 1987; Miller, ed. 1991; MacDonald 1988; 1992). However, the absence of major

**Table 1.** Bronze Age of the North Yemen Highlands: fauna identified from the collections of 1983-87. Number of identified specimens to the right. After de Maigret 1990: TABLE E. Computer-generated image by C. Andrews.

| | | |
|---|---|---|
| MAMMAL, DOMESTIC | | |
| *Ovis aries* (sheep) and *Ovis/Capra* indeterminate | +++ | 353 |
| ? *Capra hircus* (domestic goat) | + | 4 |
| *Bos taurus* (domestic cattle) | + | 12 |
| MAMMAL, DOMESTIC OR WILD | | |
| *Canis* cf. *familiaris* (dog) | - | 1 |
| *Sus scrofa* (pig or wild boar) | - | 1 |
| *Equus (Asinus)* sp. (ass or donkey) | - | 2 |
| *Felis* cf. *selvestris* (cat) | - | 2 |
| MAMMAL, WILD | | |
| *Gazella* sp. (gazelle) | - | 2 |
| Microrodents, gnawed bones | - | 2 |
| MAMMAL, MODERN INTRUSIONS | | |
| *Meriones rex* (king jird) | + | 35 |

Middle Bronze and Late Bronze sites from the southern part of the country may reflect the availability of only the donkey as a widespread beast of burden. This could have limited the extent to which trade was conducted through Jordan at that time (see also Sauer 1994b: 230-238).

*In situ* Bronze Age remains were not attested at the site of Ḥisbān, but some Bronze Age sherds may have been present among the UD sherds at the site (see Sauer 1994b). Bronze Age remains have been published somewhat from Tall al-'Umayrī (Geraty *et al.*, eds. 1989; Herr *et al.*, eds. 1991), which is part of the same Madaba Plains Project. From Tall al-'Umayrī, donkey bones were attested in the Bronze Age and Iron Age loci, and only one camel bone was attested, and it was from the Iron II period (Geraty *et al.*, eds. 1989: 14, 584; Herr *et al.*, eds. 1991: 601-610). This faunal evidence agrees with the positions being described in this paper.

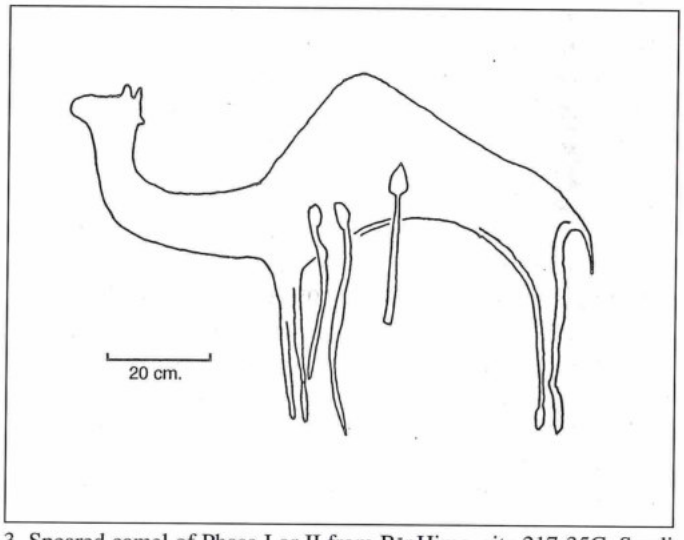
*Dromedary Camels (Wild Camelus, Domesticated Camelus dromedarius)*

The dromedary camel (*Camelus dromedarius*) is attested in the Near East much later than the donkey, and its wild progenitor is of uncertain species (*Camelus*) and geographical point of origin (Clutton-Brock 1987: 124-129, 197; Uerpmann 1987: 48-52). Many have suggested eastern Arabia as the earliest location to attest domesticated dromedary camels, but Zarins (1989: 144-149) has cited even earlier evidence from Iran and India. For long distance trade in arid conditions, it was a much superior animal to the donkey (see, e.g., Bulliet 1975; Gauthier-Pilters and Dagg 1981; Wilson 1989). With the domestication of the dromedary camel, more extensive trade routes came into fuller use in Arabia especially, and these routes passed through Jordan. After the introduction of the camel, the domesticated donkey continued to play a (declining) role in the trade routes of the fertile crescent, down into the first millennium BC and perhaps later.

Ripinsky (1975) argued for an early (c. third millennium BC) date for its appearance in parts of the Near East, and some of his viewpoints have been corroborated by recent discoveries, especially in eastern Arabia. However, Albright was still correct to note that the widespread appearance of the camel did not predate c. 1300 BC.

Zarins (1989) has published a good recent article on the topic of its domestication, and I am in general agreement with it (see TABLE 2). First there was a phase (c. 6000-2200 BC) of hunting the wild camel, which is depicted in artistic representations from Saudi Arabia (Anati 1968-74; Zarins 1989 — see FIGS. 3, 4). Then (probably only in eastern Arabia), Zarins shows that camels were domesticated but not used for trade, in c. 2200-1500 BC. Then came full trade, with various changes in saddles and associated structures, from c. 1500 BC on. With calibrated radiocarbon dates, this date would be in the Late Bronze Age, which is the earliest period that Albright would have allowed.

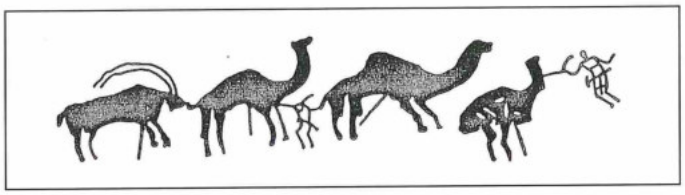
Supporting this reconstruction is the evidence from the AFSM Wādī al-Jubah Project in Yemen (see, e.g., Blakely and Sauer 1985; Blakely *et al.* 1985; Sauer and Blakely 1988). The stratigraphic probe at Ḥajār at-Tamrah was excavated by J. A. Blakely and W. Glanzman. It attested camel bones which were identified by M. R. Toplyn (Blakely *et al.* 1985: 127-128), as well as radiocarbon dates which started at least as early as c. 1300 BC (Blakely *et al.* 1985: 87-90). On the basis of this evidence, we observed that the high level of cultural development attested in Yemen after about c. 1300 BC could not have occurred without the domestication of the camel as a beast of burden (Blakely and Sauer 1985;




3. Speared camel of Phase I or II from Bīr Hima, site 217-35C, Saudi Arabia. After Zarins 1989: FIG. 14.7. Computer-generated image by C. Andrews.

**Table 2.** Suggested developmental model for camel bedouin. After Zarins 1989: TABLE 14.2. Computer-generated image by C. Andrews.

| Phase | Camel utilization | Date | Cultural evolution |
|---|---|---|---|
| V | North Arabian saddle (Shadad); Thamudic/South Arabic | 500 BC | rectangular goat hair tent; minimal use of stone |
| IV | cushion saddle | 1000 BC | rectangular stone outline; tapered structures |
| III | South Arabic saddle (Hawlani/Hadaja) pack camels; overland incense trade; change in camel status | 1500 BC | troughs; horse-shoe shape |
| II | non-riding; heards for milk; little group movement | 2200-1500 BC | Umm-an-Nar, Subr, Sihi; Phase II rock art in southwest Arabia |
| I | the wild camel | 6000-2200 BC | Phase I rock art in southwest Arabia |



4. Phase II camel hunting scene in the Bīr Hima region, Saudi Arabia. After Zarins 1989: FIG. 14.8, and Anati 1968b: 54, FIG. 4. Computer-generated image by C. Andrews.

Blakely *et al.* 1985: 151-155; Sauer and Blakely 1988). We also argued that the major trade route from Yemen to the Levant would also have begun to be used more extensively at about that same time.

In eastern Arabia, Potts is now finding domesticated camel bones in the upper strata at Tall Abraq in the United Arab Emirates, from c. 1500 BC on (see, e.g., Potts 1991).

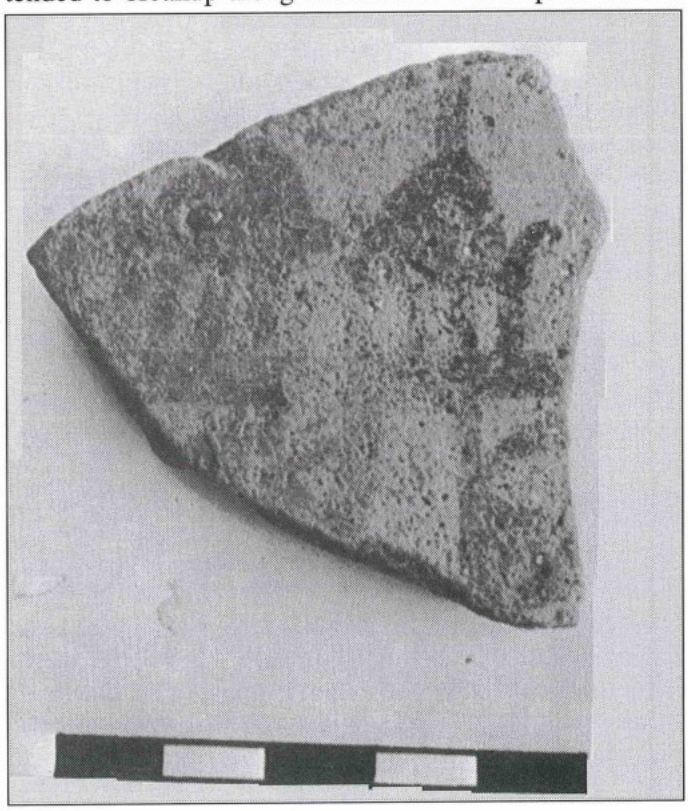
In Jordan, it is important to note that camel bones were attested in the Iron I up to Mamluk layers at Ḥisbān (see LaBianca 1990: TABLE 5.1 — see TABLE 3). For this paper, their appearance in the Iron I layers is particularly significant. That evidence also argues for the existence of the Arabian camel caravan route at that time, and it may even suggest that the site was first occupied in a major way for that reason.

Also in Jordan, there is the artistic representation of camels from Tall Dayr 'Allā (Ibrahim and van der Kooij 1983: 581 — see FIG. 5), which seems to be a camel caravan. The sherd came from an Iron II locus, but it seems to be Late Bronze in character. If it is a Late Bronze sherd, it could reflect some camel caravan activities in Jordan at that early date.

From Palestine, Wapnish published an excellent discussion of the camel bones from Tall Jammah (1981 — see TABLE 4). A few fragments were attested in the Late Bronze Age and Iron I, and most came from Iron II and later contexts.

In Yemen, major "states" and their urban centers started to flourish at this time (c. 1300 BC or earlier), and they included Sheba, Qataban, and later, Himyar (see, e.g., Van Beek 1952; 1960; 1969; Doe 1983). These Early Pre-Islamic cultures attested very complex water management systems and agricultural installations, such as the famous dam and associated silt fields at Ma'rib. Early Pre-Islamic sites attested impressive public architecture, abundant South Arabic inscriptions, and industrial activities including hand-made red-burnished pottery, bronze smelting, and working in such lithics as obsidian, alabaster, and steatite. The camel caravans originated as far south as the Arabian coast, where goods were brought by ship from India and beyond, and could be trans-shipped with local products, such as incense, to reach the large markets to the north, including Jordan.

That is why Iron Age sites are found throughout Jordan, as well as later ones (see, e.g., the surveys of Ibrahim *et al.* 1976; Yassine *et al.* 1988; Ibach, Jr. 1987; Miller, ed. 1991; MacDonald 1988; 1992). Sites from the Iron Age are much better distributed throughout most of Jordan than are those of the Late Bronze Age. It was in the Iron Age (or Late Bronze Age) that Ammon, Moab and Edom, had apparently formed as kingdoms in Jordan, and the fact that these kingdoms in Transjordan tended to breakup along the lines of the deep rivers and



5. Tall Dayr 'Allā, Jordan. Sherd of jar, reg. nr. 2776, phase V/VI, showing camels. After Ibrahim and van der Kooij 1983: PL. 127, 2. Photograph: C. Andrews.

**Table 3.** Number of identified specimens of principal domestic animals from Ḥisbān, Jordan. After LaBianca 1990: TABLE 5.1. Computer-generated image by C. Andrews.

| Strata | Period | Cattle # | Cattle % | Sheep/Goat # | Sheep/Goat % | Sheep # | Sheep % | Goat # | Goat % | Pig # | Pig % | Camel # | Camel % | Equids # | Equids % | Horse # | Horse % | Donkey # | Donkey % | Total # | Total % | Accumulation Rates |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Modern | 60 | 5.7 | 908 | 86.0 | 36 | 3.4 | 52 | 4.9 | 25 | 2.4 | 9 | 0.9 | 54 | 5.1 | 5 | 0.5 | 19 | 1.8 | 1,056 | 5.7 | 9.96 |
| 2-3 | Mamluk | 1,117 | 13.3 | 6,901 | 81.9 | 353 | 4.2 | 402 | 4.8 | 139 | 1.6 | 215 | 2.6 | 57 | 0.7 | 6 | 0.1 | 14 | 0.2 | 8,429 | 45.3 | 43.00 |
| 4 | Ayyubid | 9 | 10.7 | 71 | 84.5 | 4 | 4.8 | 6 | 7.1 | - | - | 2 | 2.4 | 2 | 2.4 | - | - | - | - | 84 | 0.5 | 1.40 |
| 5 | Abbasid | 8 | 3.9 | 188 | 91.7 | 14 | 6.8 | 11 | 5.4 | 2 | 1.0 | 5 | 2.4 | 2 | 1.0 | - | - | - | - | 205 | 1.1 | 0.73 |
| 6 | Umayyad | 68 | 10.4 | 494 | 75.3 | 47 | 7.2 | 33 | 5.0 | 80 | 12.2 | 8 | 1.2 | 6 | 0.9 | - | - | 3 | 0.4 | 656 | 6.5 | 7.80 |
| 7-10 | Byzantine | 162 | 12.5 | 932 | 71.6 | 58 | 4.5 | 48 | 3.7 | 130 | 10.0 | 14 | 1.1 | 63 | 4.8 | 5 | 0.4 | 10 | 0.8 | 1,301 | 7.0 | 4.39 |
| 11-13 | L. Roman | 286 | 11.7 | 1,892 | 77.6 | 140 | 5.7 | 115 | 4.7 | 183 | 7.5 | 17 | 0.7 | 58 | 2.4 | 2 | 0.1 | 6 | 0.2 | 2,436 | 13.1 | 10.36 |
| 14 | E. Roman | 131 | 15.0 | 682 | 78.1 | 67 | 7.7 | 36 | 4.1 | 43 | 4.9 | 7 | 0.8 | 10 | 1.1 | - | - | 3 | 0.3 | 873 | 4.7 | 4.12 |
| 15 | Hellenistic | 136 | 12.0 | 977 | 85.9 | 135 | 11.9 | 75 | 6.6 | 6 | 0.5 | 15 | 1.3 | 4 | 0.4 | - | - | 1 | 0.1 | 1,138 | 6.1 | 2.60 |
| 16-18 | Iron 2 | 256 | 14.3 | 1,406 | 78.5 | 137 | 7.7 | 83 | 4.6 | 94 | 5.3 | 5 | 0.3 | 29 | 1.6 | - | - | 9 | 0.5 | 1,790 | 9.6 | 3.58 |
| 19 | Iron 1 | 145 | 22.2 | 460 | 70.6 | 38 | 5.8 | 29 | 4.4 | 31 | 4.8 | 3 | 0.5 | 13 | 2.0 | - | - | 6 | 0.9 | 652 | 3.5 | 3.26 |
| Sum | All | 2,378 | 12.8 | 14,911 | 80.1 | 1,029 | 5.5 | 890 | 4.8 | 733 | 3.9 | 300 | 1.6 | 298 | 1.6 | 18 | 0.1 | 71 | 0.4 | 18620 | 100 | 5.81 |

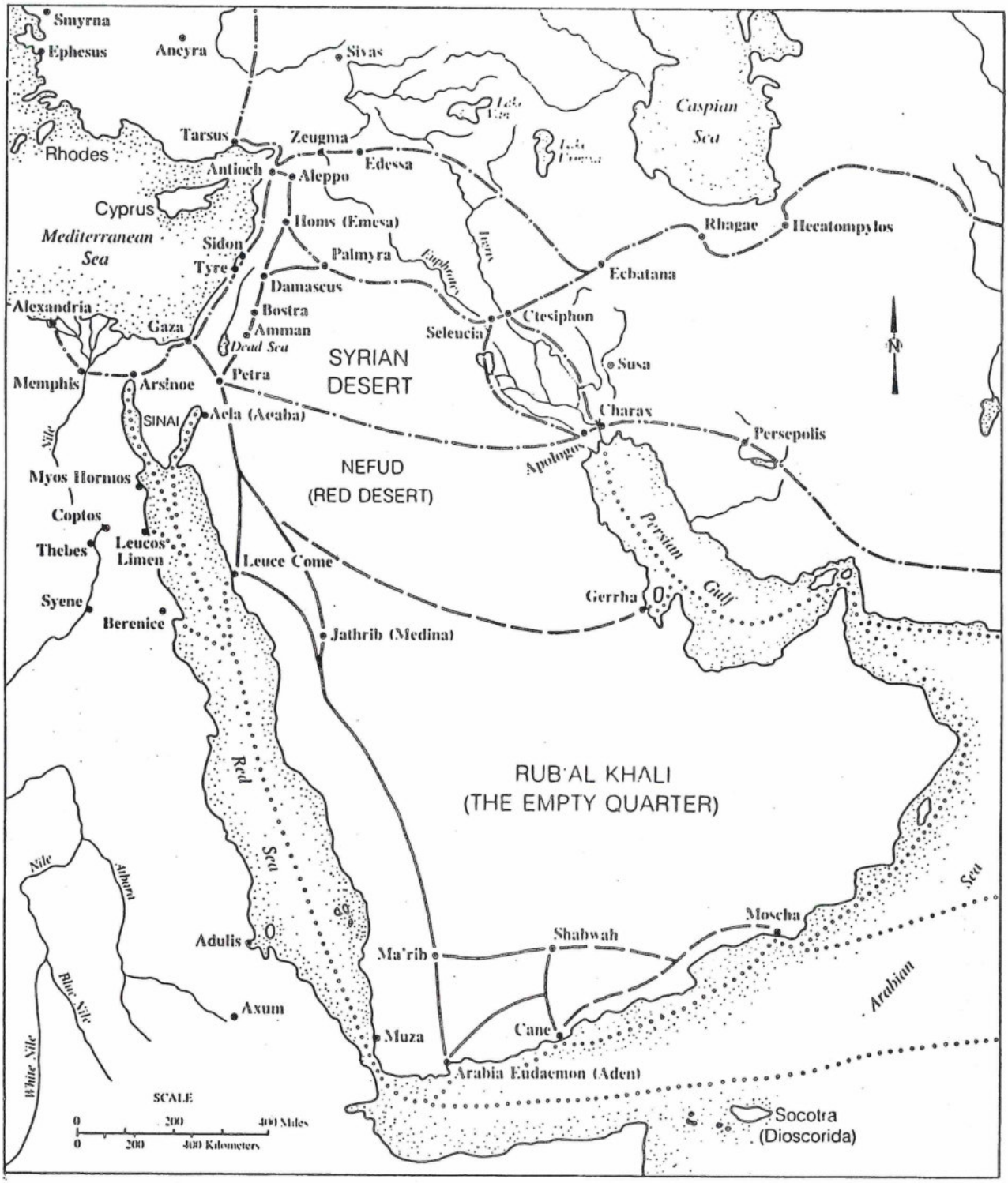
**Table 4.** *Camelus* sp. bone fragments in the Tall Jammah sample, Palestine. After Wapnish 1981: TABLE 1. Computer-generated image by C. Andrews.

| Years BC | Teeth | Mandible | Maxilla | Vertebra | Scapula | Humerus | Radius Ulna | Carpals | Innominate |
|---|---|---|---|---|---|---|---|---|---|
| 1400-1300 | | | | | | | | | |
| 1300-1200 | | | | | | | | 1 | |
| 1200-1100 | | | | | | | | | |
| 1100-1000 | | | | | | | 1 | | |
| 900-800 | | | | | | | | | |
| 800-700 | | | | | | | | 0.5 | 0.5 |
| 700-600 | 2 | 5 | 2 | 1 | 3 | 0.5 | 2 | 2.5 | 0.5 |
| 600-500 | 8.5 | 5.25 | 1.5 | 3.5 | 1.75 | 2 | 3 | 4 | 1 |
| 500-400 | 9.5 | 6.25 | 1.5 | 5 | 2.25 | 0.5 | 3 | 4 | 2 |
| 400-300 | 3 | 2.25 | 1 | 5.5 | 0.75 | 4 | 11 | 15 | 2 |
| 300-200 | 12 | 3.25 | 4 | 9 | 2.25 | | 9 | 10 | 2 |
| Other | 8 | 2 | 7 | 12 | 5 | 3 | 12 | 17 | 2 |
| Total | 43 | 24 | 17 | 36 | 15 | 10 | 41 | 54 | 10 |

Note: Fractional quantities indicate fragments distributed over different date ranges in areas where the stratigraphy is uncertain.

| Years BC | Femur | Patella | Tibia | Fibula | Calcaneus | Astragalus | Scaphoid | Cuboid | Grand Cuneiform |
|---|---|---|---|---|---|---|---|---|---|
| 1400-1300 | | | | 1 | | | | | |
| 1300-1200 | | | | | | | | | |
| 1200-1100 | | | | | | | | | |
| 1100-1000 | | | 1 | | | | | | |
| 900-800 | | | | | | | | | |
| 800-700 | | | | | 1 | 0.5 | | | |
| 700-600 | 1 | 1 | 0.5 | 0.5 | 5 | 1.5 | 1 | | |
| 600-500 | 1 | 0.5 | 1 | 2 | 1 | 1.75 | 0.5 | 1 | |
| 500-400 | 1 | 0.5 | 0.5 | 1.5 | 1 | 1.75 | 0.5 | 2 | |
| 400-300 | 2 | 1 | 3 | 1 | 5 | 6.25 | 1 | | |
| 300-200 | 2 | | 5 | | 4 | 6.25 | 1 | 2 | |
| Other | 7 | 1 | 2 | 4 | 4 | 4 | 2 | 3 | 2 |
| Total | 14 | 4 | 13 | 10 | 21 | 22 | 6 | 8 | 2 |

| Years BC | Metapodial | P-I | P-II | Sesamoid | TOTAL |
|---|---|---|---|---|---|
| 1400-1300 | 1 | | | | 2 |
| 1300-1200 | 1 | | 1 | | 3 |
| 1200-1100 | | | | | |
| 1100-1000 | | | | | 2 |
| 900-800 | | | | | |
| 800-700 | 1 | 3.5 | 0.5 | | 7.5 |
| 700-600 | 6 | 2.5 | 2.5 | | 40 |
| 600-500 | 4.5 | 3.5 | 1 | 0.75 | 49 |
| 500-400 | 3 | 2.5 | 1 | 3.75 | 53 |
| 400-300 | 9.5 | 8 | 3 | 2.25 | 86.5 |
| 300-200 | 9 | 2 | 2 | 0.25 | 85 |
| Other | 18 | 19 | 9 | 1 | 144 |
| Total | 53 | 41 | 20 | 8 | 472 |




6. The Incense Road in Graeco-Roman Times. After Franck and Brownstone 1984: 168. Computer-generated image by C. Andrews.

wadis was a natural result of the environmental constraints which those natural barriers placed on the country. However, it was also due to the widespread use of the camel as a beast of burden, that those barriers could also be more easily crossed, and that distant arid regions like Yemen could be reached, which accounts for, in part, why these kingdoms may have formed in areas which had not been as extensively settled in the Middle and Late Bronze periods (see also Sauer 1994b: 230-238).

This (now major) trade route (for a discussion of this and other related major trade routes, see Franck and Brownstone 1984: 168-184 — see FIG. 6), based mostly on the camel, almost certainly explains the economic motives of the record in 1 Kings 10 of the visit to King Solomon in Jerusalem of the Queen of Sheba. The Arabs and their camels were often of concern to the later Assyrian, Babylonian, Persian, Greek, and Roman empires, in part because of these economic trade factors.

In the c. 300 BC-AD 640 period, many sites in southern Jordan began to flourish, because of the independent capital city of Petra which was located there. Later, after the annexation of Nabataea, the Romans constructed their linking route, the *via nova*, which followed the line of the old but difficult trade route through Jordan. Himyar dominated Yemen from its mountain capital of Ẓafar in the Late Pre-Islamic period.

In the Early Islamic period, c. AD 640, the center of gravity in Arabia moved from Yemen to the north (to Makka, al-Madīna, etc.), but camel-based trade and cultural connections between Jordan and Arabia continued as before, and increased because of the religious pilgrimages to Makka.

During the Ottoman period, the new "desert highway" was constructed to the east, primarily for pilgrims, and at that time most of Jordan had moved away from village systems to nomadic ways of life.

In Modern times, small villages, farms, and cities started in Jordan again, but gasoline driven cars have mostly replaced the donkey and the camel (see, e.g., Bulliet 1975). Trucks are still used for transportation, but the airplane and sea routes through Suez and around Africa have largely replaced the camel-based routes. Because of their religious importance, the land-based pilgrimage routes continue to be used down to the modern day as well (see Franck and Brownstone 1984: 168-184).

## Conclusions

Thus it has been argued, following Albright, that the domestication and widespread use of donkeys in the mid-fourth millennium BC opened up Jordan to trade with the rest of the fertile crescent, but only in a limited way with Arabia to the south. Only with the domestication and widespread use of the camel as a beast of burden, by c. 1300 BC or earlier, did the international trade routes through Arabia become more regular, which probably explains in part why the Transjordanian states of Ammon, Moab, and Edom formed at that time. Because of the international character of the trading network in the Late Bronze Age, it would be surprising if Arabia was not somehow connected to that network. On the other hand, the existence of the camel-based trading route in the Iron I period may represent the filling of the Mediterranean-based trade gap which commenced at the end of the Late Bronze Age. After the widespread introduction of the camel as a beast of burden, the donkey continued to play a (declining) trade role on the routes of the fertile crescent, at least into the first millennium BC.

It should be noted that I. Finkelstein (1988; 1992), starting with the evidence from sites in an-Naqab, but extending his work to Edomite sites in southern Jordan as well, came to conclusions which are very similar to those in this paper. I am in agreement with most of his arguments.

This again is a tentative study, and the results which are described here need to be tested by many other sites in Jordan, Arabia, and the rest of the Near East. However, I am reasonably confident that major changes in this paper will not be necessary. It should however be noted that although major sites were not found, modest Middle and Late Bronze remains were attested in southern Jordan. Some of the UD sherds collected from those regions did belong to those periods as well.

This trade route phenomenon could also be studied using today's remote sensing technology (see, e.g., El-Baz, ed. 1984), to locate, among other things, the routes of ancient caravans. When combined with careful work on maps and with work on the ground, these techniques should allow for more detailed analyses of these routes to be accomplished.

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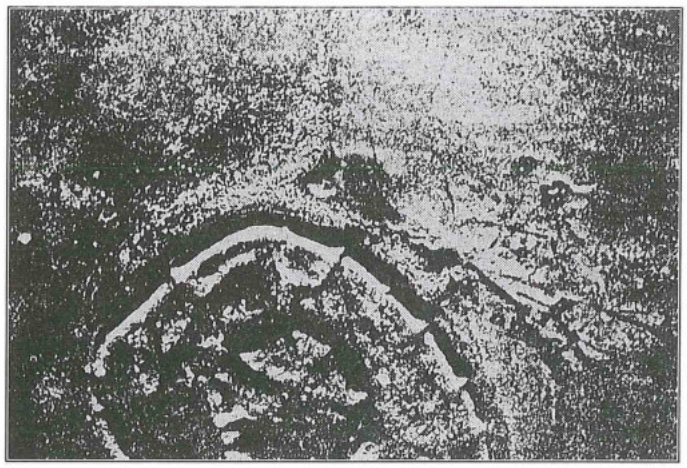
# Jāwa and North Syria[1]

> The air, now extremely hot, was clearly seen to be divided into four or five layers of unequal depth and transparency, vibrating incessantly and obstructing our view. It was the *sarab* (mirage). At 2.15 on our left we caught a glimpse of the well of al-Bajjuz. To the northwest the horizon was shut in by the elevation of Zetab az-Zerw .... The two higher volcanoes of al-Hzefat ... appeared to the south of us and, as veiled by a mirage, seemed not unlike two black monsters. From time to time the black Rigm at-Taran emerged from the mirage ... After three o'clock pieces of basalt and lava could be seen... The volcanic area stretches from the Tell Markada... as far as the well of Mlehan.
>
> On May 23, 1912, at 5.02 A.M. we set out toward the northwest in a cold west wind. At 6.30 we observed in a large basin north of us, the ruined mound of al-Malha... From 8.00 to 9.48 we stopped at al-Malha,... a well about 25 meters deep with water nearly fresh to the taste ... We wished to examine the al-Malha ruins because of their similarity to a fortified camp built of basalt blocks, but our guide warned us against the robbers who roam about .... and were most likely observing our movements all the time ... Our gendarmes ... pleaded with us to turn back ... To humor them we headed west; [by 10.27 he had left]. (Musil 1927: 87-88).

On the 30th of the same month, but 66 years later, another explorer visited the site in the desert steppe; he described it as a "no-man's land" in a salt flat beside the volcanic Jabal Ma'za directly to the east. The weather was dreadful and a sandstorm hindered his sight — he could only keep his direction by using a compass (Kühne 1983: 300-301).

The landscape described is not the Black Desert, the explorers not Harding or Helms, the site not Jāwa. The site is Malḥat adh-Dharū, the explorers Alois Musil and Hartmet Kühne, and the region: north of the Euphrates, west of the Khābūr and south of Jabal 'Abd al-'Azīz. Yet these accounts describe a place more than reminiscent of Jāwa: isolated, near a volcanic basaltic landscape, virtually deserted, and dry — in a zone receiving between 150 and 200 mm of rainfall in a year, incapable of supporting dry-farming agriculture. If with Helms we marvelled at the large site of Jāwa — more than 10 hectares — how much more so at this 37 hectare site of Malḥat adh-Dharū (FIG. 1).

When Jāwa first came into prominence in the seventies, it seemed unique to the point of being implausible in



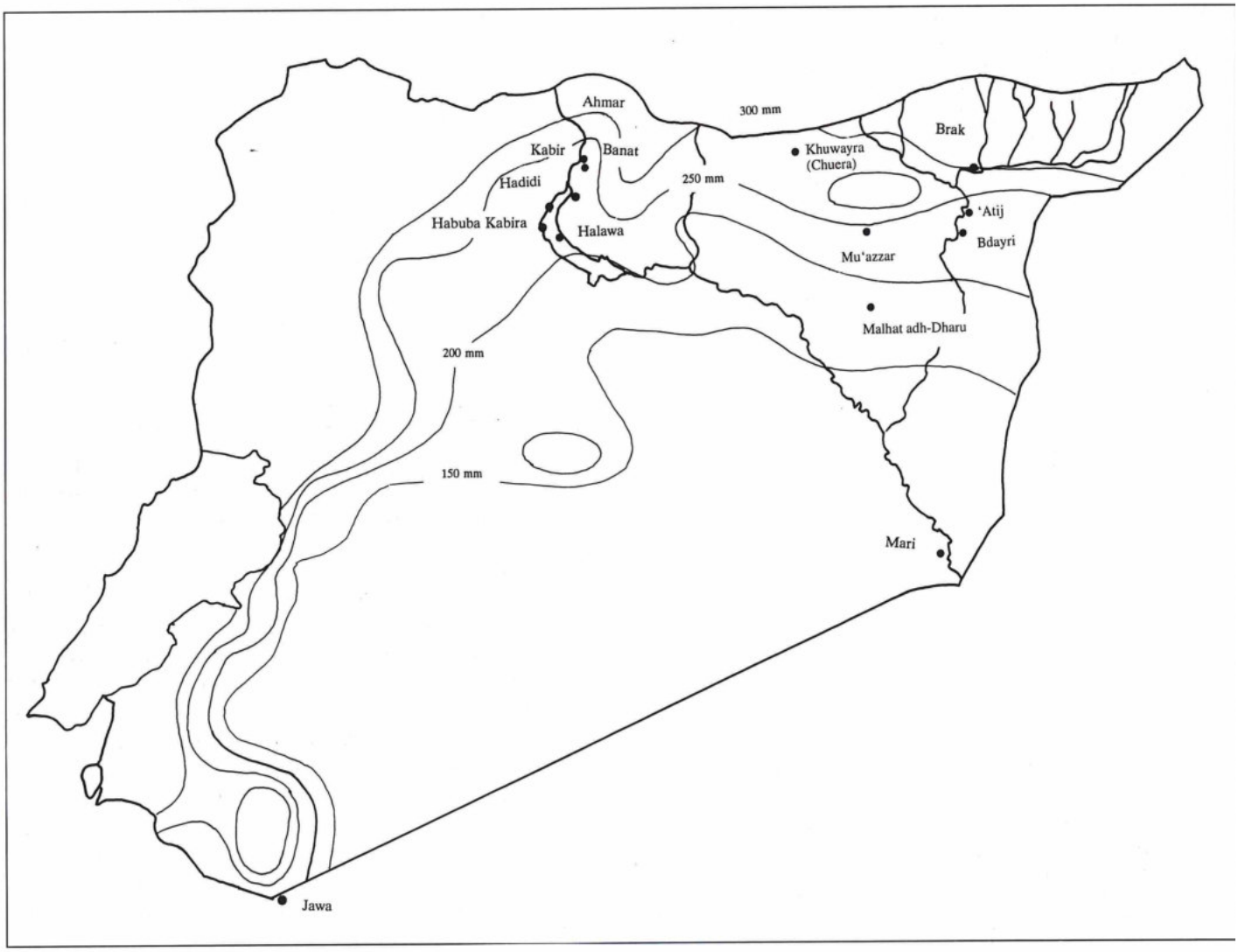
1. Tall Malḥat adh-Dharū from the air (Poidebard 1934).

[1] Field Research and analyses were undertaken with Roger Grayson, Brian Finlayson, L. K. Rogers: University of Melbourne, Centre for Environmental Applied Hydrology; and Clifford Ogleby, University of Melbourne, Department of Surveying and Land Information. The authors wish to thank Dr. Safwan Tell, former Director General of the Department of Antiquities of Jordan for inviting us to present this paper. Many persons have assisted us in Syria; we thank Dr. Ali Abu Assaf, Director of Antiquities and Museums, Dr. Adnan Bounni, Director of Excavations, and at the Aleppo Museum Dr. Wahid Hayyata and Mr. Hammido Hammade. We thank Dr. Sultan Muhesen for his interest in our project and for arranging for Mr. Ahmed al-Murshedhe, a student at the University of Damascus, to work with us in the field during October 1991. We thank Unocal el-Hassekeh Ltd., and its Deputy General Manager, Mr. John A. Packard, for permission to use the satellite images. This project was supported by the Fulbright Program and the Australian National Research Council.

terms of its inhospitable location, its elaborate hydraulic system, its massive fortifications and its early date (Helms 1981). In fact there are several sites in Syria with similar features and setting. For example, we now know of the presence of hydraulic systems in several periods near Jabal ad-Drūz (Braemer 1988). In northern Syria, large sites with massive fortifications and water harvesting functions in agriculturally marginal areas of low rainfall emerged during the third millennium BC (FIG. 2). Jāwa, we suggest, is part of a larger pattern of expanding settlement and technological development across the drier fringe of the Fertile Crescent. We will describe some of these sites and present new evidence for associated water harvesting systems. We will then review chronological synchronisms of Jāwa with North Syria, consider disparities in Syrian internal chronology and review models which may resolve some of these problems.

In North Syria the so-called *Kranzhügel* (wreath-shaped) sites — a term coined by Oppenheim early in the century (Moortgart-Correns 1972) — are usually large and low; they have an upper/inner mound encircled by a lower/outer one which in turn is encompassed by a remarkably regular polygonal or circular fortification ring, in some cases quite imposing. In addition to these defining characteristics, most *Kranzhügel* sites feature the presence of broad lines that radiate from the site (FIG. 3). Such lines are also found at many other types of site in the Khābūr region, which were occupied during the Early Bronze Age.

The exact number of *Kranzhügel* sites (TABLE 1) varies from author to author (Moortgart-Correns 1972; Warburton 1985; Lebeau 1990).[2] For the most part these sites are located south and west of the Khābūr River in areas of low precipitation as illustrated by FIG. 4, where their



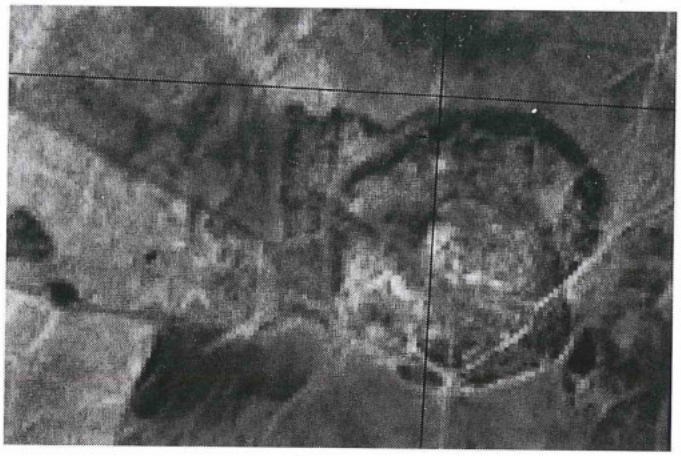

2. Precipitation for Syria with Jāwa and north Syrian sites.

[2] Tall Ḥammām, located northwest of Tall Mabṭūḥ ash-Sharqī, was first identified from a SPOT image, and verified on the ground.

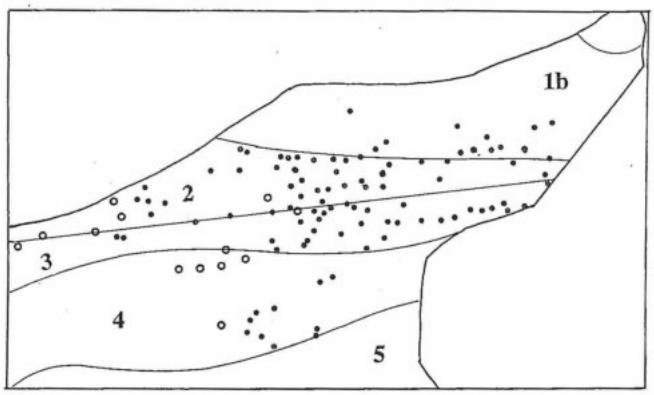
distribution over four agricultural stability zones (used by the Syrian ministry of Agriculture; Soumi 1991) is given.[3] The year to year variability in rainfall is such that five sites in zone 3 will have crops that fail one-third to two-thirds of the time, and five sites in zone 4 will have crops that fail half the time. Tall Malḥat adh-Dharū in zone five is located in an area where dry-farming is not tenable.

A distinctive morphological feature of *Kranzhügel* sites is their outer fortification ring as seen in aerial photographs and sketch plans. None of these rings has been excavated so their composition and construction techniques are not verified, but at Tall Mu'azzar and elsewhere there is clear evidence for borrow pits on the exterior side of the ring, from which much of the soil for the fortifications comes. It is probable that these rings are earthen ramparts heaped up in a manner similar to Middle Bronze Age fortifications at Carchemish and Ebla, mainly because their very size renders it unlikely that they are ruins of solid mudbrick walls. Also we have failed to find evidence of large mudbrick walls in places where erosion has occurred. On the other hand, lines of stone curtain walls are visible on top of the ramparts of Tall Mu'azzar, Tall Malḥat adh-Dharū and Tall Mabṭūḥ ash-Sharqī. Stone ruins in deep troughs in the rampart of Tall Mu'azzar are probably remains of city-gates. *Kranzhügel* sites are often described as having double, or concentric, rings of fortifications under the assumption that a second ring circumvallates the inner mound. A good example of the inner fortification is the stone curtain wall on the perimeter of the inner mound of Tall Mu'azzar; as in that case, the fortifications of inner mounds are less substantial than the outer rings and there is some question whether large earthen ramparts encircle the inner mound.

The outer fortification rings are often quite huge. At Tall Malḥat adh-Dharū and Tall Mu'azzar they are extant in places up to 6-8 meters high from their base on the outer side of the *tall*, and 2-4 meters high on the inner side of the ring, although at Tall Mabṭūḥ ash-Sharqī and Tall Ḥammām they are lower. The widths at two sites



3. Satellite image of Tall Mabṭūḥ al-Gharbī (courtesy of UNOCAL).




4. Agricultural Stability Zones for northeastern Syria. *Zone 1b*: The zone has between 350-600 mm of rain per year, but not less than 300 mm in any 2 out of 3 years. Main crops are wheat, pulses and summer crops. *Zone 2*: The zone has an average rainfall between 250-300 mm, but not less than 250 mm every 2 out of 3 years. At least 2 crops are grown every 3 years. Crops are barley, wheat, pulses and summer crops. *Zone 3*: The mean annual precipitation is greater than 250 mm, but not less than 250 mm every 2 out of 4 years. Barley is the main crop; some pulses may be grown. *Zone 4:* Average rainfall is between 200-250 mm, but not less than 200 mm every 2 out of 4 years. Barley is grown and the land is used for grazing. *Zone 5*: Average annual rainfall is less than 200 mm. Some winter pasturage, but unsuitable for agriculture without irrigation (Suomi 1991).

**Table 1.** Size and location of Kranzhügel sites.

| ID | Site | Size in Ha. Total | Inner | Rampart | Stability Zone |
|---|---|---|---|---|---|
| 1 | Khuwayra | 64 | 27 | . | 2 (3) |
| 21 | Mabṭūḥ E. | 50 | 12 | . | 4 |
| 112 | Malḥat adh-Dharū | 37 | 7 | 9 | 5 |
| 46 | Baydar | 34 | 9 | . | 2 |
| 18 | Mabṭūḥ W. | 24 | 3 | . | 4 |
| 107 | Ḥammām | 22 | 3 | . | 4 |
| 22 | Mu'azzar | 14 | 3 | 4 | 4 |
| | Dalīz | . | . | . | 3 |
| 2 | Abū Shahat | . | . | . | 3 |
| 4 | Bugha | . | . | . | 2 (3) |
| 3 | Khanzīr | . | . | . | 2 (3) |
| 19 | Mūghar | . | . | . | 4 |
| 20 | Khazna | 12 | 3 | . | 4 |
| 58 | Aswad Foqānī | . | . | . | 3 |

[3] Analysis of a longer span of annual precipitation records in North Syria indicates that three of the sites [Khuwayra (Chuera), Khanzīr and Bugha] actually have conditions typical of zone 3 (pers. comm. G. Walker, ICARDA).

have been measured by pacing, and on average are 29 m wide at Tall Mu'azzar and 43 m wide at Tall Malḥat adh-Dharū, so that depending on the radius of the ring, the fortifications may comprise large areas of land: 9 hectares, or 24% of the total size of Tall Malḥat adh-Dharū and 4 hectares, or 29% of Tall Mu'azzar. Given the marginal location and isolation of the *Kranzhügel* sites, as well as the potential cost of construction, it is puzzling that such large fortifications were erected, a consideration also raised in regard to Jāwa.

The inner mound, and the outer mound girding, are described as higher and lower platforms that lie above the surrounding terrain and are relatively flat. In some instances the platform of the outer city is irregular; at both Tall Mu'azzar and Tall Malḥat adh-Dharū the eastern and northeastern areas of the outer settlement are 2-3 m lower than the other parts. These low spots are, in effect, enclosed depressions within the outer settlement. It is possible that they and others elsewhere may have been excavated by the inhabitants as a source for soil to build the outer defensive ring or mudbrick structures inside the site.

The monumental fortifications of the *Kranzhügel,* the two-tiered structure of an upper and lower town, to use the terminology of Jāwa, their large size and their agriculturally marginal location are comparable to Jāwa, but one other key feature of Jāwa is its water management system. Helms' (1981) study provides a detailed description which may be summarized in four headings:

1. *Source*: water harvesting refers to the collection of rainwater from slope runoff and ephemeral flow in wadis. At Jāwa the bulk of the water is obtained from Wādī Rājil but some is slope runoff defined as five micro-catchments.
2. *Conveyance*: water was transported to the storage areas in channels called gravity canals. Slope runoff would in most cases flow obliquely into a channel along much of its length, and water from Wādī Rājil was diverted by dams into the channels. The channels are narrow (1-3 m wide), and rock cut or stone built (Helms 1981: FIG. 76). One substantial diversionary dam was found at Jāwa, the reconstructed plan of Deflection Dam DaI; the other two points of diversion (DaII and DaIII) are not very substantial affairs.
3. *Storage*: water is stored at Jāwa in a series of ten pools or reservoirs, three of which (P2-P4) border the lower town. Pool 4 was formed by the construction of a large holding dam D1 which is a major construction.
4. *Usage*: the impounded water provided drinking water for the inhabitants of Jāwa and their livestock. Water may have been used for irrigation but there is no direct evidence for it (Helms 1981: 183-187).

Over ten years ago Helms wrote:

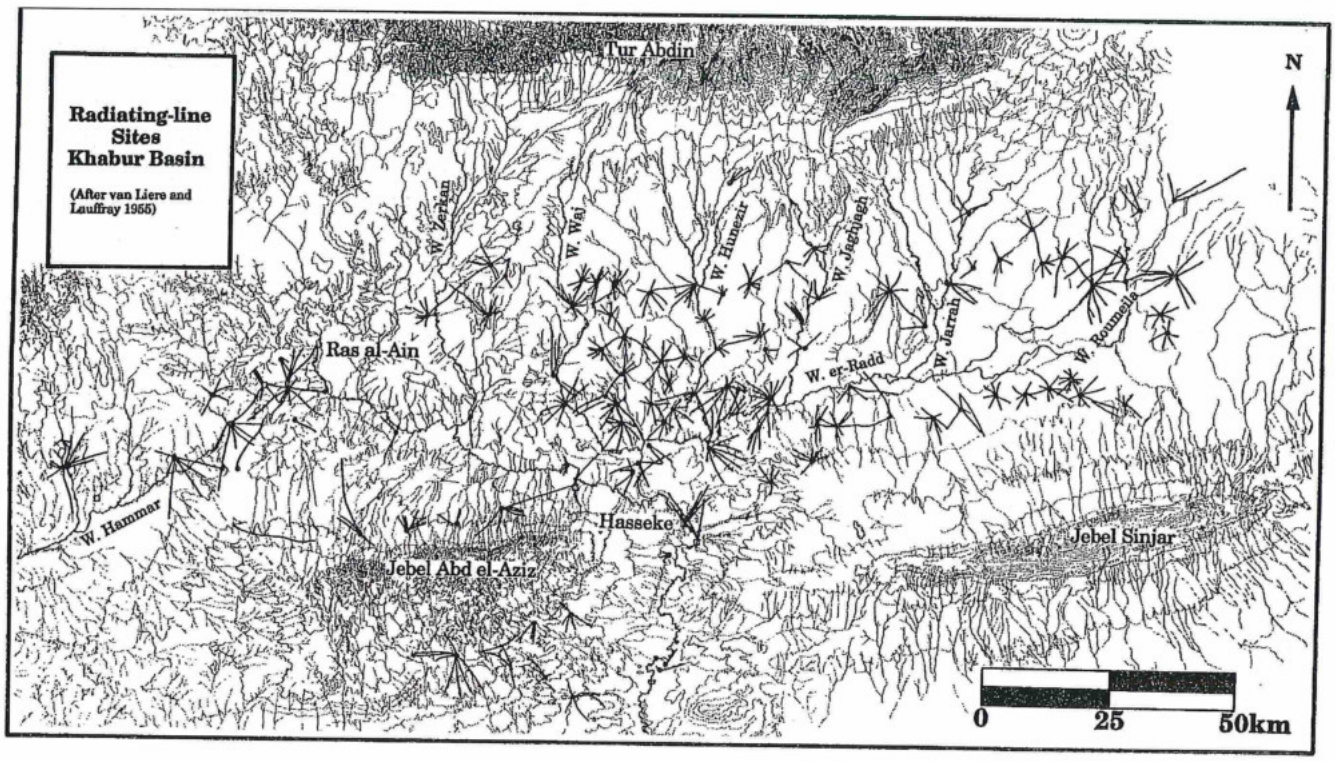
> The contention then is that the hydro- and urban technology evident in the achievement at Jāwa was very likely known and developed long before the fourth millennium in northern Mesopotamia and north-eastern Syria (Helms 1981: 167)... However unless they are sited in deserts and have not been covered with the normal millennial debris that characterizes tells in the Near East there is very little chance that anything as complete as Jawa will ever be uncovered (Helms 1981: 159).

In North Syria, new research (Grayson *et al.* nd; McClellan *et al.* nd) shows that water harvesting was likely to have been a significant aspect of *Kranzhügel* and other Bronze Age sites. When we consider the same four points as above, we note that: 1) the water source was rainwater runoff 2) that was conveyed by radial lines 3) to storage areas near sites 4) to be used by the inhabitants for drinking and for watering livestock. There is no direct evidence for field irrigation but it may have been practiced.

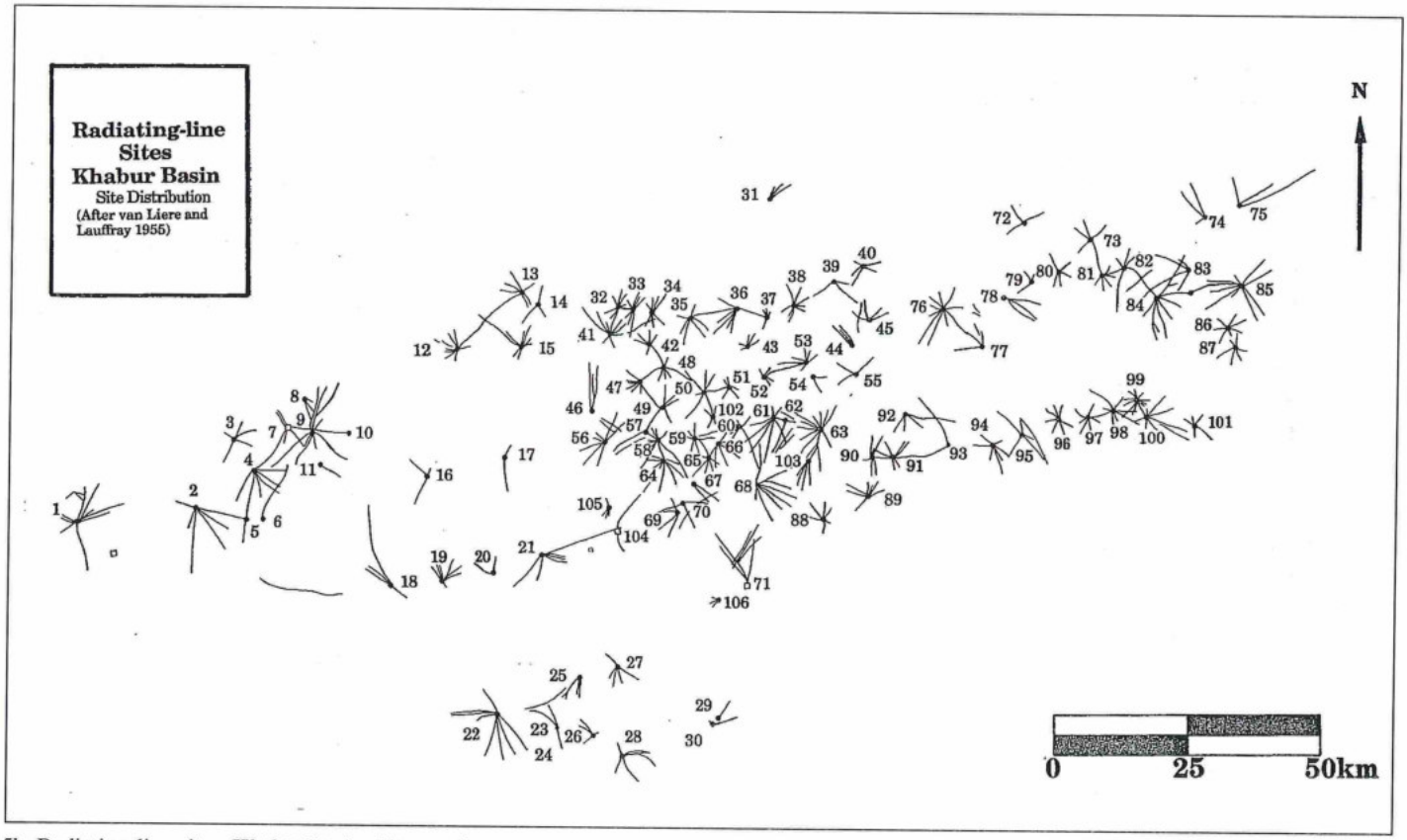
Evidence for water harvesting is seen in two elements, conveyance: lines radiating from sites, and storage: enclosed depressions adjacent to sites. Over 35 years ago van Liere and Lauffrey (1955) published a map of the Khābūr showing radial lines at more than 100 sites, including all *Kranzhügel* sites except for Tall Daliz and Tall Malḥat adh-Dharū (FIG. 5). They interpreted the lines as transportation routes that were formed by traffic.

Despite the lines being recognized by others (Buringh 1960; Oates 1968) little mention was made of them until Wilkinson (1990a; 1990b; Ball *et al.* 1989) discussed their presence in the Tall Hawa area of Iraq, due east of the Khābūr catchment. He assumed they functioned as routes and named them "hollow ways", a term used to describe sunken lanes in England and Europe. Independently McClellan (nd) proposed these lines may have had a hydraulic function. There has been no direct evidence to support either the road or hydraulic interpretations, however counter arguments have been made against each. For example many of the lines do not lead anywhere, few connect satellite sites to hub sites and several major sites are not linked by radial lines, unexpected results if they were communication/transportation routes. In turn arguments against the hydraulic interpretation have been put forward, the two main ones being: a) slope reversal along radial lines means they could not have conveyed water; and b) there are no signs of spoil heaps along the lines, which one might expect if they were deliberately dug and cleaned canals.

Data has been collected to directly address these objections and formally test McClellan's ideas. SPOT satellite images verified the existence of these lines through remote sensing, but they are of insufficient resolution to develop maps with the required vertical accuracy. Nor is aerial photography available. Thus a conventiona




5a. Radiating-line sites, Khābūr Basin: Topography.




5b. Radiating-line sites, Khābūr Basin: Site numbers.

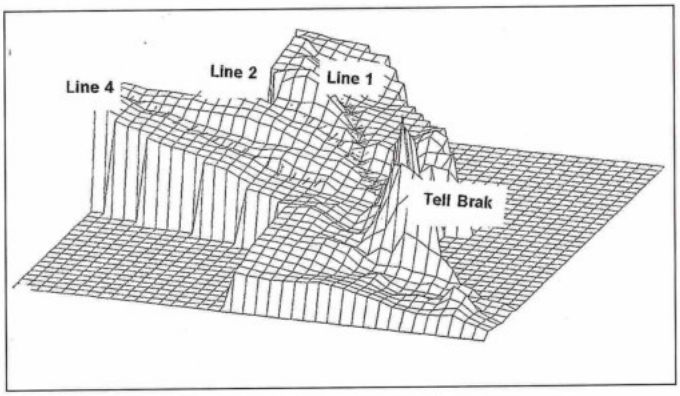
ground survey was undertaken. In preliminary field work a region was sought where radial lines visible in the SPOT images approximately coincided with the van Liere and Lauffrey map, as well as observations on the ground today. Modern agricultural activity including irrigation and land forming has made the task more difficult.

One area fulfilling the requisite conditions is near Tall Brāk. It is not a *Kranzhügel*, but at 43 hectares in area and very high, Tall Brāk is one of the most important sites in the Khābūr region. It was first excavated by Mallowan (1947) in the thirties and since 1967 has been under renewed excavation by D. and J. Oates (D. Oates 1977; 1982; 1985a; 1987). We wish to thank the Oates for their interest and cooperation in this work. Northwest of the site a general survey of the area surrounding several radial lines was made, including detailed surveys of long and cross sections of three lines and the collection of soil profile samples from transects across the lines. The long sections display a remarkably constant grade given the surrounding topography. The grade of the lines is quite different to the undulating land around them (FIGS. 6, 7).

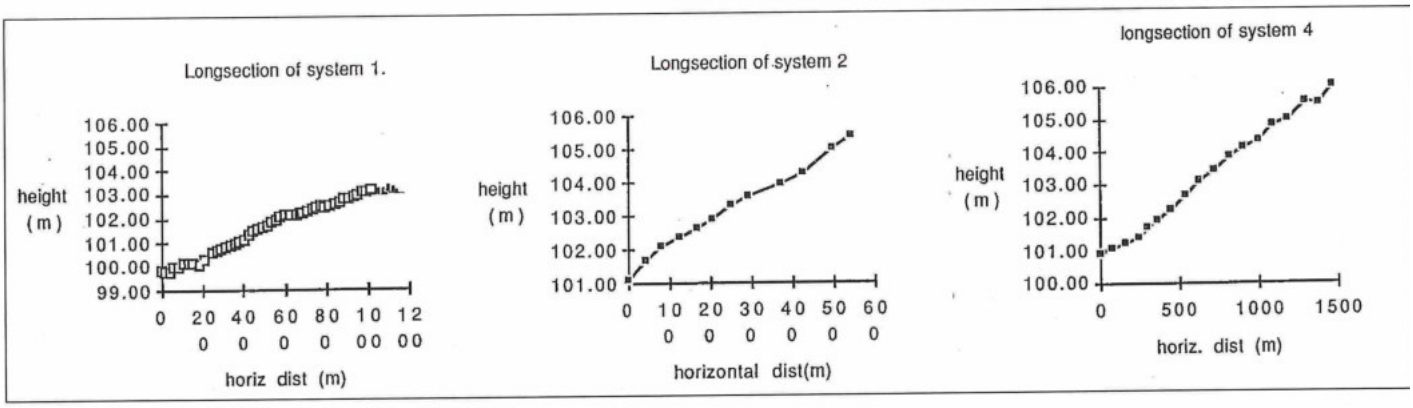
This work demonstrates that these lines would have acted as a rainwater harvesting system; it is estimated that the runoff contributing area is increased approximately seven-fold from 1.3 km$^2$ to 9.5 km$^2$. This figure is for the three lines surveyed, when other lines sloping toward the site are considered the area would be even larger. Without the effect of the radial lines it is calculated that 130 Ml of water would collect around the base of Tall Brāk, but the additional runoff diverted there by the radial lines would provide an annual total of 950 Ml, which has a volume of 9.5 x 10$^6$ m$^3$.

The increased surface runoff draining to the site may have been treated by the inhabitants in one of two ways — either as beneficial or as a nuisance. Given the relatively low annual precipitation and the even drier areas of *Kranzhügel* sites south and west of Tall Brāk, it is most probable that the extra water would have been welcomed. It may have been stored at the site in several ways. The simplest option is to recharge the shallow groundwater which would insure that loss through evaporation is minimized, although the water stored below ground would depend on the capacity of the aquifer to contain the excess water. In effect this strategy would counteract or reduce the effect of the dropping water table during the dry months. It would slow or prevent the drying up of water holes and wells.[4] Another option is to divert the water directly into agricultural fields, and a third is to store the water above ground in enclosed depressions (pools or reservoirs) adjacent to the site.

Whether stored as recharge of local ground water or above ground, a large depression would be required — artificially enclosed or dug below ground level. Today such a depression surrounds Tall Brāk, but the site is highly eroded and much of its soil has washed down to the base of the *tall*, so it is feasible that the depression was much larger in antiquity. Furthermore it is likely that much of the accumulated volume of soil at Tall Brāk and other mudbrick sites originated from the immediately surrounding area; on that assumption crude volume balance analysis indicates large borrow pits adjacent to the sites. The soil that forms Tall Brāk may have accumulat-




6. Radial lines at Tall Brāk, wireframe model.




7. Longsections of radial lines 1, 2 and 4 at Tall Brāk.

[4] Water holes dating as early as the Hassuna/Sammara period have been discovered at sites in the Tall Hawa region (Wilkinson 1990b).

ed over thousands of years of occupation, but at the *Kranzhügel* sites there is a greater likelihood that the massive outer ring fortifications and their borrow pits were formed over much shorter periods of time. As we have seen at Tall Malḥat adh-Dharū and Tall Mu'azzar, with ring fortifications of 9 and 4 hectares respectively, considerable quantities of soil were required, most of which must have come from the outer ditch. This fosse may have served a military function, but it also certainly acted as storage for rainwater runoff.

Calculations for Tall Brāk on the increased water volume and projected water consumption by humans and animals from the settlement indicate that large surpluses of water would have been available for field irrigation. While it is difficult to verify the practice of irrigation at *Kranzhügel* sites, their location in areas of low rainfall indicates the need for supplemental, or in the case of Tall Malḥat adh-Dharū, full irrigation. Even in areas with greater rainfall, the practice of supplemental irrigation would serve to buffer the community against interannual variability, of significant impact to the stability and longevity of a settlement when we consider that many of the Khābūr sites are located in areas where crops fail from once every three years, to once every two years, as noted above. Supplemental irrigation also substantially increases crop yields (Perrier 1986; Perrier and Salkini 1991).

The issue of water management in northern Syria has not been sufficiently considered. Although we acknowledge the difficulties of proving intentionality in the construction of radiating lines and enclosed depressions, water harvesting at Jāwa serves to demonstrate that such systems were on occasion deliberately designed and executed at least as early as the third millennium BC.

The presence of a water harvesting action for radial lines and depressions at Tall Brāk suggests that water harvesting occurs at the more than one hundred sites where there are radial lines. Many of these sites are situated in small natural depressions and close to wadis, locations where water collection could be readily amplified. Although we extrapolate from the Tall Ḅrāk evidence to generalize about these other sites, each site, each radial line and each enclosed depression must eventually be evaluated separately.

It must be stressed that this technology is found over all agricultural stability zones in Syria, not just in those areas where it may have functioned as an essential survival mechanism. It features in the productive rain-fed farming zones, such as at Tall Laylān, as well as the more modest precipitation areas around Tall Brāk. The focus on Jāwa's location in a highly marginal zone, while highlighting the achievement of its builders, has perhaps served to eclipse the significance of the site in developmental terms. Another contributing factor is of course the question of chronology.[5]

While one of the prominent concerns with the chronology of Jāwa has been the anomaly of its early date in comparison to Palestinian urbanism and state formation, we note the same anomaly when Jāwa is considered in relation to indigenous developments in Syria. There is a widely held view that the presence of Uruk colonies in the late fourth millennium in Syria had little lasting effect and did not lead to the later emergence of state formation there. This has been most strongly espoused by Weiss (1986; 1988; 1991) who sees secondary state formation in the dry farming regions of Syria as occurring only in the middle of the third millennium — 2600 BC (Weiss 1991), some 500-700 years after the colony period. Numerous parallels for the pottery of Jāwa have been found in the Uruk period in northern Syria, predominantly at the Uruk colony site of Ḥabūba Kabīra South (Helms 1987; Betts 1991). These parallels may provide a *terminus ante quem* for Jāwa's ceramics in as much as: a) the occupation at Ḥabūba was short-lived; b) there was little continuity of ceramic styles, particularly southern Uruk styles, after the collapse of the colonies; and c) there was a subsequent gap in occupation on the Middle Euphrates.

However, recent publications and new work at a number of sites in the Middle and Upper Euphrates necessitates a re-evaluation of specific chronological issues in the Uruk and subsequent periods. This affects not only the details of Jāwa's ceramic relationship to the north, but our understanding of its place in the emergence of complex societies in the Near East. It is proposed here that the chronological gap between Jāwa on the one hand, and the *Kranzhügel* sites on the other, may be narrower than previously thought. On the basis of ceramic comparisons from, among others, area RII at Ḥadīdī (Dornemann 1988), Area A at Tall Aḥmar (Til Barsip, Jamieson 1990), Chantier B at Mari (Lebeau 1985; 1987), and an intensive surface survey from a six-site cluster at Tall Banāt (Porter 1991; McClellan and Porter nd) the time span for the Syrian parallels at Jāwa must be

[5] There is nothing more vexing than attempting to date hydraulic systems, as has been pointed out at Jāwa, since datable artefacts and sealed deposits are usually not associated with them. Unless there is specific evidence available for individual instances, when we speak of the radial line and *Kranzhügel* sites in the aggregate we must use very broad chronological terms and expect to find exceptions to the rule. Nevertheless there is a case to be made that most sites with radial lines are occupied primarily in the third millennium. In any event they are unlikely to date later than the Middle Bronze/Old Babylonian period after which there was a significant decline in settlement in the Khābūr. This working assumption regarding the chronology is based on excavations at sites with radial lines (Tilāl Brāk, Barrī, Laylān, Muzān, Khuwayra) and surface surveys of unexcavated sites with radial lines (Meijer 1986; B. Lyonnet pers. comm.); there are in fact several sites that appear to have been occupied only in the third millennium. It is assumed that radiating lines can be dated by the occupation of the sites with which they are associated. However we cannot be certain whether the lines were developed over a short time span, or over a long period with constant and gradual modifications and additions.

extended into the third millennium. Further, not only does the material from these sites clearly demonstrate that there is continuity in the region around Ḥabūba Kabīra in terms of occupation and ceramic styles, it also provides some evidence to suggest that there was lineal and uninterrupted development in complexity from the Uruk colony period onwards.

Stratum I, area RII at Ḥadīdī, despite the limited amount of material excavated, contains elements typical of the Uruk colony period as well as the grit tempered wares of 'Āmūq G.[6] This has given rise to some debate as to whether Stratum 1 does indeed belong to the Early Bronze I as Dornemann (1988) labelled it, or is more properly to be seen as Uruk (see for example Algaze 1986, who does not accept the use of the term EB I until after bevelled rim bowls have dropped from the assemblage). In fact the question is largely one of terminology and somewhat misses the point. Stratum 1 is most appropriately understood as transitional to both periods — following on from the collapse of the Ḥabūba colony, preceding the Early Bronze proper, and equivalent to the "post Uruk" settlement at Hassek Höyük, where subsequent to the destruction of the main Uruk level, Uruk type ceramics are found with new and local materials. This parallels the situation at Karatut Mevkii, where Schwartz (1988b) has proposed that rather than representing functional variation in the Uruk scheme of colonies and trading stations, disparities in the nature and quantities of Uruk material at some sites is indicative of chronological differences. The presence of the conical bevelled rim bowl with string cut base, one of the few distinct markers of the Jamdat Naṣr period elsewhere, firmly places the "Uruk" levels at Karatut Mevkii after the period of the Ḥabūba colony (Schwartz 1988b). Similarly J. Oates (1990) divides the later Uruk material at Tall Brāk into Middle/Late Uruk and Latest Uruk/Jamdat Naṣr.[7] At Kurban Höyük, the separation of the Late Uruk material into at least two phases has been proposed by Algaze (1986). There is little question at this point that Ḥadīdī Stratum 1 belongs to this latest phase, and that it dates to the end of the fourth millennium, whether it is called Late Uruk, Latest Uruk, Jamdat Naṣr, Protoliterate C and D, or Early Bronze I.

The main difference between Ḥadīdī Stratum 1 and Stratum 2 lies in the absence of any Uruk features in the latter. There is otherwise a strong degree of continuity to be seen in many forms. Dornemann (1988) attributes Stratum 2 Level 1 to the EB II, and Stratum 2 levels 2A and 2B to the EB III. However the published ceramics for these levels show an internal coherence that suggests that they are better treated as one chronological unit, despite the appearance here of corrugated cups. There seems to be little overlap between these levels and the tomb groups, which appear to come much later in the sequence.[8] Using Algaze's terminology, Stratum 2 equates to the EB I, in Dornemann's, the EB II, and in that of Oates or Lebeau, Early Dynastic I. It is contemporaneous with Swayhāt Phases A-F (Holland 1976; 1977), Ḥalāwa B (Orthmann 1981), Area A at Tall Aḥmar and levels 18-9, Chantier B at Mari.

The importance of Ḥadīdī in this context is that it is one of the few sites in the Middle Euphrates area that provides excavated material demonstrating ceramic and occupational continuity from the Uruk colony period well into the third millennium, although this material appears to be present at a surprising number of sites.[9] One or two bevelled rim bowl fragments at Tall Aḥmar suggest that there is an earlier level there which corresponds to Ḥadīdī Stratum I, and at the Tall Banāt site cluster the recent discovery of Uruk occupation completes the ceramic and developmental sequence. As Dornemann (1988) notes, there are indications that there is also material at Ḥadīdī which may be contemporary with Ḥabūba Kabīra South. Ḥadīdī then provides a link to the Uruk colony period for that area; other Euphrates sites — especially Tall Aḥmar and Mari — can be confidently accommodated to its stratigraphic sequence, and demonstrate a continuity in ceramic forms for some Uruk types,[10] which must be understood as occurring after the colony period, and for indigenous types. Ceramics in the sequence from post-Uruk colony period sites offer direct parallels to several genres and types from Jāwa. A small sample of these are provided in FIGS. 8-12.

Thus from the perspective of North Syria at least,[11] the chronological and geographical span into which Jāwa can be placed should be broadened. This should not be limited to purely ceramic considerations. Dating difficulties, and the fact that there has been comparatively

[6] Although grit-tempered wares are found in smaller quantities towards the end of Amuq F, just as chaff tempered wares are found in smaller quantities in the Amuq G.

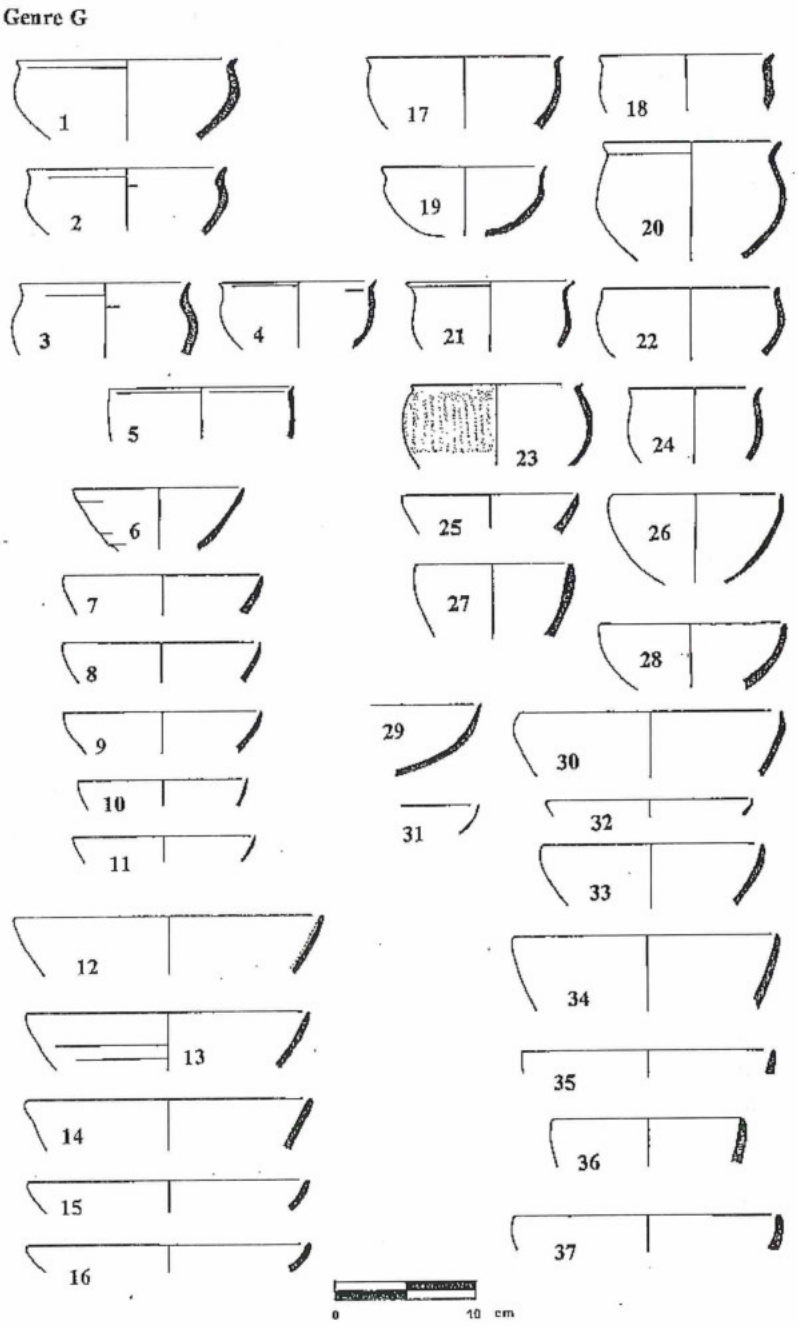
[7] There is considerable dissension over the Jamdat Nasr period itself — whether as a chronological term it can be used outside Mesopotamia, indeed whether such a period exists within Mesopotamian chronology at all.

[8] Although it is possible that differences between occupation levels and tomb groups at Ḥadīdī are functional rather than purely chronological, Tomb 1 at Tall Banāt, dated to the EB III, shows close affinities with the EB III tombs at Ḥadīdī. In the Tall Banāt tomb a large number of ordinary domestic wares, typical of domestic contexts at the site, have been included with the specialized, or luxury wares most frequently found in tomb settings.

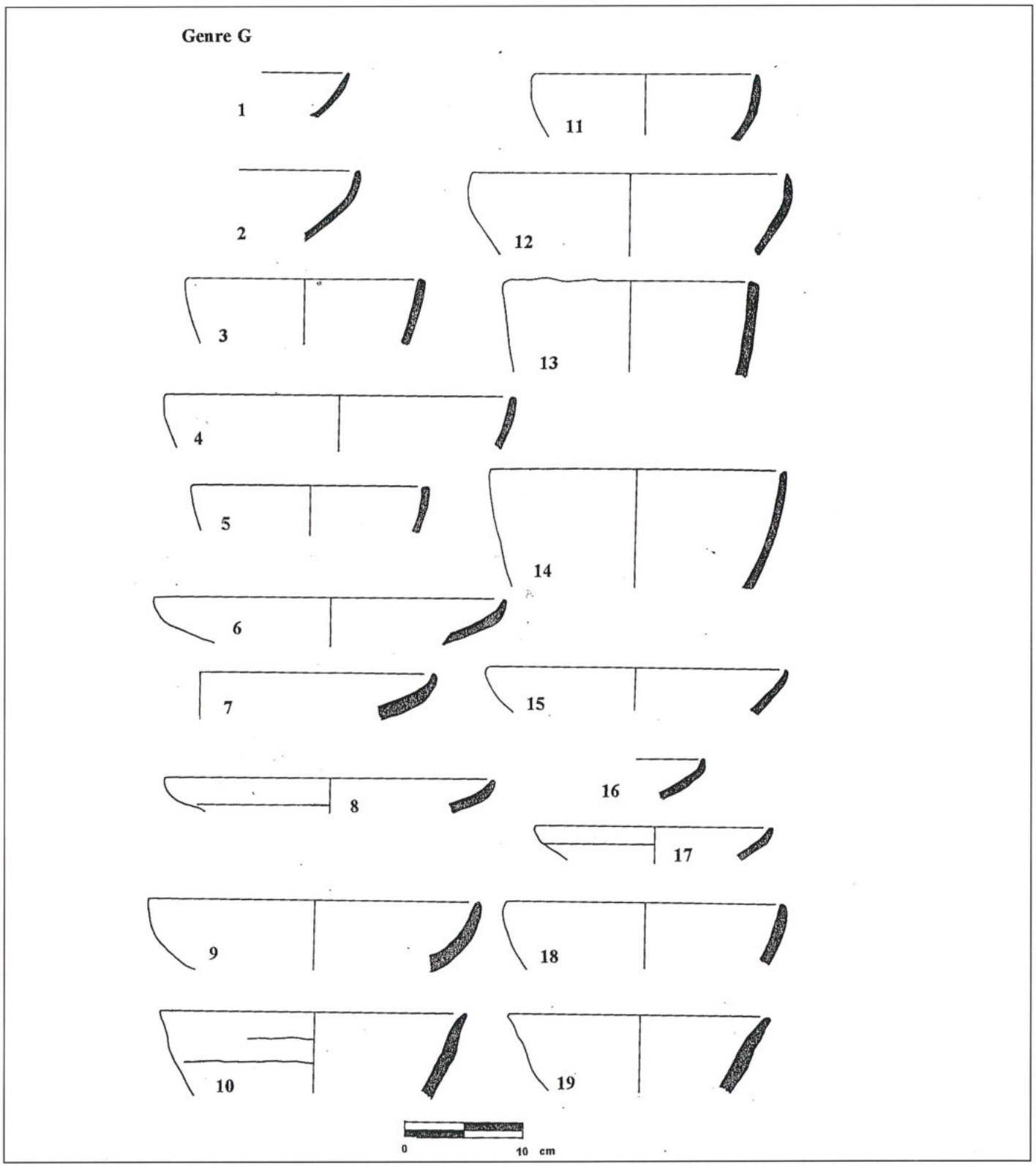
[9] Most of which, however, have yet to be excavated in such a way as to provide sequential links between the different phases of the late fourth to mid-third millennia.

[10] *Contra* D. Surenhagen (pers. comm.) who argues that Uruk forms cease with the collapse of the colony period, and that therefore any "Late Uruk" material must be dated to that period. K. Kohlmeyer (pers. comm.) on the other hand recognizes a later form of the bevelled rim bowl.

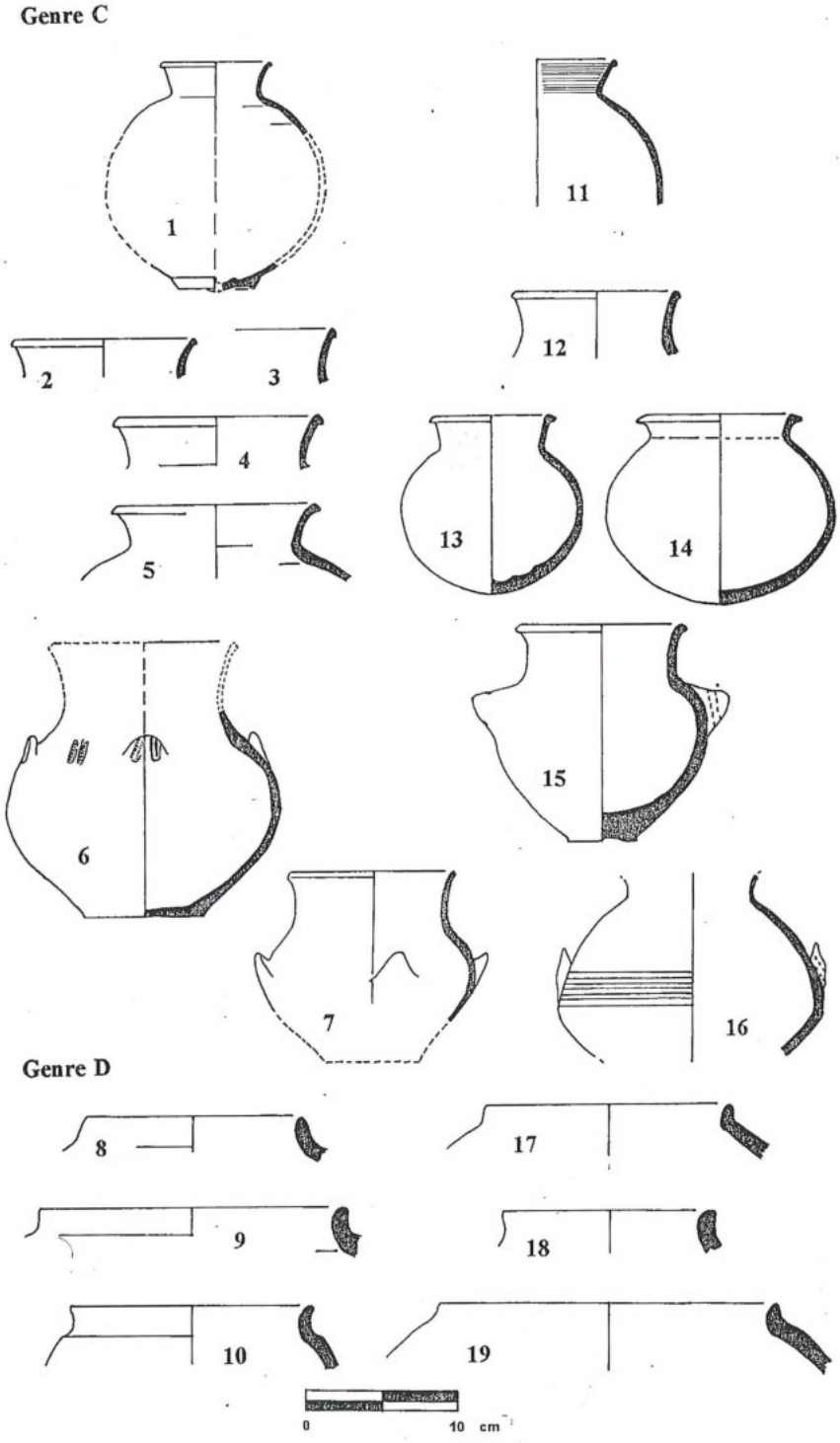
[11] We do not attempt here to address the various problems presented by the Jāwa ceramics in terms of Palestinian chronology. However the divergence between the dating for the EB I in Syria and in Palestine, and concomitant differences in levels and types of social organization, is a serious problem, and one that needs to be resolved before we can arrive at any valid explanation for the secondary origins of urbanism and the state.



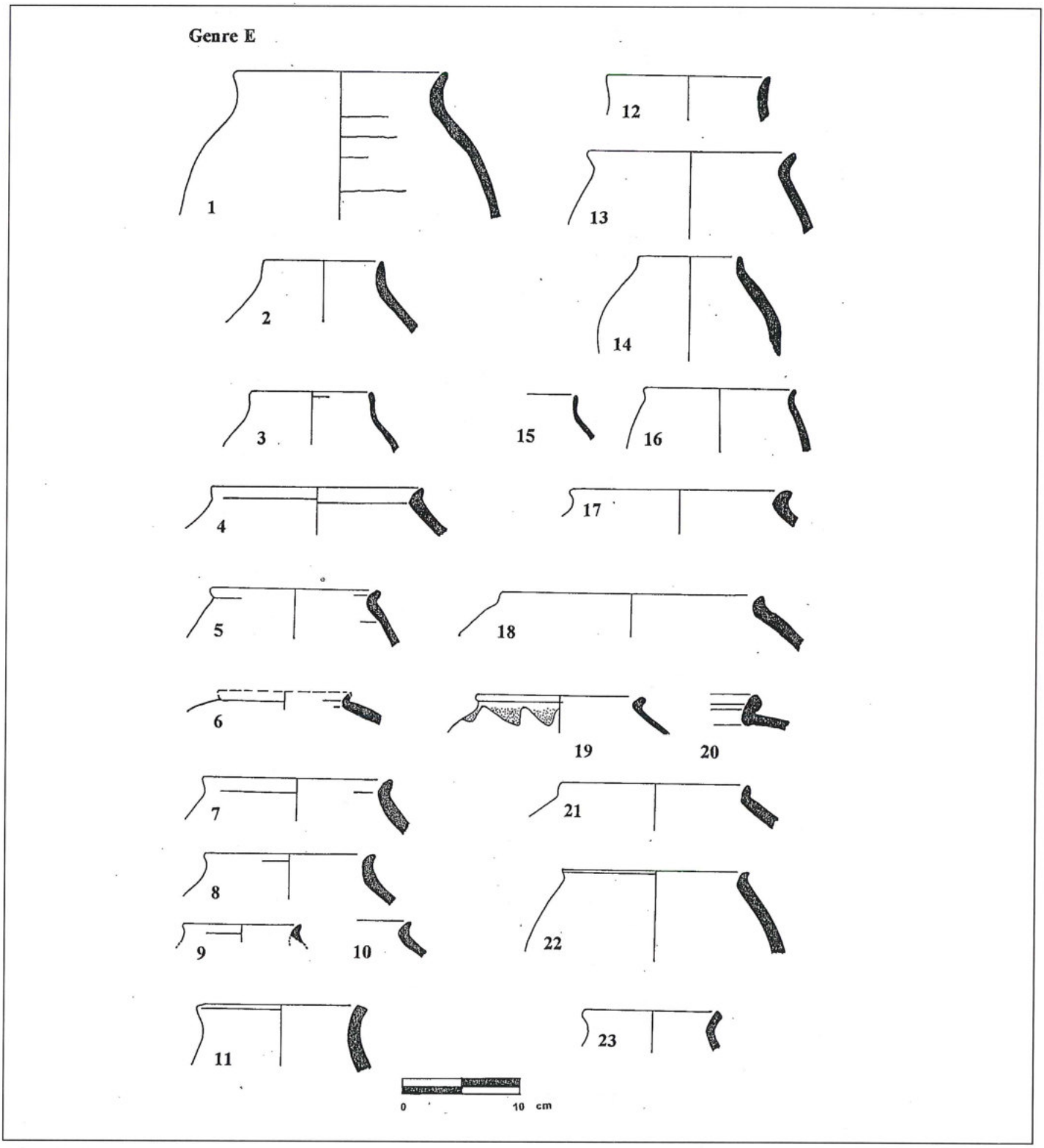

8. Parallels for Jāwa ceramics with post-Uruk colony sites in Syria (Genre G): 1. Jāwa (Betts 1991: FIG. 145.470); 2. Jāwa (Betts 1991: FIG. 145.471); 3. Jāwa (Betts 1991: FIG. 145.472); 4. Jāwa (Betts 1991: FIG. 145.476); 5. Jāwa (Betts 1991: FIG. 145.482); 6. Jāwa (Betts 1991: FIG. 145.484); 7. Jāwa (Betts 1991: FIG. 145.487); 8. Jāwa (Betts 1991: FIG. 145.485); 9. Jāwa (Betts 1991: FIG. 145.486); 10. Jāwa (Betts 1991: FIG. 146.489); 11. Jāwa (Betts 1991: FIG. 146.488); 12. Jāwa (Betts 1991: FIG. 146.490); 13. Jāwa (Betts 1991: FIG. 146.492); 14. Jāwa (Betts 1991: FIG. 146.491); 15. Jāwa (Betts 1991: FIG. 146.494); 16. Jāwa (Betts 1991: FIG. 146.495); 17. Aḥmar (Jamieson 1990: FIG. 21.10); 18. Aḥmar (Jamieson 1990: FIG. 21.2); 19. Karatut (Schwartz 1988b: FIG. 9.3); 20. Ḥalāwa (Orthmann 1981: FIG. 56.23); 21. Ḥalāwa (Orthmann 1981: FIG. 56.21); 22. Aḥmar (Jamieson 1990: FIG. 21.9); 23. Hassek (Behm-Blancke 1981: FIG. 9.2); 24. Ḥadīdī (Dornemann 1988: FIG. 4.37); 25. Ḥadīdī (Dornemann 1988: FIG. 4.17); 26. Ḥalāwa (Orthmann 1981: FIG. 56.4); 27. Mari (Lebeau 1987: FIG. 2.22); 28. Mari (Lebeau 1987: FIG. 7.6); 29. Brāk (Fielden 1981: FIG. 1.4); 30. Ḥadīdī (Dornemann 1988: FIG. 5.6); 31. Brāk (Fielden 1981: FIG. 1.9); 32. Ḥadīdī (Dornemann 1988: FIG. 5.7); 33. Ḥadīdī (Dornemann 1988: FIG. 5.34); 34. Bdayrī (Pfalzner 1988: FIG. 33.c); 35. Bdayrī (Pfalzner 1988: FIG. 33.b); 36. Ḥadīdī (Dornemann 1988: FIG. 6.25); 37. Bdayrī (Pfalzner 1988: FIG. 31.d).



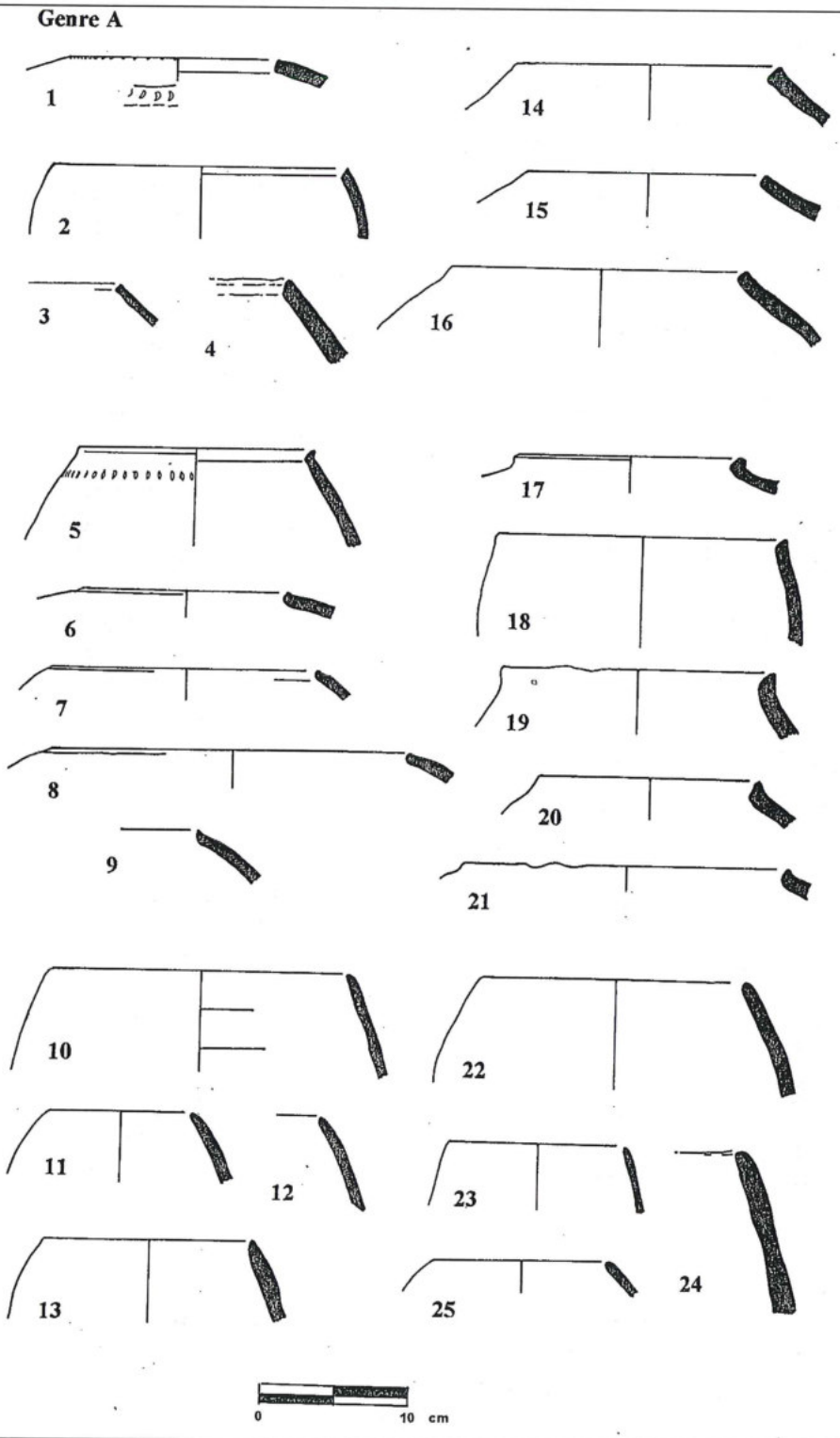

9. Parallels for Jāwa ceramics with post-Uruk colony sites in Syria (Genre G): 1. Jāwa (Betts 1991: FIG. 146.493); 2. Jāwa (Betts 1991: FIG. 146.496); 3. Jāwa (Betts 1991: FIG. 146.500); 4. Jāwa (Betts 1991: FIG. 146.497); 5. Jāwa (Betts 1991: FIG. 146.499); 6. Jāwa (Betts 1991: FIG. 147.512); 7. Jāwa (Betts 1991: FIG. 147.511); 8. Jāwa (Betts 1991: FIG. 147.513); 9. Jāwa (Betts 1991: FIG. 148.522); 10. Jāwa (Betts 1991: FIG. 148.525); 11. Mari (Lebeau 1987: FIG. 2.18); 12. Bdayrī (Pfalzner 1988: FIG. 33.1); 13. Aḥmar (Jamieson 1990: FIG. 38.2); 14. Ḥalāwa (Orthmann 1981: FIG. 56.11); 15. Ḥalāwa (Orthmann 1981: FIG. 56.9); 16. Brāk (Fielden 1981: FIG. 1.7); 17. Ḥadīdī (Dornemann 1988: FIG. 4.35); 18. Bdayrī (Pfalzner 1988: FIG. 31.2); 19. Aḥmar (Jamieson 1990: FIG. 19.12).




10. Parallels for Jāwa ceramics with post-Uruk colony sites in Syria (Genre C and D): 1. Jāwa (Betts 1991: FIG. 130.259); 2. Jāwa (Betts 1991: FIG. 130.270); 3. Jāwa (Betts 1991: FIG. 130.272); 4. Jāwa (Betts 1991: FIG. 130.263); 5. Jāwa (Betts 1991: FIG. 130.260); 6. Jāwa (Betts 1991: FIG. 122.162); 7. Jāwa (Betts 1991: FIG. 122.163); 8. Jāwa (Betts 1991: FIG. 135.332); 9. Jāwa (Betts 1991: FIG. 135.336); 10. Jāwa (Betts 1991: FIG. 135.335); 11. Brāk (Fielden 1981: FIG. 1.14); 12. Aḥmar (Jamieson 1990: FIG. 36.4); 13. Raqa'ī (Curvers and Schwartz 1990: FIG. 16.13); 14. Mari (Lebeau 1987: FIG. 1.3); 15. Brāk (Oates and Oates 1991: FIG. 8.4); 16. Brāk (Oates and Oates 1991: FIG. 8.3); 17. Aḥmar (Jamieson 1990: FIG. 39.13); 18. Aḥmar (Jamieson 1990: FIG. 39.11); 19. Aḥmar (Jamieson 1990: FIG. 39.12).




11. Parallels for Jāwa ceramics with post-Uruk colony sites in Syria (Genre E): 1. Jāwa (Betts 1991: FIG. 136.341); 2. Jāwa (Betts 1991: FIG. 136.343); 3. Jāwa (Betts 1991: FIG. 136.345); 4. Jāwa (Betts 1991: FIG. 138.362); 5. Jāwa (Betts 1991: FIG. 138.363); 6. Jāwa (Betts 1991: FIG. 138.366); 7. Jāwa (Betts 1991: FIG. 139.378); 8. Jāwa (Betts 1991: FIG. 139.380); 9. Jāwa (Betts 1991: FIG. 139.387); 10. Jāwa (Betts 1991: FIG. 139.388); 11. Jāwa (Betts 1991: FIG. 137.361); 12. Aḫmar (Jamieson 1990: FIG. 29.1); 13. Ḥadīdī (Dornemann 1988: FIG. 7.5); 14. Aḫmar (Jamieson 1990: FIG. 29.4); 15. Mari (Lebeau 1985: FIG. 27.23); 16. Ḥadīdī (Dornemann 1988: FIG. 6.31); 17. Aḫmar (Jamieson 1990: FIG. 36.16); 18. Aḫmar (Jamieson 1990: FIG. 39.12); 19. Hassek (Behm-Blancke 1981); 20. Mari (Lebeau 1985: FIG. 26.8); 21. Aḫmar (Jamieson 1990: FIG. 39.13); 22. Aḫmar (Jamieson 1990: FIG. 39.14); 23. Aḫmar (Jamieson 1990: FIG. 36.1).




12. Parallels for Jāwa ceramics with post-Uruk colony sites in Syria (Genre A): 1. Jāwa (Betts 1991: FIG. 117.92); 2. Jāwa (Betts 1991: FIG. 121.150); 3. Jāwa (Betts 1991: FIG. 117.100); 4. Mari (Lebeau 1987: FIG. 4.8); 5. Jāwa (Betts 1991: FIG. 117.94); 6. Jāwa (Betts 1991: FIG. 121.145); 7. Jāwa (Betts 1991: FIG. 121.144); 8. Jāwa (Betts 1991: FIG. 121.142); 9. Jāwa (Betts 1991: FIG. 121.143); 10. Jāwa (Betts 1991: FIG. 120.130); 11. Jāwa (Betts 1991: FIG. 120.135); 12. Jāwa (Betts 1991: FIG. 121.160); 13. Jāwa (Betts 1991: FIG. 120.131); 14. Aḥmar (Jamieson 1990: FIG. 38.5); 15. Aḥmar (Jamieson 1990: FIG. 39.1); 16. Aḥmar (Jamieson 1990: FIG. 38.6); 17. Aḥmar (Jamieson 1990: FIG. 37.4); 18. Aḥmar (Jamieson 1990: FIG. 38.11); 19. Aḥmar (Jamieson 1990: FIG. 37.3); 20. Aḥmar (Jamieson 1990: FIG. 38.10); 21. Aḥmar (Jamieson 1990: FIG. 38.13); 22. Aḥmar (Jamieson 1990: FIG. 37.1); 23. Mari (Lebeau 1987: FIG. 2.13); 24. Mari (Lebeau 1987: FIG. 4.11); 25. Aḥmar (Jamieson 1990: FIG. 20.5).

little exposure of pre-EB IV levels in the Euphrates area, have inhibited attempts to investigate the nature of settlements in the first half of the third millennium, and to ascertain their developmental status. It is generally assumed that sites such as Ḥadīdī, Swayhāt and Ḥalāwa in this earlier phase represent small to medium sized, individual and localized occupation, somewhat isolated from the rest of the third millennium world. However, evidence is emerging from recent survey and excavation work at a group of sites in the vicinity of and including Tall Banāt on the left bank of the Euphrates, north of Ḥadīdī, which suggests that during the early third millennium there was a two or three tiered, and functional differentiated hierarchy of sites there, with elite burials, centralized ceramic production and public architecture (McClellan and Porter nd; Porter 1991; McClellan 1991). The analysis of the material from the Tall Banāt project is not yet concluded, but is sufficiently advanced to place these settlements in the first half of the third millennium — the earliest post-colony material corresponds to Ḥadīdī strata 1 and 2. In conjunction with the recently published Early Dynastic remains from Mari, in particular with the ED I and II period, this warrants a reassessment of our current perception of the developments in Syria at this time. It is suggested here that urbanization and state formation may have taken place in the Euphrates area somewhat earlier than is presently proposed, and that it is unlikely to have been an isolated process.

For example, the possibility that the Middle Khābūr sites of Tall 'Atij, Tall Judayda (Gudeda) and Tall ar-Raqā'ī may be part of an embryonic state system must be considered. These sites seem to be a) contemporaneous and b) to perform related specialized functions in a regional and economic system. Fortin (1990a; 1991a) associates the function and location of 'Atij and Judayda to the establishment of Mari and cites Margueron for the potential dating of the latter to the beginning of the third millennium (see for example Margueron 1991).

Mari at its foundation was a major settlement according to Lebeau (1987) who states that ED I material is distributed across the whole extent of the site. Margueron argues that the hydraulic system, with its large concentric earthen rampart and its canals, also dates to the beginning of occupation there. This implies a planned and constructed community, rather than one that gradually developed on an *ad hoc* basis. Moreover, part of the hydraulic system at Mari (Margueron 1987; 1991) essentially uses water harvesting, since one canal conveys rainwater runoff diverted from a wadi by a dam. Mari might now be considered the largest *Kranzhügel* as it shares with them two key features: a large earthen outer ring (although interpreted as a dike to protect the interior from flooding) and radial lines, i.e. canals transporting rainwater runoff, etc. We also note similarities between Mari and Jāwa.

Mari indeed seems pivotal at this juncture. Strong connections can be made between the ceramics of its levels 18-9 and the Middle Euphrates sites, the small Middle Khābūr sites (but not the more northerly site of Tall Laylān), the *Kranzhügel* sites, and even to Jāwa. With regard to the Middle Khābūr, these parallels may offer an explanation for the puzzling nature of the small specialized sites of 'Atij, Judayda and Raqā'ī, which seem to have functioned as collection, processing and shipment stations for agricultural products. It is postulated that these products may have been directed towards Mari, rather than to the north, which, it is argued, would have had little need to exploit this area to supplement its own agricultural production (Fortin 1990a; 1991b; Curvers and Schwartz 1990).

If the location of such sites on the Middle Khābūr is problematic, where labor intensive irrigation was required (Curvers and Schwartz 1990), so too is the question of why — and when — the *Kranzhügel* sites were established in the less productive regions. Moortgart-Correns (1972) has placed Khuwayra (Chuera) and the *Kranzhügel* sites in the Early Dynastic/Mesilim period, i.e. the first half of the third millennium BC. In his study of the ceramics of Tall Khuwayra, in which he concentrated on the so-called Metallic Ware, Kühne (1976) also dated the occupation of the Period I strata to the Early Dynastic period. Some scholars on the other hand have suggested that the ceramics and occupation at Tall Khuwayra were dated too high, and have argued that they are better placed in the second half of the third millennium BC (Schwartz 1988a), and a major disagreement has arisen. The excavator of Tall Khuwayra indicates that the site was founded in the Early Dynastic period and that this occupation ended at the beginning of the Akkadian period (Orthmann 1986; 1990). While he dates the ceramics to the later third millennium, Orthmann states that there is clear evidence of ED I and ED II non-ceramic material at the site. Lebeau (1990) has recently reviewed the chronological problems and outlines a solution to the dilemma based on the suggestion that there are two kinds of Metallic Ware, the "Chuera Metallic Ware", which dates to ED I-III, and "Akkadian Metallic Ware" (also called "Stone Ware" by J. Oates), dating from the end of the ED III to the end of the third millennium BC. Lebeau (1990) also argues that the founding and main occupation of the *Kranzhügel* sites, including Tall Khuwayra, dates to the second and third quarters of the third millennium BC. This corresponds to

the founding of Mari.[12] Recent "grab-sample" surface collections from other *Kranzhügels* (Tall Mu'azzar, Tall Ḥammām, Tall Mabṭūḥ ash-Sharqī) verify that they were occupied during the third millennium, with at least a component of the assemblage datable to the first half on the grounds of parallels with the Early Dynastic material at Mari.

Although it could then be argued that levels 18-9 in Chantier B at Mari should be down-dated to better fit with the later dating of Khuwayra, the relationship of this material to other sequences on the Euphrates counteracts this. Khuwayra parallels Mari ED I (Lebeau 1985; 1987), which in turn has many good correlations with Tall Banāt, Tall Aḥmar, Ḥalāwa Tall B, (all of which correspond to Ḥadīdī Stratum 2), as well as to Ḥadīdī itself. There are, however, no direct parallels that we have ascertained between Khuwayra and Ḥadīdī in the area RII material. Dornemann has noted the association of the Ḥadīdī tomb material with Metallic Ware at Khuwayra, and there is certainly a general affinity between some of the tomb forms and the Khuwayra shapes.

While it is not here argued that the Khuwayra corpus *must* be updated, the foregoing review serves to show that the dating of Khuwayra is by no means resolved.[13] Therefore in an alternative chronological scenario, Tall Khuwayra and the *Kranzhügel* sites could have been established in the first half of the third millennium BC, perhaps sometime during 2900 - 2700 BC. South and west of the Khābūr River, agriculturally peripheral areas were settled and large-scale public works employed in the form of earthen rampart fortifications and water harvesting lines.

## Conclusion

The similarities between sites in north Syria and Jāwa, in terms of public works, technological development, ceramics and expansion into agriculturally marginal regions, are not fortuitous. This is not to argue that the relationship between Jāwa and the north is a direct or causal one, which might imply colonization or implantation, rather that the process which led to the development of technologically sophisticated, and by inference, organizationally advanced, settlements in disparate areas affected much of the Fertile Crescent. It seems that these processes represent not merely a cyclical population fluctuation but are related in some way to state formation and urbanization.

Having said this, we must face one remaining problem central to both regions:

> The location and complexity of the site generated the most difficult questions. The construction of Jawa was obviously an enormous undertaking, a great investment of human energy and ingenuity which found expression in the massive stone fortifications, extensive water harvesting systems, and densely packed domestic quarters. Over ten hectares were enclosed in two rings of walls.... the very existence of the site demands answers to so many questions, the most problematic of which are, of course, why was Jawa established and how did the population exist in the semi-arid region... (Helms 1981: 12).

We need only replace *Kranzhügel* or Malḥat adh-Dharū for Jāwa, mud for stone, and increase the size of the site to ask this question of North Syria. Various explanations have been put forward. D. Oates (1985b) has proposed that the outer settlements were "places of refuge for the agricultural population of the countryside". Alternatively he suggested that the imposing earthen fortifications were symbolic markers of prestige. On the other hand Kühne (1976; 1983) understands the presence of *Kranzhügel* sites in these marginal areas as part of the expansion of trade activity by southern Mesopotamia with Anatolia. Such an explanation meshes with that for the establishment of Mari on the Euphrates (Margueron 1987), and the organization of agricultural supply centers on the Middle Khābūr where foodstuffs were gathered to sustain Mari. It is also possible that population pressures led to this expansion into marginal areas. However some years ago van Liere (1963: 115) suggested that "... their [the *Kranzhügel* sites] position in a low rainfall zone may be indicative that these people were at least partly pastoral". Hole has recently enlarged on this possibility to explain the storage facilities at Raqā'ī, 'Atij and Kirma on the Middle Khābūr, but which might be extended to the *Kranzhügel* sites; he sees the former as centers that "...would have served a 'tribe' of people, most of whom were absent for the winter, and most of whom actually lived in tents or other impermanent shelters..." (Hole 1991: 17). The answers to the questions about Jāwa and its place in the Jordanian desert are not yet in, but they are surely to have implications for the north — a key to interpretation of these phenomena is their interconnectedness.

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[12] The only other *Kranzhügel* for which dating information has been published is Tall Malḥat adh-Dharū; Kühne(1983) has stated that its main occupation was during the third millennium BC., based on surface sherds including Ninevite V, Metallic and Simple wares, as well as triangular ledge handle cooking pots. Sherds from the Uruk, Middle Bronze, Late Bronze and Iron Age period were also found.

[13] Helms (Betts 1991) notes many parallels with the later third millennium in north Syria, including Tall Khuwayra, but treats these as "developed forms" which indicate the possibility that earlier examples may match fourth millennium Jāwa.

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# Cosmetic Techniques: A Historical and Botanical Approach

## Introduction

Through its long history, Arabia was renowned as the land of valuable aromatics, together with the Punt or the coast of Somalia, the Yemeni island of Suqutra and the Indian coast of Coromandel. This contribution will focus mainly on frankincense and myrrh, referring to the lands of the aromatic trees, to the botanical species, the technique of collecting the gum resins, and the uses in religious and funerary rituals, in medical prescriptions and finally in the preparation of perfumes. At the same time, the economic and political effects of the trade will be summarized through the historical periods of Arabia.

## The Earlier Historical Records

In the Early Bronze Age, around 2800 BC, the Pharaohs of Egypt dispatched regular expeditions to "God's Land" or Punt. Incense (*sntr*) and myrrh (*'ntyw*) were brought from that country by traders to the Upper Nile and were used in religious and funerary ceremonies, as attested by the early ritual texts (Groom 1981: 22-23). The Egyptian ships could reach the coast of the Red Sea by the eastern branch of the Nile in Wādī Ṭumaylāt, the Bitter Lakes and then the Gulf of Suez. Geographically, the Punt is to be identified with "Nubia, the ancient Land of Kush, in Sudan" (Groom 1981: 28). But Ethiopia, Somalia and the East Coast of Africa in general were rich in aromatics. The bedouins of the Punt who controlled the land trade, attacked the Egyptian vessels. Pepi I launched punitive raids, but with no success, and in the time of Pepi II (mid-third millennium BC), the Egyptian expeditions were interrupted (Montet 1946: 181). During the Middle Kingdom, the trade was resumed but ceased under the Hyksos occupation. It was Queen Hatchepsut of the New Kingdom who mounted an expedition to the Punt in 1493 BC, as recorded on the walls of her temple at Dayr al-Baḥrī: The explorers reached, after a journey by land and sea, "the incense terrace". They brought back "quantities of incense, together with trees in tubs, ebony, ivory, gold, cinnamon, eye-paint, apes, monkeys, dogs and leopard skins" (Groom 1981: 22). The paintings of Dayr al-Baḥrī reveal that the natives met in the Punt are partly of Negroid, partly of Hamitic stock. The villages are of rounded huts on piles with ladders to reach the doors. Other animals depicted on the wall paintings, such as giraffes, point to an African country. It is assumed that the Pharaohs brought myrrh from the Punt, rather than frankincense, because this resin was extensively used for mummification (*infra*). The trees grow in the eastern part of Somalia (frankincense) and in the northern hilly country, especially in Wādī Labarra (Balsan 1965: 113-117); the incense tree is called in the local dialect "*djeggar*" while the myrrh is "*malmal mour*". The aromatic species grow farther west inland in the high plateau of Haud, Dubahanta and Ogaden and "the region of Wahash in Ethiopia" (Groom 1981: 25-26). The harvest of the gum resin in that country begins in November and continues until March (Balsan 1965: 119).

Similarly, Southern Arabia is reputed for its excellent aromatic species, mainly in western Ḥaḍramawt, in eastern Dhufār and Mahra. In 1977-78, Professor Theodore Monod from the Museum of Natural History in Paris visited 16 stations in these mountainous lands and described the variety of trees (see *infra*). Although Arabia is known as the major producer of frankincense and myrrh, no mention of these spices appears before the first millennium BC: From the eighth to the first centuries BC, the history of Yemen is dominated by the caravan states who collected the gum resins and other aromatic plants and transported them to the Mediterranean markets (Robin 1991-93: 52). The episode of the queen of Sheba' (*Saba'*?) in the Bible, however, introduces the spices of Arabia as early as the tenth century BC: According to *I Kings*, 10:1-10, the South Arabian queen was attracted by the fame of Solomon's wisdom and visited him in Jerusalem, bringing with her "camels laden with spices, great quantities of gold and precious stones" (*I Kings*, 10:1-2). The holy Qur'an relates the same episode in sourat al-Naml, 27:23-45, with many attractive details.

The story of Solomon (965-928 BC) and the queen of Sheba' raises arduous chronological issues, since the

kings of South Arabia, the *mukarrib*, priest-kings or federal chiefs, are not attested before the eighth-seventh centuries BC, although the South Arabian states are believed to have been organised as early as the beginning of the first millennium BC (Eph'al 1982: 64). Even though, there is no single mention of a queen in the bulk of South Arabian inscriptions. Eph'al tried to prove, with difficulty, that the biblical tradition had "a bit of authenticity": Some authors identify the Sabaeans with the nomads of North Arabia, mentioned in the Annals of Tiglath-Pileser III and the Book of *Job* 1:15. However, it should be recalled that the biblical account mentions the queen of Sheba' and not the "Sabaeans" of *Job* 1:15, of the Assyrian *Annals*. It could be argued that we possess no information about the political situation in Saba' in the tenth century BC. It seems more plausible, at any rate, that the episode is a later literary topos, celebrating the glory of Solomon and at the same time his mercantile activities in the Red Sea, with the help of Ḥiram, king of Byblos in Phoenicia. It is also likely that the story is related to one of the North Arabian queens who are recorded in the Assyrian *Annals* in the eight-seventh centuries, in connection with the spices (*infra*).

Tiglath-Pileser III (745-727) launched a campaign against Samsi, queen of the Arabs in 733 BC and mentions in his Annals the booty he gained: "500 (bags) of all kinds of spices..." (Eph'al 1982: 35). Later, Sargon II received as tribute from the desert "all kind of aromatic substances" (Pritchard 1954: 286). King Esarhaddon (680-669) imposed on Iata', king of Arabia 100 bags "with aromatic matters, (more than) his father" (Pritchard 1954: 292). It should be noticed that the myrrh and frankincense are not mentioned in these Annals, but only "aromatic spices." Nevertheless, those gum resins existed in North Arabia before Islam for the rituals and the medical prescriptions and should have been included in the tribute rendered by the Arabs. This is confirmed by the records from the Persian period, since Herodotus (III: 97) notes that the Arabs rendered yearly to the Achaeminid king a thousand talents' weight of frankincense, equivalent to 27 tons. The trade flourished in the sixth-fifth centuries as evidenced by the numerous incense burners excavated in Transjordan and Palestine.

A remarkable limestone vase of this type was discovered at Tall as-Sa'īdiyya, in the Jordan Valley in 1966 by J. B. Pritchard (1972: 3-17). It is decorated with a geometric design in five registers, consisting of teeth of the saw, diagonal incisions and cross-hatching (FIG. 1). An Aramaic inscription on one side, dated to the fifth-fourth century BC, reads "*LZKWR*", to Zakkur. The burner was found in the open-court building and a sample of charcoal from the floor of the room where it was retrieved, produced a C14 date of 343 +/- 52 BC (Pritchard 1972: 3). In his analysis of the Tall as-Sa'īdiyya in-



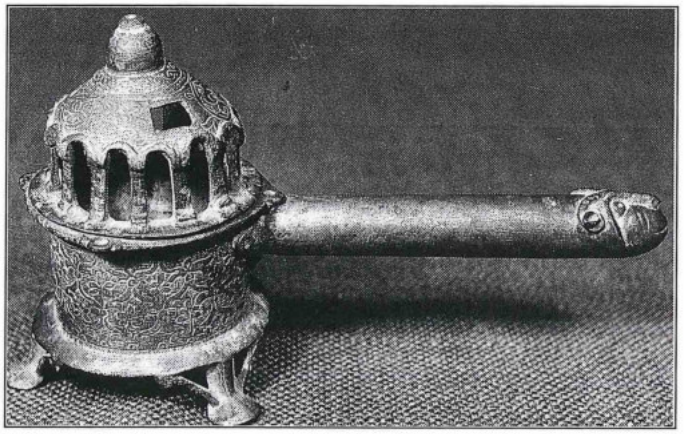

1. The Tall as-Sa'īdiyya incense burner (after Pritchard 1972: FIG A-F).

cense burner, Pritchard mentions thirteen similar objec from Tall Jammah, in southern Palestine, discovered b F. Petrie and dated to the sixth-fourth centuries BC. Si burners were discovered at Gezer and about two hur dreds limestone altars or stands were collected at La chish; an Aramaic inscription on one vase reads "*lbnt* (incense) (Pritchard 1972: 12). To judge from the larg amount of altars and vases found in Palestine, there ap pears to have been an increase in the trade during th Persian period.

In his study of the Palestinian examples, E. Ster (1973: 187-195) distinguished four different groups Group A is decorated with a geometric border and frieze of human figures, animals or plants, while group I is decorated with a geometric design alone, such as th Tall as-Sa'īdiyya example. The first group has no par allels outside Palestine and is believed to be a local pro duction, but the latter exhibits strong Mesopotamian in

fluence of the Assyrian-Babylonian periods in the sixth-fifth centuries BC. The third group includes altars decorated with a debased design of "reliefs or statuettes" and represents the last phase of decline in the production. The last group is undecorated.

In fact, not all of the incense burners described by Stern are from the Persian period, since similar objects are dated to the Arab Umayyad times in the eighth century AD as proved by L. Y. Rahmani (1980: 116-122). The author published an incense burner decorated with "chip-carved triangles", similar to Stern's specimen 22 (1973: 195), and dated by him to the sixth-eighth centuries AD. This assumption is plausible, when the numerous incense burners of the Umayyad period discovered in Jordan are considered: Some of them, from the 'Ammān Citadel, are in limestone or bronze (Harding 1951: 7-16) (FIG. 2); other censers of decorated bronze were discovered in the Umayyad palace of Umm al-Walīd (Bujard *et al.* 1992: 17-18, FIGS. 12-13) (FIGS. 3, 4; see *infra* for the Islamic period).



2. Umayyad censer from the 'Ammān Citadel.



3. Censer from the Umm al-Walīd Umayyad palace (courtesy of J. Bujard).

In Jordan, a unique bronze censer of the fifth century BC was excavated in a tomb at Umm Udhayna, western 'Ammān, together with attic lekithoi and bronze bowls of the Persian period (FIG. 5). The caryatid female figure — standing on a tripod — is dressed in a long tunic decorated with incisions, which is fastened by a tasseled belt and clings to the breasts. The shoulders are covered by a cape with large sleeves, similar to the Iranian-Achaemenid dress (Moorey 1973: 83-99; Culican 1975: 100-112). The burner consists of a cup, riveted to the triangular hat by a stem and covered by a fenestrated cover (Zayadine 1985: 155-156; Khalil 1986: 103-110).

The reputation of Arabia as the land of valuable aromatics excited the imagination of the Greek authors. To account for the high prices of the Arabian spices, they claimed the trees were protected by flying snakes "and the only way to get rid of them is by smoking them out with storax" (Herodotus, *Hist.* III, 108). In fact, the high prices of the incense is attributed to the long way the caravaneers traverse from South Arabia to Ayla (70 days according to Eratosthenes) and to the large number of territories and tribes who exacted taxes.

The frankincense and myrrh, along with other aromatic gum resins, were stocked in special storage bins called in the local dialect (*shahri*) *moḥr, moḥor* (موحر، محار) (see Al-Shahri 1994: 295). In September, at the end of the monsoon, the harvest was transported to the local ports of Mocha (Muza) or to Rās Fartak (Syagros) and from there to the major harbour of Bīr 'Alī (ancient Qana or Kané). A land track reached Shabwa (Shabwat) where the aromatics were collected and taxes paid. From the capital of Ḥaḍramawt, the caravans headed to Ma'rib (Marsyaba of Strabo) and to the kingdom of Ma'īn (Minaean) and from there to Najrān. The track continued to



4. Censer from the Umm al-Walīd Umayyad palace (courtesy of J. Bujard).



5. The Umm Udhayna Caryatid Censer.

al-Madīna, avoiding Makka and arrived at al-'Ula (Dedan) and al-Ḥijr, the famous Nabataean station (Hegra). From Petra, the desert track reached Gaza (69 to 88 days from Shabwa to Gaza) (Rouaud 1994: 41-43). From the seventh to the end of the second century BC, the Minaeans in the Jawf of Yemen were in control of spice trade and a tribe, 'Amīr, was responsible for the transportation of the precious merchandise (von Wissmann 1964: 152-159). They established commercial colonies at al-'Ula, in Egypt, along the Mediterranean coast from Gaza to Sidon and possessed a base in the Island of Delos.

When Alexander the Great captured Gaza in 331 BC, Plutarch reported in his *Vies Alexander*, 25:6 "he also sent to Leonidas his tutor five hundred talents weight of frankincense and a hundred of myrrh in remembrance of the hope with which that teacher had inspired his boyhood" (*Loeb Classical*). It is explained that when Alexander was a boy and was sacrificing to the gods, he was taking incense with both hands and throwing it on the altar-fire. So precious was the Arabian spice that Leonidas warned him: "Alexander when thou has conquered the spice-bearing regions, thou canst be thus lavish with thine incense, now, however, use sparingly what thou hast" (*Vies*, 25:6). To allow his teacher to be generous with the gods, the Macedonian conqueror dispatched him the equivalent of thirteen tons of spices.

After they settled in South Jordan around the sixth century BC, the Nabataean tribes became the middlemen of the spice trade and after the collapse of the Minaean state at the end of the second century BC, they took over this lucrative enterprise. They used the ports of Gaza and Rhinocolura (al-'Arīsh) to export the merchandise to Europe.

In 311 BC, when Antigonus Monophthalmus mounted a military expedition against the Nabataeans, his general Athenaeus captured their "Rock" about midnight and seized a large quantity of frankincense and myrrh together with five hundred talents of silver (Diodorus, *His. Library* XIX, 94:3). This account confirms the Nabataean involvement in the "spice business" as early as the fourth century BC, and this role is attested in the third century BC by the Zenon Papyri (Edgar 1925: PSI 628; PCZ 590011.51). Strabo (*Geog.* 16,4:18) provides further details on the trade activities in the Red Sea: "Near the Island of (Phoceae) is a promontory, which extends to the Rock of the Nabataean Arabians, as they are called and to the Palestinian country, whether Minaeans and Gerrhaeans and all neighbouring peoples convey their loads of aromatics." This is a clear indication of the role of the Nabataeans as intermediary of the spice trade. But where was the "Rock"? There is no doubt that the account of Strabo concerns the Red Sea and the Gulf of Ayla-'Aqaba, the Isle of Phoceae being probably modern Tīrān and the "promontory" the Isle of Gray, or Jazīrat Far'ūn (see Zayadine 1994: 496). Now the "Rock" described by Diodorus as "exceedingly strong but unwalled" with a "single artificial approach" (XIX, 97:1), according to Hieronymus of Cardia, a general of Antigonus and eyewitness of the expedition, should be somewhere else (*infra*). There is in addition a "Rock", *hasela'* mentioned in the Bible, *2 Kings*, 14:7, in relation with the campaign of King Amaziah of Judah (798-769 BC) in Edom. Following N. Glueck (1939: 25-32), several authors identified the Rock of Diodorus and of King Amaziah with Umm al-Biyāra, in the central basin of Petra. However, in a convincing analysis, J. Starcky (1964; cols. 886-895) demonstrated that the biblical Sela' is to be located to the north. Furthermore, Diodorus, *apud* Hieronymus of Cardia, specifies that the "Rock" of the Nabataeans is distant "three hundred stades from the Dead Sea," that is 34 miles or c. 50 km. This figure conforms with the situation of as-Sala', a huge rock, 10 km south-southwest of aṭ-Ṭafīla, and not with Umm al-Biyāra, about 100 km from the Dead Sea. The recent discovery by Dr. Hamd Qatamine of an Assyrian bas-relief with a long cuneiform inscription, gives credit to the identification of this Rock with the biblical tradition; the presence of Nabataean sherds, of houses and turrets, half cut in the sandstone rock, half built with ashlar blocks may account for the "watchmen who informed the Nabataeans by prearranged fire signals" (Diodorus XIX

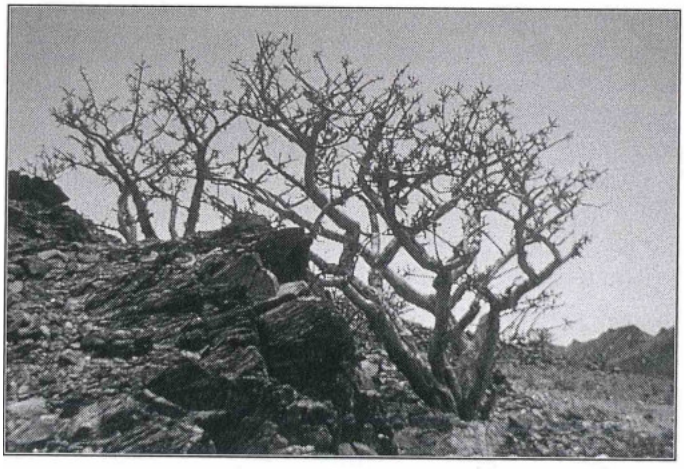
97:1). It is more plausible that the Nabataeans, before they settled in Petra-Reqem, used the naturally fortified rock of as-Sala' near aṭ-Ṭafīla and Bozrah (modern Buṣayra), the capital of the Edomites, to store the aromatics they received from the Gerrhaeans and the Minaeans and distributed them to the Mediterranean markets.

**The Aromatic Trees and their Gum Resins**

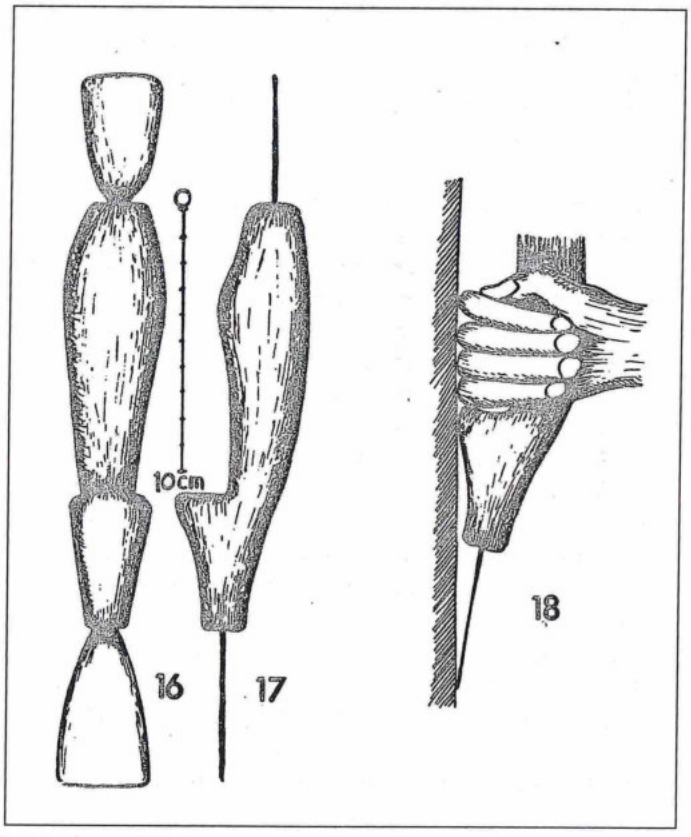
The incense trees examined by T. Monod in his botanical survey of South Yemen (1979: 146-150) belong to two different species: The *Boswellia sacra*, *luban* in Arabic and *maghrayt*, *magar* in *shahri* (مغر-مغيروت), springs from the ground in the form of a shrub or African acacia. The other type, the *Boswellia carteri* (FIG. 6), develops from a central trunk which may average from three to six metres in height; this latter type is however rare. Usually, the trees grow in a calcareous soil or even between the rock fractures, by the sea shore or in mountainous areas at an altitude of more than 2000 m. The myrrh tree, *Commiphora*, *murr* in Arabic and *qafal* in the local dialect, has a central trunk which may average six metres in height and gets covered with foliage after the monsoons, at the end of August or the beginning of September; it blossoms in spring time (Van Beek 1960: 71-73). The west central portion of South Arabia seems to be the only area where the myrrh tree grows. Pliny (*Nat. His.* XII, 35-69) lists seven varieties of myrrh, named after the regions where it grew, from Somalia "cave-dwellings" to Ma'īn, Ḥaḍramawt, Qatabān, Ausan, etc. The Somali land is rich, no doubt, in myrrh gardens, as attested by the exploration of Balsan (1965). But it is doubtful that other areas had important groves of this aromatic tree.

In Ḥaḍramawt, Somali workers are specialized in tapping the trees and collecting the gums, while this technique is practiced by bedouins in Dhufār (Monod 1979: 149). In Antiquity, according to Pliny (XII, 50:54), "there are no more than 3,000 families who retain the right of trading (the frankincense) as a hereditary property, and that consequently the members of these families are called sacred, and are not allowed to be polluted by ever meeting women or funeral processions when they are engaged in making incisions in the trees." Today, the incisions, about 15 cm long, are cut with a special knife, called *mengeb* or *mengeff*, measuring 35 x 45-60 mm and provided with a wooden handle and two blades (FIG. 7). The upper blade, with a rounded edge is used as a scraper to harvest the incense or myrrh resin that exudes in lumps or tears and solidifies in ten to twenty days. Frankincense tears are yellowish translucent when freshly gathered, while myrrh is reddish-brown and becomes greyish opaque when it hardens (FIG. 8).

The crops were much more abundant in ancient times: When Pliny published his *Natural History*, in the first century AD, the frankincense production was evaluated at 2500 to 3000 tons, while myrrh averaged 450-600 tons (Rouaud 1994: 41-42). Two harvests were possible at that time: If the incisions were done in summer, the collection of the gum resins occurred in autumn and if in winter, the harvest was undertaken in spring time. Freya Stark (1936: 10) mentions that the Dhufār coast could also produce two crops a year. She registered 1200 tons of frankincense that were exported from Dhufār and 800



6. *Boswellia carteri* in Dhufār, 'Oman (courtesy of S. Schmidt).




7. The *mengeff*, knife for cutting the bark of the incense trees (after Monod 1979: FIGS. 16-18).



8. The incision of the myrrh tree (courtesy of S. Schmidt).

from Somalia, the Arabian product being of better quality. Two varieties of *luban* can be distinguished: *badawi* or bedouin is used as a fumigant in religious or social ceremonies (*infra*), while the *luban miti* or *mayt*, named after a port in Somalia is a chewing gum. In 1967, Monod (1979: 150) recorded the following quantities in libras which were brought to the market of Mukalla: February: 900; March: 2300; May: 1500; July: 1600; September: 800; November: 2210; a total of 9210 libras for six months, equivalent to 4180 kilograms. In March and November are the highest crops, corresponding to the periods of the harvest. The figures are much reduced, in comparison to 1200 tonnes in 1934. In recent years "just a few tons of frankincense are produced each year in Dhofar" (Abercrombie 1985: 484).

**The Economic and Political Impact of the Aromatics**

Reference was made above to the monarchs from the Assyrian periods to the conquest of Alexander the Great who coveted the Arabian spices and looted them or imposed tribute on these commodities. The Romans considered the South Arabians as the wealthiest race, because they were producers and distributors of the incense "and buy nothing in return" (Pliny, *Nat Hist.* XII, 32:162). However, this author notes the surprising demand in Arabia for imported scents (XII, 38:78), a tendency still common today. Nevertheless, Pliny complained that "India, China and the Arabian peninsula take from our empire 100 million sesterces every year (equivalent to 85 tons of minted silver) — that is the sum which our luxuries and our women cost us" (XII, 41:84), and half of that sum was spent for Arabian merchandise alone. We now understand why Augustus ordered Aelius Gallus in 25 BC to conquer Arabia Felix, "to win wealthy friends or conquer wealthy enemies" (Strabo, *Geog.* 16, 4:24). The expedition was, as it is known, a failure, because the minister Syllaeus who was appointed by Obodas III, king of Petra, as a guide for the invading army, was aware of the danger the Nabataean trade was going to suffer, if the Roman venture ever succeeded.

The response of Augustus was to divert the spice trade to the Red Sea and to the Egyptian coast. However, the Nabataean cameleers continued the land trade to Gaza and to Egypt through the Sinai as late as the third century AD (Zayadine 1990: 151-152). It is true that the trade in the first century was in full prosperity. In the Gospel, the Magi came from the East and offered the child Jesus "gifts of gold, frankincense and myrrh". The gold is believed to be a variety of frankincense (Rykmans 1951: 372-376). St. Justin, a native of Neapolis (Nāblus) (AD 160), identified the Magi with Arabian princes (*Dialogue*, LXXVII, 9). Bultmann (1963: 291-301) suggests "that the story of the Adoration of the Magi had its origin in the Arabian cult of Dusares," born from a virgin mother. It is plausible that the Magi were Arabian dignitaries, and more precisely Nabataean, since the kings of Petra controlled the aromatic trade in the first century AD. But the belief in the virgin birth of Jesus Christ was probably influenced by the Alexandrine myth of the god Aïon who was born from the virgin Korè, on the sixth of January, the day the Orthodox Church still celebrates Christmas. At any rate, the Nabataean trade was prosperous in the first centuries BC-AD and the demand for frankincense in Palestine was high at that time because the Temple of Jerusalem was reopened to the cult by Herod the Great. In the Copper Scroll of Qumrān, dated to the end of the first century AD, treasures of aromatic spices are listed five times, together with gold and silver (Milik 1960: 137-155; 1962: 201; McCarter 1992: 227-241). The identification of a priestly family, *beth haqqoṣ*, who were treasurers of the Jerusalem Temple before and after the Exile (location 32 of the Copper Scroll), may solve the riddle of the hidden treasures: They might be tithes and donations entrusted to the family Haqqoṣ, who owned a property in Jericho and buried the offerings in different locations, waiting for the reconstruction of the Temple (McCarter 1992: 239-240). The discovery of a first century juglet in a cave near Qumrān with a residue of an aromatic liquid (possibly balsam; Patrich and Arubas 1989), in addition to a large quantity of bottles with tight necks designed for perfumes and a treasure of silver coins, make the hypothesis of McCarter very significant. Jericho was also famous for the balsam groves that were annexed by Cleopatra (Starcky 1964: col. 910).

The creation of the Provincia Arabia by Trajan in AD 106, and the paving of the Via Nova Traiana, "from the border of Syria to the Red Sea", improved the communications and opened new markets to both Nabataeans and Palmyrenes.

The rise of Palmyra in the second century AD and the control by her traders of the caravan routes from the Ara-

bian-Persian Gulf to the North, along the Euphrates, certainly brought them in direct contact with the Nabataean merchants. The Palmyrenes penetrated to Wādī as-Sirḥān (Starcky 1970: 161-162), a vital communication crossroads where the Nabataeans were established long before (Winnett and Reed 1970: 141-160). They were also present in Ḥaḍramawt, at the site called al-'Uqla (Pirenne 1990: 108). There is no apparent competition between Nabataeans and Palmyrenes. Surprisingly, there is no mention of frankincense or myrrh in the famous tariff of Palmyra, but only of perfumed oil in alabastron or in leather bags (Teixidor 1984: 86). In the Palmyrene inscriptions the word *ḥammana* means "incense altar". The offering of incense is represented on the bas-reliefs together with frankincense boxes (Starcky 1964: col. 1099). There is no doubt in this case that the Palmyrenes traded the spices of Arabia. However, the Alexandrine fleet opposed a severe competition to the land caravans since Somalia and the East Coast of Africa produced an abundant supply of aromatics from earlier times up to the first century AD (*Periplus*, 7,10,24 and Casson 1989: 57). In AD 268-270, the troops of Zenobia invaded Egypt in an attempt to counter the Alexandrine commercial hegemony. The Nabataeans were present in the Sinai at that time, as could be deduced from the bulk of graffiti in Wādī Ḥajjāj, Wādī Mukattab and the oasis of Fayrān. Part of Zenobia's troops probably followed the Via Nova Traiana and traversed the Sinai. This military operation may account for the epitaph published by Seyrig (1958: 120-123) that laments the death of many Syrian soldiers, who were abandoned in the desert, without burial. The end of the Palmyrene revolt was tragic! The spice trade from South Arabia declined because there was less demand of aromatics (Crone 1987: 51-54; Fiema 1991: 167-168). There was apparently a revival of the old incense road only in the second half of the sixth century AD (Vasiliev 1950: 362, *apud* Fiema 1991: 180). However, Cosmas Indicopleustes, a merchant-turned-monk, mentions the trade of frankincense and myrrh from the eastern coast of Africa, but there is no indication about South Arabia (Crone 1987: 32). The reason is probably the occupation of Yemen a that time by the Persians until the triumph of Islam in AD 632 (Robin 1991: 53). Thus, a new chapter in the use of aromatics is opened (*infra*).

**The Uses of Incense and Myrrh**

In Antiquity, the high demand for the aromatics was justified by the varied uses in the funerary rituals, in the worship of the gods but mainly in the preparation of medical prescriptions and perfumes. In Pharaonic Egypt, the Arabian aromatics were used for the embalming procedure. According to Herodotus, the body was emptied of the visceral organs except for the heart and "filled with pure bruised myrrh, cassia and other aromatic substance with the exception of frankincense" (*Hist.* II, 86). In the biblical tradition, the embalming was not practiced, except for Jacob and Joseph (*Gen.* 50:2-3, 26). The operation took forty days. Usually, the corpse was soaked in natron for seventy days (Groom 1981: 20); according to Diodorus (I,7), the embalming process consisted of rubbing myrrh on the eviscerated and cleansed body. Spices were also put in the wrapping sheet of the corpse.

In Rome, the funerary rite was less complicated, except that the incineration required a good amount of aromatics: We learn from Pliny (XII, 41:83) that "Arabia does not produce so large quantity of perfume in a year's output as was burned by Emperor Nero in a day at the obseque of his consort Poppaea" (*Loeb Classical*). The information was probably exaggerated, although the extravagances of this emperor are famous. In any case, the Romans burned a large quantity of incense in religious ceremonies, in the triumphal parades and in banquets. Pliny is quoted above for the high expenses of the Arabian spices.

Because the burning of aromatics was a pagan custom, the early Christian Church refrained from using it in the cult. But when Christianism became the state religion in the fourth century, the incense burners were adopted in all of the liturgies. In Ethiopia for example, vases are set in front of churches to receive offerings of incense (Müller 1976: 129).

For the Hebrews of ancient Palestine, the consumption of aromatics had conflicting usage: Originally, the frankincense was a symbol of the cult of Yahweh and the rite of the memorial consisted in the burning on the altar of a handful of wheaten flour, of oil and incense to appease Yahweh (*Leviticus*, 2:2). The common people continued, however, to offer sacrifices and burn aromatics on the high places for the idols (*I Kings*, 22:44; *II Kings,* 12:4; 14:4; 15:4), despite the severe condemnation of the prophets (*Hosea*, 4:13). After the monarchic period and the destruction of the Temple, incense and myrrh were involved in the daily life of the Hebrews: In the *Song of Songs*, a love poem of the post-exilic Persian period, reference is made in several verses to the Arabian spices: "What is coming from the desert, like a column of smoke, breathing of myrrh and frankincense, and every perfume the merchant knows" (3:6). In another verse, 5:15, "His stature is that of Lebanon", the Ethiopian version translates: "His head is like frankincense", probably in reference to the custom of fumigating the hair with frankincense in South Arabia (*kandar* in the dialect). In the verse 4:11, "and the scent of your garments is like the scent of frankincense" (*luban*) is a better interpretation than the "scent of Lebanon". This is another allusion to the custom of fumigating the garments with frankincense

in South Arabia. In addition, Yemeni Jews were said to burn abundant frankincense for the funerals or to help a woman in labour and after the birth of a child.

The same tradition was observed in the daily life of Yemeni Muslims: Glaser noticed during his journeys between 1882 and 1894, the costume of "recitations from the Qurān and incensing with frankincense at three successive evenings" after a case of death (Müller 1976: 129). To wash the corpse in Islam, water was mixed with salt, lotus leaves and camphor. Before his death, Ibn az-Zubayr drank a large quantity of perfumed water and refrained from eating, to give his corpse a pleasant scent (Wellhausen 1961: 178).

More common was the use of the Arabian aromatics for the preparation of medical prescriptions and perfumes. Before his crucifixion, Jesus Christ was offered wine mixed with myrrh as an analgesic (*Mark*, 15:23). This gum resin is efficient for the treatment of infections of the ears and eyes, blains and chilblains, and relief the liver and side pain (see Groom 1981: 20). The myrrh is usually mixed with frankincense for these prescriptions. A special issue of the 'Omani periodical *Ḥaṣād*, vol. 5 (al-Ghul, ed. 1980) is devoted to popular medical prescriptions and to the healing virtues of plants: Frankincense is described as a good drug "to stimulate the stomach and liver, to revive the strengths, the intelligence and memory. It is digestive, helps the wounds to heal and scar, and is efficient against chest diseases etc." (pp. 123-124). Red myrrh, *Commiphora*, or *qafal* in the 'Omani dialect, is recommended in *Hasad* 5: 129 to cure diabetes, paralysis, migraine, conjunctivitis, rheumatism, etc. It is surprising to learn that a report from the International Institute for Cancer Research demonstrated the efficiency of herbs to cure forms of skin cancer. More than fifty medical references in the history of medicine prove the curative effects of frankincense for skin infections, especially those of cancerous origin (Kessler 1991: 40).

Pliny was certainly not correct when he stated: "Arabia Felix is more indebted to the dead than to the living" (*Nat. Hist*. XII, 27). From the Aromatics of Arabia, perfumes were produced for the joy and comfort of the ladies. The technique was a woman's profession (*muraqqitu* in Akkadian). Seven operations were needed to produce perfumes: The aromatic plants or the gum resins were first selected and cleaned, then cut into pieces or pounded; after this preliminary operation, they were sieved and soaked in hot water for one day. Salt and spices could be added in the evening. The liquid was then filtered and placed in a cooking pot on the fire; oil or grease was added and mixed with a spatula, until a white foam was formed. The oils saturated with perfume floated on the surface and were removed the next day (see Faure 1987: 64-68). The procedure was delicate and complicated and there existed a large variety of perfumes, according to taste and fashion. Pliny offers in Book XIII, 2-4 a list of perfumes known in his time. He even describes (XII, 2:18) the 'royal' unguent, prepared for the kings of Parthia. He is satirical about expensive perfumes used by women: ... "when a woman passes by, her scent may attract the attention even of persons occupied in something else — and their cost is more than 400 denarii, per pound! All that money is paid for a pleasure enjoyed by somebody else" (*Nat. His* XIII, 3:20).

**General Conclusion**

This contribution focused on the economic and political effects of frankincense and myrrh in Arabia through the ages together with their use in funerary and religious ceremonies. Many other aromatic plants and gum resins existed or were exploited in South Arabia (see Robin 1994: 25-30, who lists thirteen aromatic essences). No doubt that Arabia was one of the richest countries in the East because it traded the less heavy but most valuable merchandise. This wealth was not exploited, however, in productive projects: The South Arabians or the Nabataeans invested their riches in building expensive funerary or religious monuments; they depended mainly on the land trade by caravans and did not care to develop commercial fleets to compete with the Alexandrines or the Phoenicians, although they were bordering on the sea. Like the black oil today, the aromatics did not profit the Arabs but brought them, on the contrary, political domination from the mighty states, the Assyrians and later the Persians and the Romans. Nevertheless, the curative uses of the gum resins alleviated the sufferings of the ancient world.

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# Textiles, soie principalement, et artisanat du textile dans les inscriptions grecques du Proche Orient

Les inscriptions grecques, d'époque impériale romaine ou d'époque byzantine, trouvées dans l'actuelle Jordanie ou même, en élargissant le domaine de recherche, dans l'antique royaume nabatéen, sont, en l'état actuel de la documentation, extrêmement pauvres en mention d'artisanat, et tout particulièrement d'artisanat textile. De façon certaine, nous n'en trouvons qu'une seule mention, à Gérasa, celle de la corporation des tisserands de lin, *`η τοῦ αἰώνος ἱερά τέχνη λτνύφων*, souvent citée[1].

C'est donc à l'ensemble du proche Orient qu'il faut élargir l'investigation, afin de mieux cerner et situer les données et les problèmes. La recherche est d'autant plus importante que cette région est dans l'antiquité gréco-romaine et byzantine, l'une des grandes régions productrices et exportatrices de tissus.

Les textiles anciens, mentionnés dans les inscriptions du proche Orient, sont essentiellement la laine, le lin, le coton et la soie, non parfois sans quelque confusion ou quelque imprécision. Diverses appellations s'appliquent à un même textile, ainsi pour le lin, sans doute selon les diverses qualités de tissus ; mais le même mot *byssos* peut, à l'époque impériale romaine, désigner non seulement le lin, mais aussi la soie et le coton[2]. Le lin et le coton étaient souvent confondus ; il n'est donc pas sûr que les termes *ὀθονιακός, ὀθονιοποιός*, ou autres de même famille, signalent toujours des tisserands ou des marchands de tissus de lin. *Le Périple de la Mer Érythrée* parle d'*ὀθόνια Σηρικά ou d'ἔριον Σηρικόν*[3]; traducteurs et commentateurs ne s'accordent pas sur les sens concrets de ces mots.

La laine et le lin étaient des produits "indigènes". Selon l'*Expositio totius mundi et orbis*, au IVe siècle de l'ère chrétienne, les ports de la côte syrienne ou phénicienne, Laodicée, Byblos, Beyrouth, Tyr, exportaient de *la toile, linteamen*, dans tout l'empire[4]. La façon même de s'exprimer de l'auteur de l'*Expositio* laisse supposer que la production se faisait, en grande partie au moins, dans les régions de l'intérieur. La laine, sans doute le textile le plus commun, est curieusement celui qui apparaît le moins souvent dans les inscriptions. Il y avait également parmi les lainages syriens des produits d'exportation. Preuve des contacts et des échanges entre l'Occident et le lointain Orient, des tissus de laine, de provenance syrienne, ont été découverts à côté de soieries chinoises dans les fouilles de Lou-Lan[5], oasis située dans le bassin du Tarim sur la route de la soie, ce qui rappelle aussitôt à l'esprit la rencontre, mentionnée par le géographe Marinos de Tyr, entre les agents du marchand oriental gréco-romain Maes Tatianos et des marchands "chinois" dans l'Asie centrale[6].

Le coton était cultivé en Egypte et en Mésopotamie. Seule la soie était de provenance exotique et, dans le monde occidental, sa nature, végétale ou animale, n'était pas précisément connue. Les textes grecs et des textes latins[7] montrent la grande incertitude dans laquelle restèrent pendant des siècles les gens du monde médi-

[1] C.B. Welles, dans C.H. Kraeling, *Gerasa, City of the Decapolis*, New Haven 1938, n°19 • ,†p. 442. Voir les références aux tisserands et tisserandes de lin et aux ateliers de tissage de lin dans les textes grecs, J. Pouilloux, P. Roesch, J. Marcillet-Jaubert, *Salamine de Chypre* XIII.2, Paris 1987, n°143,†p. 63-64; SEG 37, 1987 [1990], 1394.

[2] Voir *A Greek-English Lexikon*, de Liddell, Scott et Jones (éd. Oxford 1940, réimpr. 1958), s.v. λίνον, βύσσος, ὀθόνη, avec références aux *Indica* d'Arrien, à Philostrate, à Strabon, à la "pierre de Rosette" *OGI* 90. Une "soierie façonnée" peut être dite "de *Byssus*", *Bulletin du CIETA* [Centre International d'études des Textiles Anciens, Lyon], 53 (1981/I) p. 79.

[3] *Périple de la Mer Érythrée*, 39 et 56; voir R. Pfister, *Textiles de Palmyre*, I (1934), p. 58; Z. Kadar, *Acta Classica Debrecen.*1967 (cité ci-dessous note 7), p. 92.

[4] Cf. R. Mouterde, *Regards sur Beyrouth (*Beyrouth, 1966; extrait de *Mél. Univ. S. Joseph*, t. XL), p. 43.

[5] H. Granger-Taylor, 'Two Silk Textiles from Rome and some thoughts on the roman Silk-weaving industry', *Bull. CIETA*, 65 (1987) p. 25.

[6] Ptolémée, *Géogr.* I,11.6. Cf. Ammien Marcellin 23,6.60. Voir Y. Janvier, 'Rome et l'Orient lointain. Le problème des Sères', *Ktèma* 9 (1984) p. 261-303, particulièrement p. 286-287. Voir aussi *La Route de la Soie*, sous la dir. du Muséum d'Hist. Nat. de Paris, Paris 1985; ma contribution 'L'Arabie dans les routes de commerce entre le monde méditerranéen et les côtes indiennes', dans *L'Arabie préislamique et son environnement historique et culturel*, Actes du Colloque de Strasbourg 1987, éd. T. Fahd, Travaux du CRPOGA 10, Leyde 1989, p. 235.

[7] G. Coedès, *Textes d'auteurs grecs et latins,relatifs à l'Extrême-Orient*, Paris 1910; réimpr. Hildesheim 1977; Z. Zadar, Serica. Le rôle de la soie dans la vie économique et sociale de l'Empire romain', *Acta Classica Universitatis Scientiarum Debreceniensis* (Debrecen, Hongrie), 3 (1967) p. 89-98, et 4 (1968) p. 79-84.

terranéen sur l'origine de la soie. La Chine gardait bien son secret. Les marchands en outre ne devaient pas se priver de raconter des histoires merveilleuses, d'insister sur l'éloignement et les difficultés d'accès, d'ailleurs réelles, afin de justifier le prix élevé de la marchandise. Il apparaît très clairement que non seulement le vocabulaire, mais plus d'un auteur confondait la soie et le coton, comme souvent, d'ailleurs, le lin et le coton; σηρικόν, *serica,* ne doit pas toujours se traduire par "soie": la "sérique", disait-on parfois, est une sorte d'efflorescence laineuse qui pousse sur les arbres, ce qui décrit exactement le coton, produit dans les Indes[8], dans les termes mêmes qu'utilisait déjà Hérodote[9].

Pour parvenir dans le monde méditerranéen, la soie chinoise pouvait se présenter sous deux formes: écheveaux de fils, pièces de tissus. Il faut mentionner tout particulièrement la soie grège, *μέταξα,* qui arrivait elle aussi sous forme de fils ou de tissus. Dans le tarif douanier d'Anazarbe, en Cilicie, aux confins des pays sassanides, une taxe *μεταξαρ(ικών)* frappe les articles de soie grège[10]. Contrairement à ce que l'on dit souvent, la soie grège pouvait être teinte et tissée sous cette forme[11]; on appelait *metaxablatta* "a raw silk dyed with *blatta* purple", *blatta* désignant une nuance rouge de pourpre véritable, la plus chère dans l'édit du Maximum de Dioclétien[12]. Reste l'ambiguïté du terme *μεταξάριος*", qui pourrait aussi bien désigner un commerçant qu'un artisan en soie grège. La présence d'un *μεταξάριος*" dans un village de Syrie du Nord pourrait inviter à se représenter le travail de la soie dans l'antiquité sous la forme de cet artisanat rural et familial qu'on le voyait naguère dans les villages de la région lyonnaise. Encore faudrait-il être certain que ce Julianos, fils de Jean, du bourg de Maratô des Myrtes, ait exercé son activité dans ce village ; or nous ne savons pas exactement où a été trouvée la mosaïque qu'il a offerte et qui le fait connaître[13]. Un passage de l'*Histoire Secrète* de Procope indique que le tissage de la soie grège était traditionnel dans les villes de Beyrouth et de Tyr et que ces produits à forte valeur ajoutée étaient exportés par toute la terre. Les deux *μεταξάριοι* que nomment des inscriptions de Tyr[14] sont-ils de ces artisans ou de ces marchands dont parle Procope[15]? L'un et l'autre tout à la fois, sans doute : ils importaient pour produire puis vendre leurs soieries. Il faut en dire autant des "soyeux", les *σηρικάριοι*; le terme est moins précis que *σιρικοποιός*", attesté à Rome au début du 1er siècle de l'ère chrétienne pour un Syrien d'Antioche, qui est clairement désigné comme un fabricant de soieries[16].

Beaucoup de spécialistes estiment que la soie de Chine arrivait principalement sous forme de tissus. Mais ces tissus n'étaient pas adaptés à l'usage et au goût des Romains, dont des peintures murales, des peintures d'hypogées ou de stèles funéraires illustrent pour nous les habitudes vestimentaires. Le décor des soieries chinoises, trop exotique, ne plaisait pas aux habitants de l'empire romain et leur largeur, quelque 50 centimètres seulement, était insuffisante pour fabriquer des vêtements amples ou drapés; il eût fallu coudre côte à côte plusieurs lés. C'est dans la riche Palmyre seulement, où les influences de l'Orient parthe ou sassanide sont si importantes dans le vêtement et dans l'art, que les tissus chinois semblent avoir été utilisés tels qu'importés[17]. Même à Palmyre, une partie des tissus de soie sont, en tant que tissus, de fabrication occidentale, c'est-à-dire peut-être, tyrienne. Il faut considérer aussi que les tissus chinois, très serrés, étaient chers. Souvent donc les tissus étaient défaits fil à fil, et les fils étaient tissés à nouveau de façon plus lâche ; comme le coût de la main d'oeuvre, avant tout féminine, était négligeable, le profit procuré était grand, et l'on obtenait ainsi des pièces dont les dimensions et l'aspect convenaient aux gens du monde méditerranéen, même si la légèreté, pour ne pas dire la transparence de ces soieries soulevait l'indignation des moralistes. Plus d'une fois, il est question de cette patiente et minutieuse technique du parfilage, dans des textes poétiques où l'on a rarement su le reconnaître: c'est ainsi que les femmes romaines "libéraient" la soie chinoise. Pline l'Ancien (*NH* VI 17, 54) pourtant est explicite: les femmes défont et retissent les tissus venus de Chine.

Il y avait diverses spécialisations des artisans. Les uns sont ainsi appelés seulement ouvriers ou ouvrières en soie, *σηρικάριοι*[18]. D'autres sont dits brodeurs; ici encore, il existait des spécialisations variées: tels les *plumarii* [19]; sur sa pierre tombale, une ouvrière est qualifiée de calligraphissa[20]. Les *barbaricarii* sont des fab-

[8] Cf. Y. Janvier, *loc. laud.*, p. 265, avec note 25.

[9] Hérodote, 3, 106, cité par J.-F. Salles, 'Les échanges commerciaux dans le golfe arabo-persique au 1er millénaire avant J.-C.', dans *L'Arabie préislamique*, p. 84-85.

[10] G. Dagron et D. Feissel, *Inscriptions de Cilicie, Travaux et Mém. du Centre de Rech. d'Hist. et de Civil. de Byzance,* Collège de France, Monographies 4, Paris 1987, p. 170-185, n°108·

[11] Cf. J.-P. Rey-Coquais, Inscriptions grecques et latines découvertes dans les fouilles de Tyr (1963-1976), I, Inscriptions de la nécropole, *Bulletin du Musée de Beyrouth,* XXIX (1977) p. 156, note 9, et p. 176, *Addenda.*

[12] H. Granger-Taylor, *loc. laud.*, p. 26, avec note 80, renvoyant à M.H. Crawford et J.M. Reynolds, The Aezani Copy of the Price Edict', *ZPE* 34, 1979, p. 167 et 195.

[13] *Inscr. Nécropole Tyr*, p.157, avec note 2 ; cf. *SEG* 32, 1439.; *Bull. épigr.* 1989, 874.

[14] *Inscr. Nécropole Tyr*, n°22 et 98, et p.156-157.

[15] Procope, *Hist. arc.* 25; cf. R. Mouterde, *Regards sur Beyrouth*, p. 43.

[16] IG XIV 785. Cf. la précision *negotians siricarius* ou *negotiator sericarius* à Rome, *CIL* VI 9678, CIL XIV 2793.

[17] H. Granger-Taylor, *loc. laud.*, p. 13-31.

[18] Cf. Waddington, *Inscr. Syrie*, 1854 c; R. Mouterde, *Regards sur Beyrouth,* p. 44.

[19] *Inscr. Nécropole Tyr*, n°171 et p. 157.

[20] R. Mouterde, *Regards sur Beyrouth*, p. 44.

ricants de tissus de soie brochée d'or ou d'argent[21]. Parmi les ateliers de tissage, tous n'étaient pas privés; il existait des ateliers impériaux de tissage de la laine, les *λυναικεῖα*, et des ateliers de tissage du lin, les *λινύφια*, qui travaillaient pour la Cour, pour les fonctionnaires et les militaires[22]. Le tissage des brochés de soie et d'or fut, à maintes reprises, du IVème au VIème siècle, affirmé comme un monopole d'état, et les artisans privés se virent interdire la fabrication de vêtements de soie. Le rappel des données épigraphiques du proche Orient ancien et des textes juridiques (dans le détail desquels ce n'est pas ici le lieu de rentrer) fournit le contexte dans lequel doit s'inscrire la recherche pour la Jordanie.

L'extrême rareté des mentions épigraphiques de textiles ou d'artisans en textiles dans les inscriptions de l'ancienne province romaine d'Arabie surprend, car les Nabatéens auraient été les premiers à importer la soie de Chine ou le coton des Indes dans le monde méditerranéen. Le nom araméen de Pétra, *Reqem*[23], se trouverait transcrit *Liqian* (*Likem* dans l'ancienne transcription) dans les Annales chinoises où il semblerait en être venu à désigner de façon générale l'empire romain[24]; cette interprétation, on le sait, est discutée. Signalons seulement un vers de Properce, *Elégies*, III 3, 15, qui décrit une femme "étincelante du bombyx d'Arabie". S'agit-il de soie de Chine, arrivant dans le monde méditerranéen par l'intermédiaire de l'Arabie, ou d'un vers à soie sauvage de l'Asie occidentale connu plus tard par Pline?

On n'aura garde d'oublier les vicissitudes de la fameuse route de la soie, et notamment les efforts que firent les Parthes pour se garder le monopole du transit. Malgré ce qu'a écrit, de façon tout à fait générale, Michael Rostovtzeff dans son monumental ouvrage sur l'histoire sociale et économique du monde hellénistique[25], et ce que l'on a répété depuis en s'appuyant sur son autorité[26], il n'est pas certain qu'avant l'époque d'Auguste, le commerce de la soie ait été une activité des marchands arabes; il semble bien que la soie de Chine n'était alors pas connue dans le monde méditerranéen. La soie n'apparaît pas dans la littérature grecque ou la littérature latine, dans les inscriptions grecques ou les inscriptions latines, avant l'époque d'Auguste[27]. Il est caractéristique qu'en Syrie et en Palestine, à l'époque impériale et à l'époque paléo-byzantine, soient relativement fréquents des noms d'homme ou de femme dérivés de la soie, *Σιρίκιος, Σιρικά, Σηρικούς, Μεταξια* même[28]; l'anthroponymie atteste dans ces régions la présence familière et la séduction de cette matière douce, chatoyante et précieuse.

Vers le premier siècle de l'ère chrétienne, qu'apportaient au port nabatéen de Leuké Komé, où était établie une station de la douane romaine, les vaisseaux venant de l'Océan Indien? Il serait également étrange que les caravanes de Pétra, dont on connaît les principaux itinéraires et leurs directions variant au long des siècles (il me suffira de renvoyer aux Actes du Colloque de Strasbourg sur *l'Arabie préislamique et son environnement historique et culturel*[29]) n'aient pas trouvé à charger en pays parthe, parmi toutes les denrées précieuses dont raffolait le monde occidental, des ballots de soie, écheveaux de fils ou pièces de tissus. Qu'en fut-il ensuite, lorsque Palmyre eut pris la première place dans le commerce avec le lointain Orient? Les sources épigraphiques ou littéraires ne permettent guère de répondre à ces questions.

Les archéologues peuvent verser dans ce débat des éléments d'appréciation. Fusaïoles et pesons ne nous apprennent pratiquement rien. Tissus et métiers à tisser sont des matériaux périssables, qui ne traversent que rarement les siècles ou les millénaires. Il convient donc de porter aux éventuels vestiges textiles trouvés dans les fouilles, particulièrement, évidemment, dans les fouilles des tombes, la plus vigilante attention. Tout autour de la Jordanie, il ne manque pas d'exemples de référence. Les textiles de Doura-Europos, étudiés par L. Bellinger[30], les textiles de Palmyre, publiés par R. Pfister[31], sont des documents de la plus grande importance. De même encore viennent enrichir notre documentation les tissus trouvés dans le désert de Judée, dans les grottes de Murrabba'at[32] ou dans la fameuse *Cave of Letters*[33], les vestiges de soieries découverts à Salamine de Chypre ou ceux qui ont été mis au jour sur le site mésopotamien d'Al-Tar[34], ou encore les textiles trouvés à Quseir al-Qadim, l'antique Leukos Limèn, port égyptien sur la Mer Rouge[35]. On sait les débats auxquels donnèrent lieu

21 *Inscr. Nécropole Tyr*, p.157, avec note 5, et p. 176, Addenda. Cf. Clément d'Alexandrie, *Pédagogue* II, 10 bis, 109.1 (Sources Chrétiennes 108, p. 206-207).

22 Cf. L. Robert, *Cahiers archéologiques* 8 (1956) p. 28-34; voir aussi mes *Inscr. Nécropole Tyr*, p. 156, avec note 4.

23 Cf. F. Vattioni, 'Rucuma e Petra', *Antiquités africaines* 26 (1990) p. 10, citant Flavius Josèphe, *AJ* 4, 82 et 161, et Eusèbe/saint Jérôme.

24 Cf. 'L'Arabie dans les routes de commerce...', dans *L'Arabie préislamique* (cité note 6 ci-dessus), p. 232, note 34.

25 M. Rostovtzeff, *The Social and Economic History of the Hellenistic World*, Oxford 1941, p. 1227.

26 Ainsi R.H. Smith, 'Trade in the Life of Pella of the Decapolis', in *Studies in the History and Archaeology of Jordan*, III, éd. A. Hadidi, Amman 1987, p. 56.

27 Voir Z. Kadar, *loc. laud.*

28 Cf. J. et L. Robert, *Bull. épig*r.1958, 512.

29 *L'Arabie préislamique* (Coll. Strasbourg 1987), passim.

30 L. Bellinger, *The Excavations at Dura-Europos, Part II, The Textiles.*

31 R. Pfister, *Textiles de Palmyre*, I-III, Paris 1934-1940.

32 G.M. Crowfoot, *Discoveries in the Judean Desert*, II. Les grottes de Murrabba'ât, Oxford 1961, p. 59.

33 Y. Yadin, *The Finds of the Bar Kohba Period in The Cave of Letters* (Israel Expl. Soc., Jerusalem 1963), p. 252.

34 Voir H. Granger-Taylor, *loc. laud.*

35 G.M. Eastwood, 'Textiles', dans D. Whitcomb et J. Johnson, *Quseir al-Qadim* 1980, Preliminary Report, Malibu 1983.

les textiles de Palmyre[36]. Il est bien assuré aujourd'hui que les tissus retrouvés n'y sont pas tous chinois. Les spécialistes s'accordent avec R. Pfister pour considérer que les tissus de soie damassés de Palmyre ont pour origine la Syrie (au sens large du terme)[37].

Revenons à Tyr, que les textes et les inscriptions montrent comme l'un des grands centres textiles du Proche Orient. Tyr ne nous éloigne pas des pays du Jourdain si l'on veut bien se souvenir, comme Henri Seyrig l'a mis en lumière en étudiant les cultes de Philadelphie-Amman, que Tyr entretenait de constantes et étroites relations avec ces contrées intérieures et que son port en était sur la mer le débouché naturel. Prenons la description des fouilles de la nécropole, telle que l'a publiée l'émir Maurice Chéhab, avec les limites que les malheurs des temps ont imposées à cette publication[38]. Le contenu de chaque tombe, *loculus*, caveau ou sarcophage, est sommairement détaillé. Fils d'or provenant d'un tissu ou touffe de fils d'or provenant d'un tissu, c'est la mention qui revient le plus souvent[39] ; sans doute avons-nous là les vestiges des tissus brochés fabriqués par les *barbaricarii.* C'est avec un point d'interrogation bien symptomatique que sont mentionnés des fragments de fils provenant d'un tissu de laine[40] ; l'analyse n'a pu être faite. Il faut en dire autant d'un "fragment de tissu", indiqué, sans aucune précision de matière, parmi les trouvailles diverses faites dans un sarcophage[41]. Il est rare d'avoir la chance qu'ont rencontrée en Hongrie, au nord de Pecs, les fouilleurs d'Alsó Hetény. Dans le cimetière d'une église du IVe siècle, une tombe leur a offert un voile de soie très fin, une longue écharpe aux extrémités tissées en tapisserie avec fils d'or, de soie et de laine, une large pièce rayée à franges, un damas comparable aux damas trouvés à Palmyre et ailleurs. Inventaire merveilleux[42]...

L'historien souhaite un temps où seraient connus en quantité suffisante fils et tissus, textures et teintures, systématiquement analysés, comparés[43]. Tout est significatif: la matière, bien sûr, le mode de torsion des fils, l'armure, c'est-à-dire la façon dont sont croisés les fils de chaîne et les fils de trame; ce n'est pas le lieu d'entrer ici dans plus de détails. S'il faut des circonstances exceptionnelles de conservation pour que puissent un jour apparaître des éléments de métiers à tisser antiques, l'étude technique des procédés de tissage mis en oeuvre permet de restituer le type de métier utilisé[44]. Nous savons quel était le métier à tisser utilisé en Chine à l'époque des Han pour produire les tisssus façonnés dont un certain nombre d'exemplaires ont été retrouvés en Asie Centrale. Nous ne connaissons pas de tissus damassés plus anciens que ceux de Palmyre. Les spécialistes en sont arrivés à conclure que les artisans du proche Orient, en Syrie peut-être (la Syrie considérée au sens antique le plus large), avaient apporté au métier à tisser des innovations décisives dans le traitement complexe des fils de chaîne et que ces améliorations techniques étaient parvenues en Chine sous la dynastie des Tang, où les tisserands chinois les avaient à leur tour perfectionnées, avant qu'elles ne fassent retour vers l'Occident[45].

Les analyses chimiques des colorants ne sont pas non plus à négliger, car, comme on l'a montré plus d'une fois, notamment dans l'étude des diverses teintures rouges, les produits tinctoriaux, minéraux, végétaux ou animaux utilisés différaient selon les régions ; mais on en faisait aussi un commerce international[46]. On a pu ainsi établir que, parmi les soies chinoises retrouvées à Palmyre, l'une avait été teinte à la garance et à la laque des Indes, une autre au santal[47]. On connaît bien les coquillages qui produisaient la pourpre, dont la couleur varie du violet sombre au rose lumineux[48] ; certaines nuances étaient plus appréciées que d'autres[49]. A Beyrouth une inscription trouvée par Ernest Renan mentionne un κνικιακονχυλευτής, dans lequel on verra, non pas un "teinturier en pourpre orange", comme le propose R.Mouterde dans son très pratique opuscule *Regards sur Beyrouth,* mais un pêcheur - ou un entrepreneur de pêche - de cette variété de coquillages[50]. A Tyr, apparaissent

36 R. Pfister, 'Les soieries Han de Palmyre', *Revue des Arts Asiatiques* 13/2 (1941) p. 67-77. Voir O. Maenchen-Helfen, 'From China to Palmyra', *The Art Bulletin* 25 (1943) p. 358-362; J.F. Flanaghan, 'Textiles from Palmyra', *Burlington Magazine* (1944) p. 179-181; R.J. Charleston, 'Han Damasks' [les damassés Han], *Oriental Art* I (1948) p. 63-81; K. Yokohari, 'Textiles du Musée de Damas', *AAAS* 24/1-2 (1974) p. 39-46.

37 D. De Jonghe et M. Tavernier, 'Les damassés de Palmyre', *Bulletin du CIETA* 54 (1981) p. 20-52.

38 M. Chéhab, *Fouilles de Tyr, La nécropole,* III, *Description des fouilles* (= *Bull. Mus. Beyrouth* 35; Paris 1985).

39 M. Chéhab, *loc. laud.*, p. 89, 98, 248, 294, 372, 374, 692.

40 M. Chéhab, *loc. laud.*, p. 114.

41 M. Chéhab, *loc. laud.*, p. 376.

42 W. Endrei, E. Sipos, 'New Finds of Silk Fabrics in Hungary', *Bull. CIETA* 65 (1987) p. 32-33.

43 Il convient que les descriptions utilisent des normes, des méthodes, un vocabulaire internationalement admis, telles les normes proposées par le Centre International d'étude des Textiles Anciens. Voir aussi *Archaeological textiles. Report from the 2nd NESAT symposium,* Copenhague, Arkaeologisk Institut, Københavens Universitet 1988, notamment p. 228-231 Ellen Schølberg, 'Elementary statistical methods as a tool in describing separate textile finds in relation to comparative find collections'.

44 Un papyrus du début du IIe siècle après J.-C., P. Oxy. Hels. 34 (cf. *REG* 1981, p. 551) donne la description d'un métier à tisser.

45 D. De Jonghe, 'Un métier à la tire chinois', *Bull. CIETA* 68 (1990) p. 75-87.

46 D. Cardon, 'Les échanges de teintures rouges entre l'Orient et l'Occident jusqu'aux grandes découvertes', *Bull. CIETA* 67 (1989) p. 27-35.

47 D. Carton, *loc. laud.*, p. 29.

48 J. Doumet, *Étude sur la couleur pourpre / A Study on Ancient Purple,* Beyrouth 1980.

49 *Inscr. Nécropole Tyr*, n°137, p. 77-78.

50 E. Renan, *Mission de Phénicie,* p. 350; R. Mouterde, *Regards sur Beyrouth,* p. 45-46.

dans les inscriptions de la nécropole paléo-byzantine[51] différents métiers de la pourpre, *πορφυραΐ* et *πορφυρευταί*, depuis ceux qui récoltent les murex, *κογχυλεΐς* et *κογχυλευταί*, et ceux qui les broient pour en extraire la substance tinctoriale, *κογχυλοκόποι*, jusqu'aux vendeurs de tissus de pourpre, *πορφυροπώλαι*, en passant par ceux qui plongent écheveaux ou tissus dans les bains de pourpre, *κογχυλοπλυταί*, *πορφυροβάφοι*; est ainsi mentionné un *άληθεινοβάφος*", teinturier en pourpre véritable. Quel était le coloris de cette pourpre, de quel coquillage était-elle tirée? La teinture s'effectuait-elle sur les écheveaux de fil ou sur les tissus? Et quelles étaient les matières ainsi travaillées? Quels mordants étaient éventuellement utilisés? Et les autres couleurs, comment les obtenait-on[52]? Quelles étaient les installations de séchage? Qu'y a-t-il donc exactement derrière le nom de métier *βαφεύς, βαπτής* ou *άρχιβάφθης*[53]? que faisaient ces foulons, ces *γναφεΐς* d'Antioche sur l'Oronte, qui ont donné leur nom à un canal, celui-là même certainement dont les eaux étaient indispensables à leur industrie[54]? On voit les immenses lacunes de notre documentation.

Il convient de se demander si l'on pratiquait en Arabie la teinture et le tissage des textiles exotiques, ou si le pays nabatéen n'était pour ces matières premières textiles qu'une région de transit. En l'état actuel de nos connaissances, dans la plupart des cas, seule l'archéologie, trouvant des vestiges d'ateliers, de bains de foulons, peut, dans une certaine mesure, suppléer les silences des inscriptions. Il faut veiller à ne pas laisser dissociés les choses et les mots, à préciser ces aspects de l'activité économique, de l'état des techniques et de l'organisation des métiers dans l'Arabie antique. Cette recherche paraît d'autant plus importante que les techniques modernes d'analyse des textiles anciens permettent de gagner une vue progressivement plus étendue et passionnante des savoir-faire, des échanges de techniques et de produits. Dans cette enquête minutieuse, patiente, dans les textes et sur le terrain, c'est à la fois la vie quotidienne des artisans et l'aventure millénaire des civilisations que nous essayons d'atteindre.

Avant de conclure, un point encore, qui vise à situer l'homme et son activité dans son environnement et son paysage. On sait que le ver à soie fut introduit dans l'empire byzantin sous Justinien et que la Syrie byzantine vit très rapidement se développer les plantations de mûriers nécessaires à l'élevage des vers à soie. Il n'est pas inimaginable que l'on retrouve des souches de mûriers antiques et que l'on puisse les dater. Comme il serait intéressant de pouvoir se dire, par delà quelque quinze siècles: là, sur cette colline, étaient plantés des mûriers, là étaient élevés les vers à soie, là les cocons étaient vendus - ou dévidés! Puis, à nouveau, nous perdrions le fil...

L'épigraphiste trouve des inscriptions, des mots, et pressent, derrière les mots, une réalité vivante encore imprécise; assailli de questions, d'hypothèses, l'historien se prend à rêver; l'archéologue peut contribuer à réaliser son rêve et lui fournir des réponses concrètes.

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51 *Inscr. Nécropole Tyr*, p. 158-160.

52 Vêtements "couleur de Sardes", "couleur de fruits verts", vert tendre, rose, rouge écarlate [...] pourpre, safran: Clément d'Alexandrie, *Pédagogue* II, 10 bis, 108.4 - 109.1 (trad. C. Mondésert, Sources Chrétiennes p. 206-207); étude de matières colorantes, égypte, IIe siècle après J.-C.: garance pour le rouge orange, genêt à base d'indigo pour la couleur verte, indigo pour le bleu foncé, safran pour le jaune d'or, W. Endrei et L. Hajnal, Analyse de toiles de lin anciennes', *Bull. CIETA* 10 (1959) p. 22-29.

53 Cf. *Inscr. Nécropole Tyr, ibid.*, avec la note 7, p. 158 (métier souvent mentionné par Clément d'Alexandrie, *Pédagogue*, II, 65.2, avec la note et d'autres références); en Palestine, dans la nécropole de Beth Shearim, M. Schwabe et B. Lifshitz, *Beth Shearim*, II. The *Greek Inscriptions* (Israel Explor. Soc., Jérusalem 1967), n°188; cf. J. et L. Robert, *Bull. épigr.* 1958, 512.

54 D. Feissel, *Syria* 62 (1985) p. 77-103; cf. M. Sève, *Bull. épigr.* (1987) 42.

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# Cultural Resources Management and National Inventory of Archaeological and Historic Sites: The Jordanian Experience

## Introduction

The Cultural Resources Management program of the American Center of Oriental Research in 'Ammān in cooperation with the Department of Antiquities of Jordan is being implemented since 1987.

The main purpose of this USAID financed program is to assist the Department of Antiquities in developing an independent system of coordination with governmental agencies responsible for development projects, and to start a process by which cultural resources will be given recognition in the earliest phases of a new construction design. Until very recently, in fact, the Department of Antiquities was usually informed of a new construction project only when bulldozers had already damaged a site, often forcing the Department to begin desperate salvage excavations. Thanks to the Cultural Resources Management Project, information flow is now at the feasibility or tender bidding stage, when project design is either almost or totally complete. This leaves only a short period of time to assess the impact of a new construction on the archaeological sites of an area, but at least it is possible now to speak about "rescue" more than "salvage" archaeology being conducted in Jordan.

The evolution from an "emergency" to a rescue oriented approach is displayed in TABLE 1. It is clear that the maximum effort is now concentrating on two aspects of coordination, that is, creation of information sources and mechanisms for sharing that information.

## Cultural Resource Management Program Rationale

The Jordan Antiquities Database and Information System (JADIS) program is one of the cornerstones of the present CRM project. The ultimate goal is to enter into a computerized database coded information about *all* known archaeological sites in Jordan, allowing quick and effective monitoring of sites under threat of destruction. The JADIS program included the design of the system, the development of the database, the design of the cardfile to be used for data entry, and the training of six Department of Antiquities employees in card compilation and use of the database system.[1] This database system fills a major gap in the Department of Antiquities management of its archives: a computerized inventory which can provide a wide range of different site lists (by name, by geographic coordinate, by period of use, by level of preservation, and so on), all available at a key-stroke and within a few minutes. When complete, this database will have met one of the requirements of the 1988 Antiquities Law (art. 4), and of the 1972 UNESCO convention (articles 29-31) on the Protection of the Cultural and Natural Heritage, that is, a complete inventory of the known archaeological heritage. It will also ease the process of monitoring areas under construction, since by entering any area's coordinates, all of the archaeological sites within those coordinates will be displayed, greatly reducing the chances of accidental destruction.

The creation of information sources has been accompanied by the organization of information-sharing mechanisms. To speed the process of coordination between CRM, Department of Antiquities, and development agencies, a network of liaison officers was created in various ministries and departments. The JADIS database will allow Department of Antiquities officials and local inspectors to effectively monitor archaeological sites in areas under development. At this moment, protection of cultural resources is ensured on a case-by-case basis by early coordination between the various development agencies and the CRM team, but JADIS will soon provide a more effective management tool.

The following examples illustrate the level of cooperation attained under the current program, but they also reflect the need to improve coordination by means of more formal procedures.

Design phase intervention is an important element of

[1] After this paper was presented at the 1992 Irbid conference, training was expanded to include five more employees. Presently (1994) the JADIS program is directed by Khawla Qussous at the Registration Section of the Department of Antiquities and is conducted by Wafa Assaf, Ahmed Ajaj, Hanan Azar, Qamar Fakhoury, Samar el-Habahbeh, Salam Hajjawi, Sahar Nsour, Fadwa Shamaileh, Ahmed el-Shami and Jihad Shobaki.

**Table 1.**

| EVOLUTION OF COORDINATION DURING THE CRM PROJECT | | | |
|---|---|---|---|
| **PHASES:** | **PAST:** | **PRESENT:** | **IN PROGRESS:** |
| **Design** | No consideration of possible damage to cultural resources. **No rescue work** by DAJ. | CRM **requests** information on new projects, releases preliminary impact assessments. | Development agency **offers** the DAJ information about new projects. The DAJ releases preliminary impact assessments. |
| **Feasibility study** | No consideration of possible damage to cultural resources. **No rescue work** by DAJ. | CRM **negotiates** changes to the project (if needed), releases final impact assessments. | DAJ conducts intensive survey. Development agency and CRM/DAJ coordinate mitigation plans on the basis of final impact assessments. |
| **Tender Bidding** | No consideration of possible damage to cultural resources. **No rescue work** by DAJ. | CRM **negotiates** provisional sums for rescue work. CRM **requests** the addition into the construction contract of recommendations for cultural resource protection. | Development agency **automatically provides** sums for rescue excavations on the basis of CRM/DAJ report. Recommendations for the protection of cultural heritage are **automatically included** in construction contracts. |
| **Construction** | No consideration of possible damage to cultural resources. Contractor legally required to inform DAJ of remains uncovered during construction. **Emergency work** by DAJ. | DAJ conducts rescue excavations. Emergency excavations still needed. CRM **coordinates** information flow among contractor, development agency, and DAJ. | DAJ conducts rescue excavations. No need for emergency excavations during major construction projects. CRM/DAJ, contractor, and development agencies exchange information on work progress. |

the CRM strategy in order to minimize the necessity for rescue or salvage archaeology. Design phase planning involves a detailed study of new projects and the preparation of feasible alternative locations for projects. Preliminary surveys and excavations, whether conducted directly by the CRM program, or coordinated by it and conducted by the Department of Antiquities or by the Universities, are important in establishing patterns of pre-development cultural resource strategy and in demonstrating the importance of early coordination to avoid both damage to cultural resources and costly delays to construction projects. The preparation of Cultural Resources Impact Assessments also creates a model for future activities involving pre-development procedures. The standardization of these reports will be of great help, as a cultural resources component will have to be included in Environmental Impact Reports required prior to construction, as provided for by the forthcoming Environmental Law.

While it is preferable to start coordination at the design phase, it is still possible to limit the damage to cultural resources by intervening at the Feasibility Study level. During this phase CRM personnel are now either negotiating changes to projects, where feasible, or are releasing final Cultural Resources Impact Assessments to be used as a basis to negotiate provisional sums for rescue work.

Awareness of sites endangered by a construction project at this late phase, while not an uncommon occurrence, compels the Department of Antiquities to organize emergency surveys or excavations. A project at this stage of development can be modified only at a great cost, and often results in construction delays. Theoretically, it is still possible to negotiate provisional sums for rescue archaeological work, but this possibility is remote.

CRM personnel were able to negotiate successfully six projects, all of them followed from the design phase. This shows that only coordination at the earliest stage of a project guarantees that funds will be provided to the Department of Antiquities for any work that might be necessary thereafter.

Two types of interventions may occur at the construction phase: (1) rescue, based on planned activities resulting from early coordination with the development agencies, and (2) emergency excavations.

***Rescue excavations (i.e. planned interventions)*** have been conducted by the Department of Antiquities and Yarmouk University with provisional sums negotiated by CRM in the Tender Bidding phase of each project. CRM also provided coordination to avoid conflicts between the contractors and the archaeologists.

***Emergency excavations (i.e. unplanned interventions)*** have normally been the only possibility open to the De-

artment of Antiquities to save, usually only for the cord, what was left of an archaeological site damaged uring construction. The creation of coordination procedures by the CRM project has as its principal aim the voidance of unplanned interventions at the construction hase.

The emergency excavation of the Roman fort on the bid-Jarash road can be considered a hold-over from ast procedures and therefore a failure (Palumbo *et al.* 993: 89-117). On the other hand the "sacrifice" of this npressive monument (FIGS. 1-2) and the desperate efrts to complete the excavation, as well as the costs and elays caused by the operation, made an impression on ie development agencies. This may have resulted in an wareness of the necessity for planning at the earliest hases of project design.

The creation of a network of liaison officers and the asic information sharing advocated by CRM personnel re not sufficient to meet the needs of an integrated sysem in which *all* governmental departments are obliged exchange information and obtain Department of Anquities release permits before construction. The CRM roject contributed to the development of a routinized ystem of information sharing, and to the study of appropriate modifications of existing laws. In this framework, an opportunity is offered by the new Environiental Law, which takes into consideration a series of ecommendations presented only a few months ago in ie National Environmental Strategy for Jordan. If approved, this law will provide the basis for formal coordination and information flow between the developient agencies and the Department of Antiquities.

## enesis and Applications of the JADIS Program

1 1990 the Cultural Resources Management Project set s one of its priorities the study and the production of a omputerized system to record the archaeological sites of ordan, mainly known through published reports or unublished information. The objectives of this database ere multiple: to organize the existing information into a lexible system that would allow different types of data earch and analysis, to produce site lists based on map rid coordinates for quick reference and to facilitate the xchange of information between Department of Anquities and development agencies on the location of arhaeological sites.

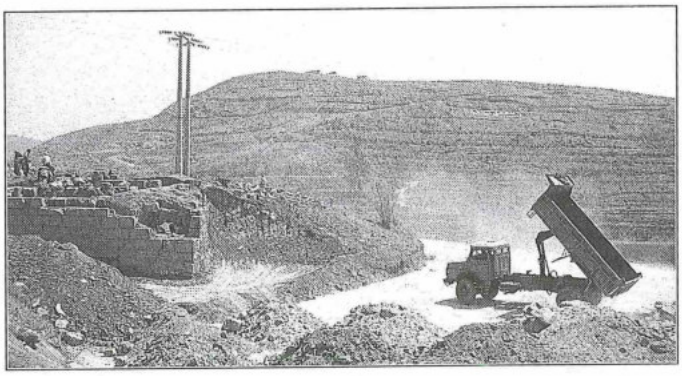
This is a brief survey of the problems encountered uring the creation of the JADIS system.

. ***No recording system:*** the Department of Antiquities as very large archives, but they are not computerized. he only recording system was some index files of sites n alphabetical order. An important project started almost en years ago, a cooperative effort of Prof. Denyse Homès-Fredericq of the Musées Royaux d'Art et d'Histoire in Bruxelles and Prof Basil. Hennessy of the University of Sidney. The project has produced three volumes to date, the first being a list of references (cross-indexed by site), and the second and third containing short reports with similar formats for all the archaeological projects in the field at the time the volumes were published (Homès-Fredericq and Hennessy 1986; 1989). Besides these publications, the *Annual of the Department of Antiquities of Jordan* (ADAJ) is to be mentioned, but until today a general inventory of Jordan's archaeological and historic heritage was missing.

**2.** ***Uneven method to record site map coordinates:*** Palestine grid and UTM system are commonly used, but are not compatible with each other. It is to be considered that Palestine grid is preferred on the latest 1:25,000, and UTM grid on the 1:50,000 (and most complete) map sets.

**3.** ***Size of the database:*** to keep the databases relatively small, a decision was made to encode most of the information and use the least amount of free-text. This obviously limits the possibilities of describing sites; on the other hand a standard set of codes greatly reduces chances of misinterpretation that may arise when free-text descriptions are used.

**4.** ***Amount and type of information to record:*** recording of information was limited to map and topographic location, period and type of use, site condition and threats,



1. "Tall Fayṣal": the Roman fort salvage excavations during road construction. View from south.



2. "Tall Fayṣal": bulldozing operations besides the southeastern wall.

bibliographical references. It was felt that more information (owner, soil type, present land use, distance from water, etc.) would have considerably slowed down the project of data compilation. This data, in the future, can be obtained by linking JADIS to a GIS system.

In Palumbo (1993) this and other technical problems are analyzed in detail. Here it is sufficient to say that data collection and encoding is made on a physical card, which is then copied into the computer database (FIGS. 3-4). An example of output is shown in FIGS. 5-6.

A large part of the data collected has CRM significance: site condition, disturbances, inventory rating, type and level of threat of destruction. All these variables have useful applications in organizing lists or maps including sites under threat, in understanding the most common causes of disturbance affecting archaeological sites, and — in general — in providing a database for the creation of what could be defined a "*map of threatened heritage*" in the country. We will later see how this map can be integrated in the archaeological policy of the Department of Antiquities.

The computer program itself is user friendly, and allows a smooth data entry and a quick and effective search using a large number of "filters".[2] The software is able to search and sort the information according to parameters set by the user (e.g. by period, in alphabetical order, according to the state of preservation, etc.), but the most common search is made by coordinates, which gives the presence of archaeological sites in a given area.

Further steps this project can take are field checking and GIS. Field checking will start as soon as is feasible, especially for those sites with the least or outdated information, or with inaccurate coordinates. A team of archaeologists will re-visit those sites, completing or updating the required information, and locating the sites with greater accuracy than in the past, possibly using GPS technology.

As regards GIS we are thinking of integrating JADIS into digitized or scanned maps. The objective is to obtain a database which would allow the monitoring of areas with sites under threat of destruction, following "step-by-step" the development of construction projects and the expansion of agricultural areas across the country. The output will be a "*map of threatened heritage*", to be updated periodically when more information on archaeological and historic sites and on the expansion of development projects is available. This map could be made available to the main agencies responsible for development in Jordan, reducing the risk of inadvertent construction projects over archaeological sites — still a common occurrence today — thus reducing the need for either rescue or salvage projects concurrent with construction.

## Conclusion

The CRM program and its main tool, JADIS, can be considered a successful experiment in site management and preservation. Further steps towards the adoption of this project as a Department of Antiquities operation will include the establishment of standard procedures of coordination with development agencies, the complete catalogue of the existing information, the refinement of the database using GPS technology, in order to find the exact location of archaeological sites, and the possibility of integrating the database into a Geographic Information System program that can allow the output of detailed maps and the production of a "*map of threatened heritage*" containing all the information for future construction work and for forecasting the expansion of urban and agricultural areas in the country. This map may be the best tool available to the Department of Antiquities for the management of the archaeological heritage, and may constitute the basis for its policy of site protection and preservation in the coming years. The integration of the JADIS database system into the network of already existing GIS applications in Jordan will contribute to the ability of those departments to positively impact cultural environment preservation.

From a strictly archaeological point of view, JADIS can also be useful to the Department of Antiquities to check on the expansion of the archaeological activities in the country, and to implement a policy of emergency archaeological surveys to be conducted in areas where updated information is missing. In those cases, predictive models on the location of archaeological sites, which could be derived from GIS applications, might be used to plan surveys more effectively and to complete the total survey of Jordan at reduced costs and within a few years.

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Palumbo, G., 'Amr, K., Musa, A. and Rasson-Seigne, M. 1993. Salvage Excavations at "Tell Faysal", Jarash. *ADAJ* 37: 89-117.

[2] The software was prepared, under specification designed by Dr. Gaetano Palumbo, by Linda Faris and Nadine Mushahwwar of CDG Management and Associates, Amman. The software is distributed by CDG Management and Associates, P.O. Box 925740, Amman.

## JADIS
## Jordan Antiquities Database and Information System

## SITE FORM

1.Site Number: ☐☐☐☐ - ☐☐☐ 2.Site name(s):

3.UTM Zone: ☐☐ 4.UTM Coords. East: ☐☐☐☐☐☐ 5.UTM Coords. North: ☐☐☐☐☐☐☐

6.UTM Calculated: ☐ 7.UTM Cited: ☐ 8.P.g. Calculated: ☐ 9.P.g. Cited: ☐

10.Palestine grid East: ☐☐☐ - ☐☐☐ 11.Palestine grid North: ☐☐☐ - ☐☐☐

12.K737 Map no.: ☐☐☐☐ - ☐ - ☐☐ 13.Other Map number: _____

14.Air photo series: _____ 15.Air photo number: _____ 16.Satellite photo no.: _____

17.Site size (m2): ☐☐☐☐☐☐☐ 18.Elevation (m): + / - ☐☐☐☐

19.Type of site: _____

20.Period and type of use:

| | | |
|---|---|---|
| Unspec. Paleolithic | EB III | Unspec. Byzantine |
| Lower Paleolithic | EB IV (EB-MB) | Early Byzantine |
| Middle Paleolithic | Unspec. MB | Late Byzantine |
| Upper Paleolithic | MB I (IIA) | Umayyad |
| Unspec. Epipaleolithic | MB II/III (IIB/C) | Unspec. Abbasid/Fatimid |
| Kebaran | Unspec. LB | Abbasid |
| Natufian | LB I | Fatimid |
| Unspec. PPN | LB IIa/b | Crusader |
| PPNA | Unspec. Iron Age | Unspec. Ayyubid/Mamluk |
| PPNB | Iron I | Ayyubid |
| PPNC | Iron IIa/b | Mamluk |
| Unspec. PN | Iron IIc | Unspec. Ottoman |
| PNA/Yarmoukian | Persian (Iron III) | Early Ottoman |
| PNB | Hellenistic | Late Ottoman |
| Unspec. Chalcolithic | Unspec. Nabataean | Unspec. Islamic |
| Early Chalcolithic | Early Nabataean | Modern |
| Late Chalcolithic | Middle Nabataean | Unspec. flints |
| Unspec. EB | Late Nabataean | Unspec. pottery |
| EB I | Unspec. Roman | Unspec. structure |
| Unspec. EB II/III | Early Roman | Inscription |
| EB II | Late Roman | |

21.Topographic location of site: ☐☐ / _____

22.Site condition: ☐ 23.Disturbance: ☐☐ ☐☐ ☐☐ 24.Inventory rating: ☐

25.Type and level of threat of destruction by:

| | | |
|---|---|---|
| Construction: ☐ | Dam: ☐ | Quarry: ☐ |
| Road work: ☐ | Cultivation: ☐ | Other: ☐ |
| Development: ☐ | Erosion: ☐ | |

26.Bibliographical references:

27.Visited by: 28.Date visited: ☐☐☐☐☐☐

29.Encoded by: 30.Date encoded: ☐☐☐☐☐☐

31.Notes:

. Front page of the JADIS form, used to encode site information.

## JADIS
## Jordan Antiquities Database and Information System

## CODES SUMMARY:

**Codes for fields 19 and 20 (Type of site; Period and type of use):**

**General archaeological Information:**
01-Sherd / flint scatter
02-as above (uncertain presence)
03-as above (main presence)
04-as above (one-period site)
05-Material culture remains found with no structures
06-Multi-period stratified site (tell or khirbet)

**Habitation, military sites:**
11-Village site (no fortifications)
12-Fortified settlement
13-Possibly fortified settlement
14-Fortress
15-Castle
16-Castrum
17-Tower
18-Ruin
19-Palace
20-Caravanserai
21-Nomadic camp
22-Cave / shelter
23-Hermitage

**Cultic structures:**
31-Temple
32-Church / chapel
33-Mosque
34-Monastery
35-Sanctuary / High place
36-Stone circle
37-Menhir

**Agricultural structures:**
41-Hamlet/Farmstead
42-Villa
43-Mill
44-Agricultural terrace
45-Oil press
46-Wine press
47-Threshing floor
48-Other structures

**Other structures:**
51-Aqueduct / water channel
52-Cistern
53-Birket / water reservoir
54-Dam / barrage
55-Qanat
56-Baths
57-Bridge
58-Road
59-Milestone
60-Kite
61-"Jellyfish" structure
62-Animal pen
63-Hut circle
64-Storage facility / silo
65-Cairn

**Industrial / manufacturing sites:**
71-Quarry
72-Mine
73-Smelting site / slag heap
74-Furnace
75-Kiln
76-Flint knapping site
77-Other industrial installations

**Inscription:**
81-Arabic
82-Aramaic
83-Greek
84-Kufic
85-Latin
86-Nabataean
87-Safaitic
88-Thamudic
89-Turkish
C1-Other or Unspecified

**Funerary structures:**
81-Cemetery
82-Rock-cut shaft tomb
83-R.-c. multi-chambered tomb
84-Burial in natural cave
85-Burial cave (arcosolium type)
86-Colombarium
87-Hypogaeum
88-Grave
89-Burial cairn / tumulus
90-Dolmen
91-Sub-floor burial
92-Jar burial
93-Pit burial
94-Mausoleum
95-Burial in church
96-Other tomb

**Other features:**
A1-Petroglyph
A2-Mosaic
A3-Frescoes

**Codes for field 21 (Topographic location):**

01-Alluvial fan
02-Alluvial Plain
03-Valley bottom
04-Wadi terrace
05-Cutbank
06-Gully
11-Hilltop
12-Ridge
13-High spur
14-Low spur
15-Saddle
16-Plateau
21-Slope
22-Upper slope
23-Middle slope
24-Lower slope
25-Terrace on hill side
26-Cliff top
27-Cliff face
28-Cliff bottom

**Codes for field 22 (Site condition):**

1-Excellent
2-Good
3-Fair
4-Poor
5-Inundated
6-Destroyed
0-No information

**Codes for field 23 (Disturbance):**

00-No information
99-No disturbances
01-Archaeological excavation
02-Clandestine excavation/ vandalism
03-Deflation
04-Erosion
11-Agricultural use (general)
12-Plowing
13-Deep plowing
14-Grazing
15-Terracing
16-Reforestation
17-Fruit / olive grove
21-Bulldozing
22-Trench (pipeline, sewage, aqueduct)
23-Trench (canals)
24-Road work
25-Quarry
26-Mining
27-Construction
31-Structural decay

**Codes for field 24 (Inventory rating):**

0-Site destroyed: no excavation possible
1-Site damaged or very disturbed: excavation not advisable
2-Excavation not essential: low priority
3-Excavation recommended: medium priority
4-Excavation imperative: high priority
5-Preservation recommended
6-Preservation imperative
9-Site already under protection

**Codes for field 25 (Type and level of threat of destruction):**

N-No risk
L-Low risk
M-Medium risk
H-High risk

## جاديس
## برنامج معلومات الآثار الأردنية
## ملخص معلومات

**كودات رقم ١٩، ٢٠ ( نوع الموقع ، الفترة ، طبيعة الاستعمال)**

معلومات أثرية عامة
١ – قطع فخار او صوان مبعثرة
٢ – (السابق) وجود غير مؤكد
٣ – (السابق) وجود مؤكد
٤ – (السابق) فترة واحدة
٥ – مخلفات أثرية بدون بقايا معمارية
٦ – موقع ذو طبقات متعددة ومتتالية (تل أو خربة)

مواقع عسكرية وسكنية
١١– قرية (بدون تحصينات)
١٢– مستوطنة محصنة
١٣– مستوطنة محصنة محتملة
١٤– حصن
١٥– قلعة
١٦– مخيم عسكري روماني
١٧– برج
١٨– رجم
١٩– قصر
٢٠– كرفان سراي، مجمع نوافل
١٢٢ – مخيم بدوي
٢٢ – كهف / ملجأ
٢٣ – صومعة

إنشاءات دينية
٣١– معبد
٣٢– كنيسة
٣٣– مسجد
٣٤– دير
٣٥– حرم ، مكان مقدس
٣٦ – دائرة حجرية ، ضريح
٣٧ – نصب حجري

إنشاءات زراعية
٤١– مزرعة
٤٢– بيت زراعي
٤٣– طاحونة
٤٤– مصطبة زراعية
٤٥– معصرة زيت
٤٦– معصرة خمر ، نبيذ
٤٧ – أرضية لدرس القمح
٤٨– إنشاءات زراعية أخرى

إنشاءات أخرى
٥١– قناة ماء فوق جسر
٥٢– خزان ماء
٥٤– بركة
٥٤– سد
٥٥– قناة
٥٦– حمامات
٥٧– جسر
٥٨– طريق
٥٩– حجر تحديد المسافة في الطريق
٦٠–جدران تضيق المسافة ويقيا الصيد
٦١– أكواخ دائرية مجمعة بشكل دائري ضمن سور
٦٢– مقالع
٦٣– كوخ دائري
٦٤– مخازن ، صوامع تخزين
٦٥– كوم حجارة

مواقع إنتاجية صناعية
٧١– محجر
٧٢– مقلع
٧٣– موقع صهر معادن
٧٤– فرن الصهر
٧٥– أفران الفخار
٧٦– موقع شحط صوان
٧٧– إنشاءات صناعية

**النقوش الكتابية**
١ب– حميري
٢ب– آرامي
٣ب– يوناني
٤ب– كوفي
٥ب– لاتيني
٦ب– نبطي
٧ب– صفوي
٨ب– ثمودي
٩ب– تركي
١٠ب– نقوش أخرى أو غير معروفة

خصائص أخرى
١١– نقش حجري مصور
١٢– فسيفساء / موزاييك
١٣– لوحة جدارية / فريسكو

٩١– معدن تحت أرضية السكن
٩٢– معدن داخل جرة
٩٣– معدن داخل حفرة
٩٤– ضريح
٩٥– معدن داخل كنيسة
٩٦– معادن أخرى

**كودات رقم ٢١ (الموقع الطبوغرافي)**

١– محدب / دلتا
٢– سهل فيضي
٣– قعر الوادي
٤– مصطبة / سطح الوادي
٥– جرف النهر
٦– مجرى ماء
١١– قمة التلة
١٢– حافة
١٣– تلزع جبلي مدبب عالي
١٤–(السابق) منخفض
١٥– سرج / قمة
١٦– هضبة
٢١– منحدر / سطح
٢٢– سطح طري
٢٣– سطح أوسط
٢٤– سطح سفلي
٢٥– مصطبة طبيعية
٢٦– أعلى الجرف
٢٧– واجهة الجرف
٢٨– أسفل الجرف

**كودات رقم ٢٢ ( نوع الحماية والتدمير)**

٠٠– لا توجد معلومات
٩٩– لا يوجد حيث
١– حفرية أثرية
٢– حفرية تخريبية
٣– تفريغ محتويات
٤– انجراف
١١– إستعمال زراعي
١٢– حراثة
١٣– حراثة عميقة
١٤– رعي
١٥– سلاسل / مصاطب
١٦– تصريح / زراعة حرجية
١٧– بستان فواكه / زيتون
٢١– تجريف بالآليات
٢٢– خنادق / مواسير ، مجاري
٢٣– خنادق / قناة
٢٤– أعمال طرق
٢٥– محجر
٢٦– مقلع
٢٧– إنشاءات
٣١ – تلف أو تآكل بالمياه

**كودات رقم ٢٣ (حالة الموقع)**

١– ممتاز
٢– جيد
٣– وسط
٤– ضعيف
٥– مغمور بالماء
٦– مدمر
٠٠– لا توجد معلومات

**كودات رقم ٢٤ ( جرد تصنيفي للمواقع)**

٠٠– موقع مدمر / لا توجد إمكانية للحفريات الأثرية
١– موقع مدمر جزئيا / لا يتسع بإجراء الحفريات
٢– الحفريات غير ضرورية / إدارية ضعيفة
٣– ترميمية بالحفر / أولوية متوسطة
٤– ضرورة قصوى للقيام بالحفريات / أولوية عالية
٥– ترميمية بالمحافظة على الموقع
٦– ضرورة قصوى للمحافظة على المواقع
٩– موقع محمي

**كودات رقم ٢٥ ( درجة خطورة التدمير)**

N – لا توجد خطورة
L – خطورة قليلة جدا
M – خطورة متوسطة
H – خطورة عالية

4. Back page of the JADIS form, with description of the codes to be used, in Arabic and English.

**JADIS**
**Jordan Antiquities Database and Information System**
**FULL REPORT**

1. Site Number : **2309.001**
2. Site Name : **KHIRBET EL- LEHUN**

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3. UTM Zone: 36 4. UTM Coords East: 7712 5. UTM Coords North: 34849
6. UTM Calculated : N 7. UTM Cited : Y
8. P.g. Calculated : Y 9. P.g. Cited : N
10. Palestine Grid East: 230.900 11.Palestine grid North: 096.900

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12. K737 Map no. : 3152.1.NW 13.Other Map number :
14. Air photo series : 15. Air photo no. :
16. Satellite photo no. :

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17. Site size(m2) : 660000 18. Maximum Elevation (m): +748 Minimum Elevation (m) :

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19. Type of site & 20. Period and type of use :

| | |
|---|---|
| UNSPECIFIED PALEOLITHIC | 01 SHERD/FLINT SCATTER |
| UNSPECIFIED PN | 01 SHERD/FLINT SCATTER |
| UNSPECIFIED CHALCOLITHIC | 01 SHERD/FLINT SCATTER |
| UNSPECIFIED EB | 01 SHERD/FLINT SCATTER |
| EB I | 01 SHERD/FLINT SCATTER |
| | 96 OTHER TYPE OF TOMB |
| UNSPECIFIED LB | 01 SHERD/FLINT SCATTER |
| | 11 VILLAGE SITE (NO FORTIFICATIONS) |
| UNSPECIFIED IRON AGE | 66 TABUN |
| IRON I | 14 FORTRESS |
| IRON IIA/B | 14 FORTRESS |
| IRON IIC | 14 FORTRESS |
| UNSPECIFIED NABATEAN | 11 VILLAGE SITE (NO FORTIFICATIONS) |
| | 31 TEMPLE |
| | 88 GRAVE |
| UNSPECIFIED ROMAN | 31 TEMPLE |
| UNSPECIFIED BYZANTINE | 52 CISTERN |
| UMAYYAD | 01 SHERD/FLINT SCATTER |
| UNSPECIFIED ABBASID/FATIMID | 01 SHERD/FLINT SCATTER |
| MAMLUK | 11 VILLAGE SITE (NO FORTIFICATIONS) |
| | 33 MOSQUE |
| UNSPECIFIED OTTOMAN | 11 VILLAGE SITE (NO FORTIFICATIONS) |
| UNSPECIFIED ISLAMIC | 52 CISTERN |
| MODERN (1915-1950) | 11 VILLAGE SITE (NO FORTIFICATIONS) |

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21. Topographic location of site: 12 RIDGE

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22. Site Condition : 02 GOOD
23. Disturbance : 01 ARCHAEOLOGICAL EXCAVATION
04 EROSION
24 ROAD WORK
24. Inventory rating : 05 PRESERVATION RECOMMENDED

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25.Type and level of threat of destruction by:

| | | | | | |
|---|---|---|---|---|---|
| Construction | : H | Dam | : N | Quarry | : N |
| Road work | : N | Cultivation | : N | Other | : N |
| Development | : N | Erosion | : H | | |

5. First page of a "full report" output in JADIS.

**JADIS**
**Jordan Antiquities Database and Information System**
**FULL REPORT**

1. Site Number : **2309.001**
2. Site Name : **KHIRBET EL- LEHUN**

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27.Visited by: HOMES-FREDERICQ 1978-1993 28.Date visited: / /

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29.Encoded by: GP 30.Date encoded: 17/02/92

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31.Notes : Scarab (LB)
Coin (MAM/OTT)

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6. Second page of a "full report" output in JADIS.

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# The Conservation of Historic Sites and Monuments: A Fact-Finding Analysis in Jordan

It is often alleged that the root cause of underdeveloped aspects of the cultural heritage — such as ancient monuments and monumental architecture — is to be found in the chronic scarcity of economic resources. Although this situation is a real obstacle to progress, it hardly represents the major reason for the disrepair or abandonment of many ancient sites and monuments. In fact, the state of preservation itself is often the most pressing cause. While the preservation of standing architecture is often considered delicate, this situation is even more dramatic for architectural antiquities reduced to ruins.

The most important factor in conservation is usually not referable simply to the age of the ruins. For example, many extremely old buildings may be treated with the traditional, "tried and tested" methods. On the other hand, less ancient but badly fragmented monuments require specialised analyses and specific criteria for intervention.

Likewise, the potential or desire for modern reuse cannot be considered a major factor. As is occasionally the case, many ruined monuments that bear very important witness to the past — even if just in terms of local history — are accessible only with great difficulty. On the other hand, it often happens that monuments are chosen for rehabilitation after the recognition of the site's importance. This usually occurs after the passage of time (in the case of monuments with their own political or religious character, or other cultural stigma), the acquisition of new information, or simply "second thoughts". Unfortunately many such monuments have been the victims of benign neglect or even worse, victims of improvised conservation efforts that lead to new and even more serious damage.

It should be recognized that such intervention is often embarked upon only for the sake of tourism and improvement of the site's image. This situation is even more noticeable when comparison is made with the field of restoration of mobile remains (such as statuary) where there have been important advances in conservation methodology and technique.

The conservation of ruined buildings comprises just one part of a wider discipline, but has its own specific needs and characteristics, for which special skills are required (Marino 1988a; 1989). For a long time it was considered necessary to intervene through the consolidation of ancient walls — invariably with the indiscriminate use of cement and resins — in the conviction that this would finally solve all structural problems. For some time, however, the notions of ordinary maintenance and above all prevention have gained more acceptance and proven more advantageous than final, so-called "definitive" restorations.

Additionally, diagnostic studies are even more important in the work of conservation. The present condition of the site can invariably be better understood in the light of analyses of what has happened in the past, including the work of former conservators. For example; apparently enigmatic cracking of architectural features can sometimes be traced to previous conservation efforts, which, while temporarily solving a problem, in fact led to secondary forms of deterioration and masked the original cause.

The chances of recovering the traces of ancient building activities, while safeguarding not only their present significance but also their future revelations, often depends upon the protective measures put into effect at the time of the excavation. In most cases little thought is given to what will happen to excavated features, or to the conservation that might be required. Regrettably, in this situation, the unpredictable nature of excavation and what is found, is often the usual excuse.

One of the most neglected areas is what may be called "emergency conservation" (Marino 1988b). This aims at assuring the maximum conservation of the building feature, while at the same time exploiting to the fullest the conditions of discovery. This is important when there are fortuitous finds where the procedures and economic resources are limited and a determining factor.

We have been doing active research into these matters for some years at the University of Florence, in conjunc-

tion with other universities and heritage organisations.[1] The main aim of the research has been to define a methodology of analysis and operative procedures on archaeological buildings, in particular those reduced to ruins. It should be understood that here when we talk about "operative" procedures, we mean all possible kinds of work to be included, namely: conservation, cleaning, completion of elements, symbolic reconstruction, replacement, abandonment, use of copies, temporary and final consolidation, protection during the excavation, control of the movement of water, control of vegetation, protection from the action of atmospheric agents, construction of museum facilities *in situ* and under cover, reuse, pollution control, and control of decay due to improper use.

The verification of works carried out recently and those carried out some decades ago is fundamental to our research. A comparison between present conditions and those existing before the first works of conservation, permits us to write a kind of medical file for the monument that can evolve as the situation changes. In such a way we can evaluate and in many ways assess with maximum precision the level of danger that the buildings are in, the resulting thresholds of risk, and we can also evaluate the incidence of the degenerative mechanism and the speed of decay. At the same time we can carry out checks, after due time has passed, on the various categories of operation and of the most widely employed technologies.

These research projects also permit us to investigate the "authors" of the works of conservation and the historic conditions that prevailed at the time of the operations, and thus we may attempt to discover the tendencies and schools of thought which have sometimes determined the work of entire generations. This situation turns out to be particularly evident in areas often used in the past (and sometimes still today) as experimental areas by groups of (local as well as foreign) archaeologists who sometimes do not bother themselves with putting procedures of conservation into effect even in the areas where they have carried out important excavations.

The observations and investigations we carried out in Jordan[2] have been of particular importance. The reasons for this are at least six-fold.

1) The presence of important sites and monuments — even if they are little known outside the local area, with the exceptions of Petra and Jarash. It should not be forgotten that intervention which is not improvised but rather tailored to the local conditions is also important for those areas and monuments found in inaccessible areas, and thus can benefit less from operations of systematic maintenance. The whole of Jordan presents the typical characteristics of sites and monuments left in the open without protection, such as the decay of materials and the subsequent ruination of the structures. The scale of erodability is quite variable from place to place, just as the materials from which the structures were made vary in resistance. It sometimes happens that the phenomena of decay appear not to be serious and are underestimated, while with the passage of time and the influence of unforeseen mechanisms of decay, the degradation assumes an irreversible character with very serious consequences.
2) The existence of environmental conditions that can be described at best as exasperating due to the natural elements, which work independently but more often in a dangerous mixture. This includes the action of wind (especially gusting wind, causing an abrasive sand blasting action); rain water which can form uncontrollable impacting masses; the effect of infestations of vegetation, and even the insidious action of temperature and water movement in both long and short cycles.
3) The continuance of forms of settlement, both nomadic and sedentary, using traditional materials and techniques which have remained essentially unaltered, and whose survival is linked above all to systematic and careful maintenance — for example plaster work and facings. In the last few years there has been in fact a legitimate acceleration of change even where a greater measure of prudence would have been appropriate. Sometimes, driven by the misunderstood and misperceived needs of tourism, decisions are made which time reveals to have been damaging while at the same time having produced no organic development whatsoever. While it is undoubtedly true, for example, that an efficient road network may be important for the economic development of an area, it is equally true that every project should take environmental impact (including archaeological impact) into account, and evaluate the risks to which historic monuments and natural sites are exposed.
4) The presence of numerous archaeological projects — local as well as foreign — each with its own characteristics and operative methods. This presents an in-

[1] The research project "Towards a definition of archaeological conservation. Research and preliminary studies" is active in the Universities of Bologna, Naples, Florence and Urbino. The first joint report on the work in progress was published in 1989.

[2] Research commenced in 1986 and since then we have always enjoyed the firm support of the Jordanian authorities. Special thanks are in order to Dr. G. Bisheh, Dr. F. Zayadine and Mr. S. Farajat for their help. We would also like to thank the Italian consular authorities, Dr. F. deCourten, the Italian Ambassador to Jordan, and the Italian Cultural Attache, Mr. G. Benenati. We would finally like to recognize with esteem and affection the help which was always forthcoming from Prof. M. Piccirillo. A stay in Jordan in 1989 under invitation from the Department of Antiquities was of noteworthy usefulness and was directed toward investigating the condition of sites and historic monuments. This was accomplished in the context of an agreement for cultural exchanges between Italy and Jordan.

teresting (and perhaps disheartening) sample of methodologies employed over the past few decades; some of which are valuable; some of which are wholly unacceptable.

5) The objective risk of degradation due to tourism, at times poorly motivated and insensitive to the problems of care for the historical heritage. We cannot continue to pretend that unique historical and natural features are indefinitely renewable resources.
6) The fact that the authorities and local operators have always been very helpful and that we have an excellent history of maximum cooperation and exchange of ideas.

From the point of view of our research, Jordan may be considered, in many ways, to be a richer archive than is generally appreciated, and to a large extent present material which has not been recorded before. It is thus amenable to being consulted in a systematic manner and is suitable for reliable comparative studies with already known situations in other areas.

The research program envisaged the scrutiny of the recorded material, locally and outside Jordan, but above all reconnaissance of the monuments. After preliminary general reconnaissance we chose certain areas to be considered as deserving of special attention in which direct systematic and repeated investigations were carried out. Among these should be noted the great monumental complexes (above all Jarash and 'Ammān); the Crusader fortresses (Cardini *et al.* 1987; Vannini *et al.* 1990; Marino *et al.* 1990a; 1990b);[3] the area of Mādabā and Mount Nebo with regard to both the architecture and the mosaic floors (Marino, in press) (FIGS. 1, 2);[4] the monuments hewn out of the rock at Petra with particular emphasis on quarry faces, marks left by stone masons, as well as the water systems (Marino *et al.* 1990c); some sites left abandoned in the desert, and finally, the areas of the plateau where basalt was used as a construction material, such as at Umm al-Jimāl (Marino 1991; Marino and Piccirillo 1991).

Analysis of the state of conservation in some cases has served to define the diagnostic picture of the areas under consideration in order to better clarify the policies of intervention. The connecting factor in all the investigations has been a detailed graphic survey of the sites, carried out to provide the double function of "recording" the actual state and as an instrument of "interpretation". By way of example we offer summarized information about the investigation conducted at Machaerus (Makāwir).[5]

The program conceived for Herod's fortress was designed to take diverse directions. On the one hand operations were planned to solve some particularly serious aspects of decay and ruination, and on the other hand some plans were drawn up for ways to create a valid tourist attraction (FIGS. 3, 4). The phenomena discovered and analysed concerning the decay of the structures were as follows:

1) widespread cracking — by this we mean a general lack of cohesion between distinct structural elements — due to the natural ageing of the materials, especially the mortar;
2) localized damage with the recognizable situation of cracking;
3) actual or potential landslides;
4) loss of verticality in the walls due to bulging or overturning;
5) top or basal architectural shifts due to land pressures (earthquakes?);
6) surface break-up due to the action of water and temperature, assisted by wind and deepened by freeze-thaw;
7) pooling of rain water by depressions formed in the land or in the wall tops or counterslopes;
8) runoffs of surface flooded earth, and erosion by rivulets;
9) spontaneous vegetation and aggressive root systems;
10) various kinds of pollution;
11) ruination caused by neglect or acts of vandalism.

From the details of data gathered from all over Jordan, it can be affirmed that as a general rule the state of conservation is to be considered adequate, but local deterioration due to particular conditions has given rise to serious concern. We have established that numerous monuments — some of which are well-known and important — risk imminent collapse or substantial partial loss. The educative and descriptive facilities that would render the remains more comprehensible to visitors are practically nonexistent. These might, in their own way, make the sites more protectable. The most common form of intervention in Jordan consists of large-scale replacement of parts which, though they may be justified in extreme cases, should be less invasive or replaced by programs of systematic maintenance. Only prevention and routine maintenance programs carried out over a pe-

[3] The investigations for the project "Crusader settlements in Jordan" were conceived at the University of Florence (Prof. G. Vannini) and the University of Urbino (Prof. R. Franchi). Of particular interest to our research, was the archaeological excavation at the fortress of al-Wu'ayra near Petra. It allowed us to develop our criteria for the evaluation of the forms of degradation as well as their rate of development, a process which is initiated after excavation and exposure to the elements.

[4] Mount Nebo is one of the most important areas of our research since it presents the uncommon characteristic of having been the subject of surveys and investigations of a number of excavations and conservation projects, undertaken over a period of more than fifty years.

[5] The project "Machaerus: Plan for Restoration, Maintenance and Tourist Development" (presented in July 1991) is the outcome of cooperation between the Department of History of Architecture and Restoration of Architectural Structures at the University of Florence and the Studium Biblicum Franciscanum. We would like to thank the former Director General of Tourism, Mr. Nasri Atallah with whom we have had numerous and profitable exchanges of ideas.

riod of time would avoid, or at least limit, the risks of degeneration in the future. The degeneration is particularly dangerous as it is unexpected and represents a significant economic cost.

The future development of our research program aims at collecting a large quantity of data by the completion of operations, concerning:

1) detailed surveying of building techniques in addition to physical layout;
2) completion of survey of structures recognized as being of special importance;
3) sample probes of foundation structures;
4) ascertaining the static conditions, particularly evaluating the notable variability of the coefficients of resistance of degraded and ruined building materials;
5) recording the phenomena related to the water-table, which is perhaps the main cause of damage in exposed archaeological areas;
6) studying the procedures for analysis of the speed of degradation in order to evaluate risk factors over time for the archaeological features as well as people;
7) setting up the operations and definition of the methodologies involved in the obligatory recording of every aspect of archaeological fieldwork.

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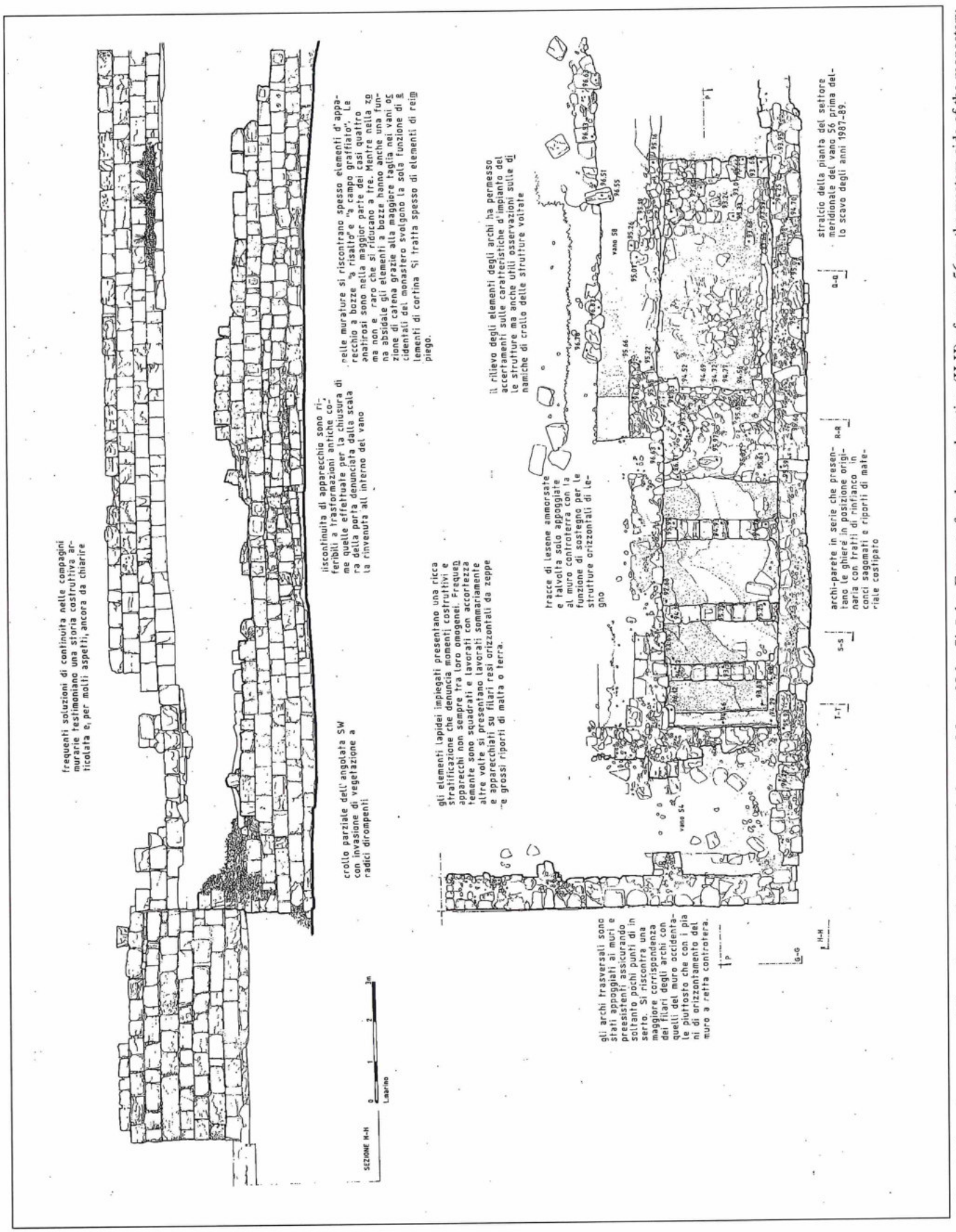
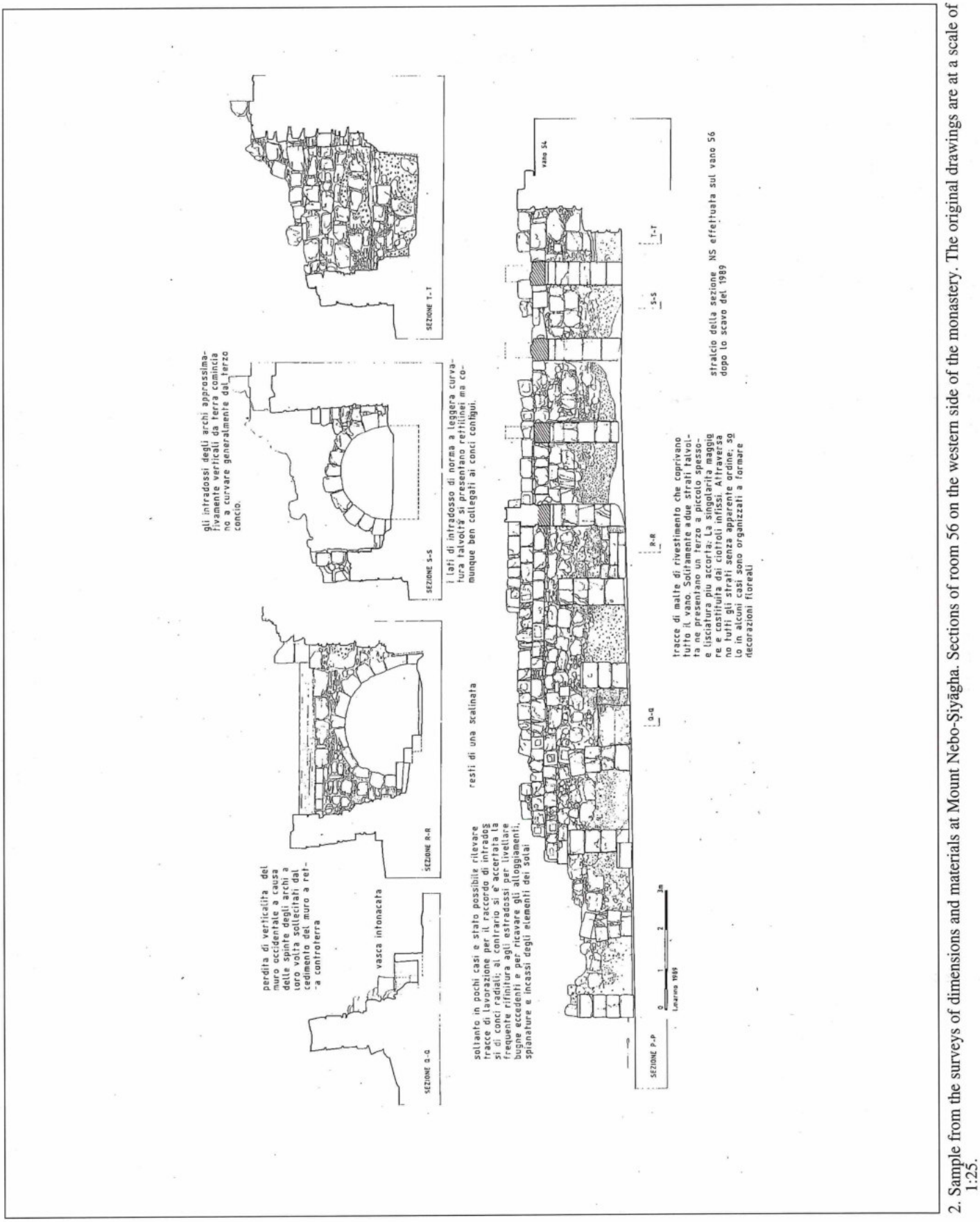
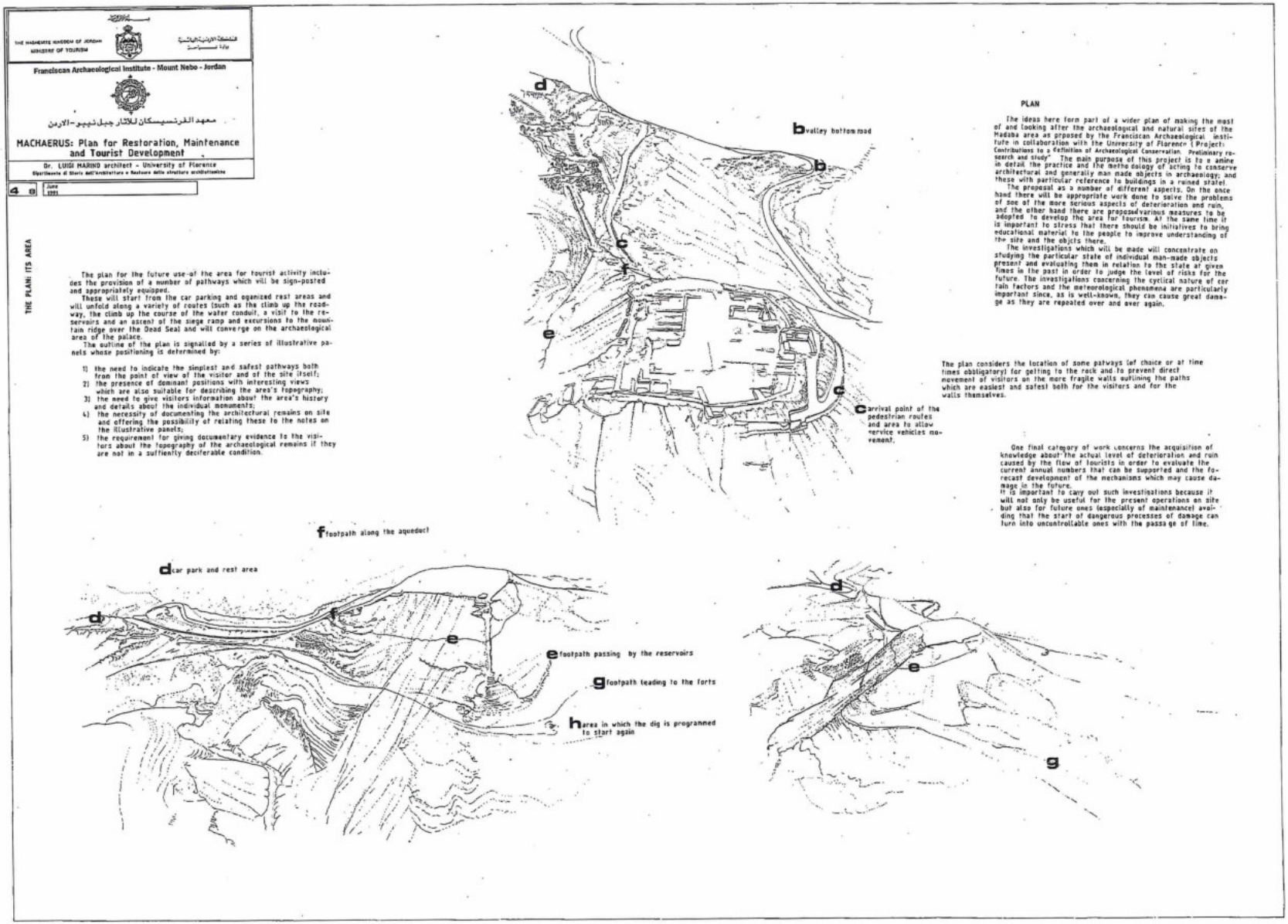


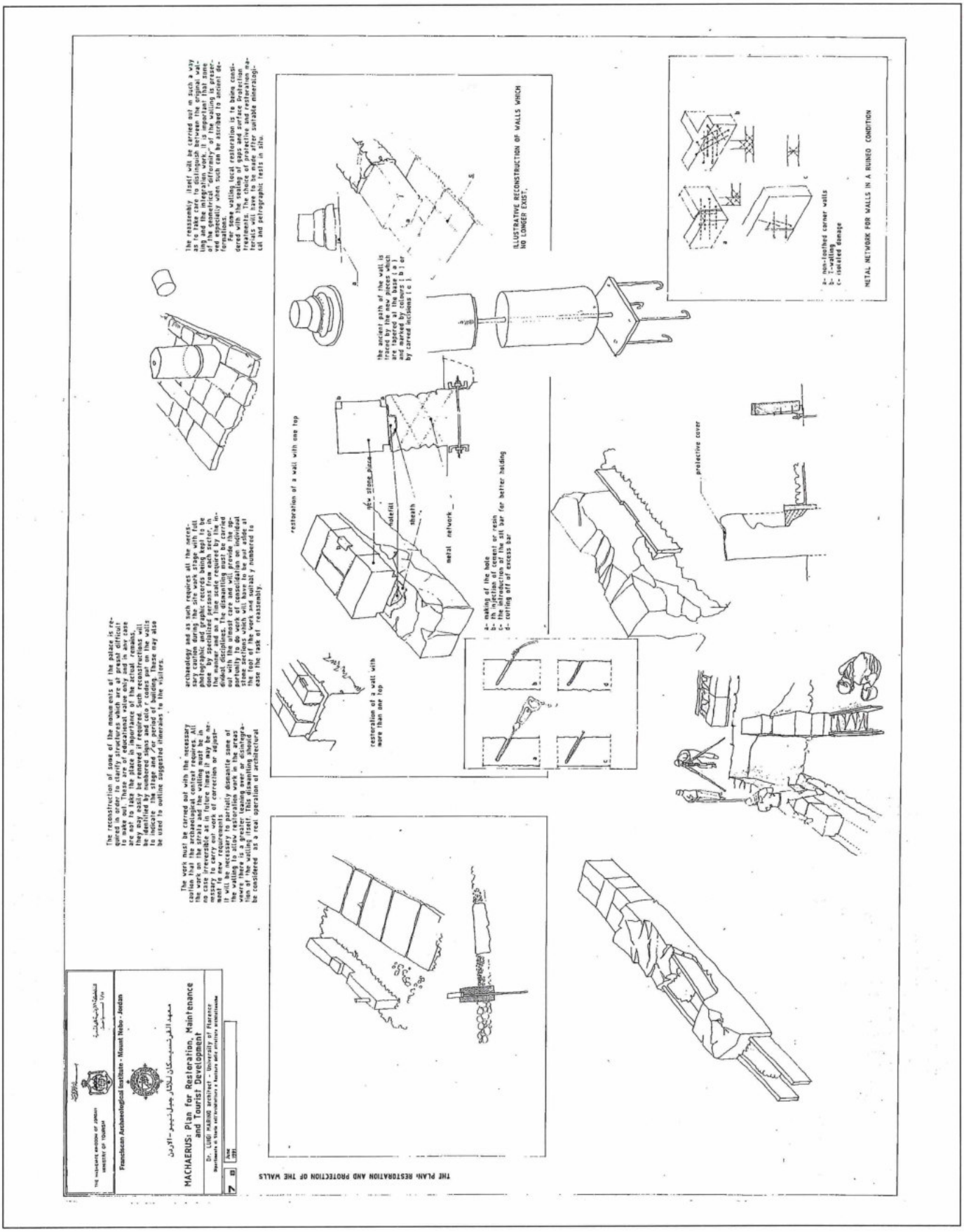

1. Sample from the surveys of dimensions and materials carried out at Mount Nebo-Ṣiyāgha. Extract of a plan, and section (H-H) of room 56 on the western side of the monastery. The original drawings are at a scale of 1:25.




2. Sample from the surveys of dimensions and materials at Mount Nebo-Ṣiyāgha. Sections of room 56 on the western side of the monastery. The original drawings are at a scale of 1:25.




3. Sample from the work prepared for the intervention at Machaerus. Table 4 concerns the proposal for the urban redevelopment of the area and the provision of pedestrian pathways.




4. Sample from the work prepared for the interventions at Machaerus. Table 7 shows examples of some categories of intervention for the strengthening and completion of the walls.

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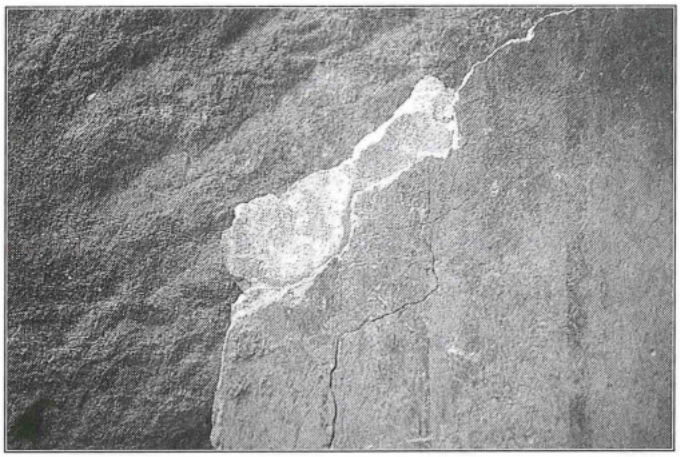
# The Wall Paintings at Petra and Bayḍa in Jordan: Mineralogical-Petrographic Study of the Causes of Deterioration and Proposals for Their Restoration

This study was carried out to define the state of preservation and determine the causes and effects of the deterioration of the wall paintings in two tombs located at Petra and Bayḍa.[1] The latter Nabataean locality, smaller and less well-known but equally interesting, lies about 5 km north of Petra.

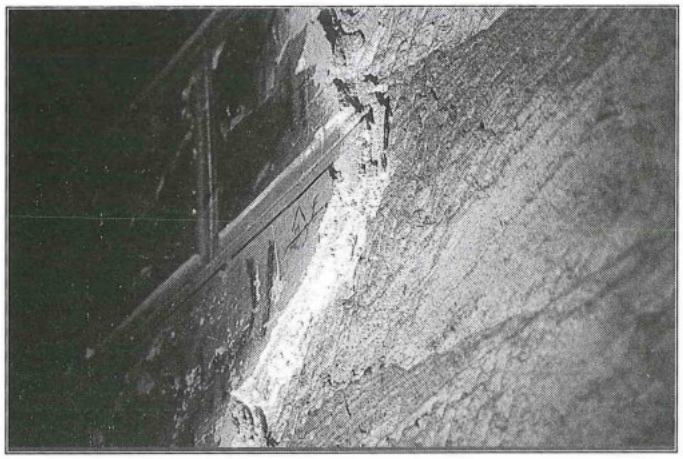
The frescoes discovered in 1979 in the Petra valley are fragmentary, covering the walls of a small chamber (approximately 3 x 3 m) dug into the northern bank of Wādī aṣ-Ṣiyyagh. The painted motifs are architectural, of unquestionable Hellenistic influence (Zayadine 1987). In the past, partial restoration and consolidation limited to a band of about one metre in the central zone of the west wall was carried out by personnel from the Madrid Institute of Restoration.

The chamber concerned was dug out using a rather crude excavation technique utilizing a long-handled instrument. Deep curved furrows, irregular and often imbricated, are visible, indicating inversion of the working position (FIG. 1). The base for the paintings is formed by a triple layer of mortar (FIG. 2). The first layer in direct contact with the rock wall is of very uneven thickness and was applied for the purpose of smoothing out the irregularities in the walls. It is uneven, having not been smoothed on the outer face, and has a coarser structure than that of the two layers above it. The second layer has a quite even thickness of about 1 cm and the granulometry of the aggregate is finer and better sorted. The frescoed layer of mortar has a very even thickness of approximately 0.5 cm.

The state of preservation, even upon initial visual inspection, appears extremely precarious. In many zones the layers of mortar are peeling off from the walls. Parts of the frescoes are covered by a layer of straw mixed with small amounts of clay and dung. Where this coating is absent, the paintings are darkened, in some cases to the point of being indecipherable, by encrustations formed of combustion residues resulting from human activities during the period when the chamber were utilized as a dwelling place by Bedouin families. Moreover, zones covered by a whitish efflorescence are present even in



1. Petra frescoes. Traces of working on the rock walls.



2. Petra frescoes. The triple layer of mortar and the layer of "coating" are visible.

[1] This work was supported by MURST (40%, R. Franchi) and forms part of a broader research programme that was carried out for three years in the Petra region by an interdisciplinary team of specialists from a number of Italian Universities (Urbino, Florence, Pisa, Bari and Salerno). R. Franchi is responsible for the section on geological and mineralogical-petrographic studies.

the restored areas.

The frescoes at Baḍya — of Alexandrine influence, dating from about the first half of the first century AD (Zayadine 1987) — were painted in a biclinium dug out in the rock along Sīq al-Bārid. The north wall is frescoed with isodomic panels. The alcove is decorated with thickly interwoven grapevines, birds — which must originally have been very brightly coloured — and hunting putti. These wall paintings were also executed on a triple layer of mortar, of similar thickness and texture. The rock walls were prepared more carefully than those at Petra. The furrows, cut by chiseling, are continuous, parallel, and very uniform; deeper and further apart on the walls, shallower and closer together in the vaulting and the ceilings. The extreme state of deterioration of both painted surfaces and layers of mortar is immediately apparent. The greatest damage has undoubtedly been caused by smoke from fires. The surfaces are completely blackened and covered with strongly adherent encrustations of soot and greasy substances. The latter, especially in the vicinity of the fireplaces, have unfortunately penetrated to a depth of several millimetres, due to the porosity of the plastering.

## Methods of Examination

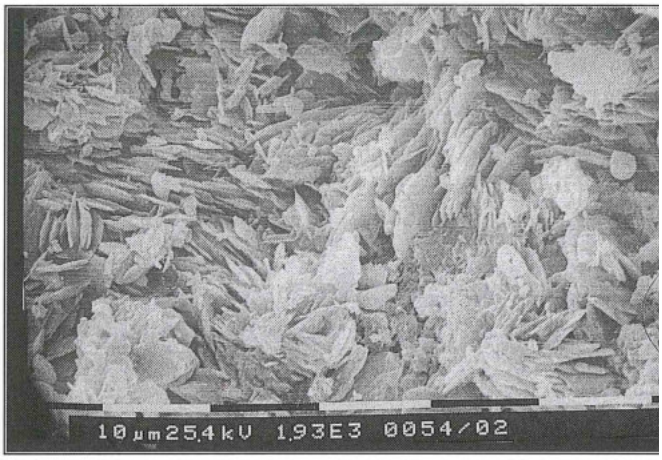
The various layers of mortar, as well as the efflorescence and the clay and straw coating found on the Petra paintings were examined by X-Ray Diffraction. In the latter samples, the products of recrystallization obtained after extraction by leaching were also analyzed. In addition, the amount of total carbonate was determined chemically, in order to check the diffractometric data. The petrographic characteristics were studied in thin section under an optical microscope.

Using a Scanning Electron Microscope (SEM) and an Energy-Dispersion Spectrometry system (EDS), the painted surfaces were examined with special attention paid to the mineralogical neoformation phases produced by deterioration.

## Results

The principle mineralogical composition of the samples from the various layers of mortar in the two frescoed sites showed no significant differences, either qualitative or quantitative. Analysis revealed the presence of quartz, with contents ranging from 70 to 80%; calcite (17-20%); and kaolinite (3-5%). The latter mineral is characteristic as cementing material of some levels within the sandstone outcrops in the Petra area (Franchi 1990), from which the quartz aggregate used to prepare the mortar was obviously taken.

Diffractometric analysis performed on surface samples showed the occasional presence of whevellite and weddellite. These calcium oxalate hydrates can form not only due to the metabolic activity of lichens, but als through the oxidation of organic substances (protein that may have been used as fixatives in mixing the co ours. The efflorescence was found to consist of calciu sulphate (FIG. 3). This mineral is also present, in diffe ent concentrations, on all the surface samples, frequentl in association with potassium nitrates (FIGS. 4, 5, 6). C




3. Closely packed microcrystals of calcium sulphate (SEM).



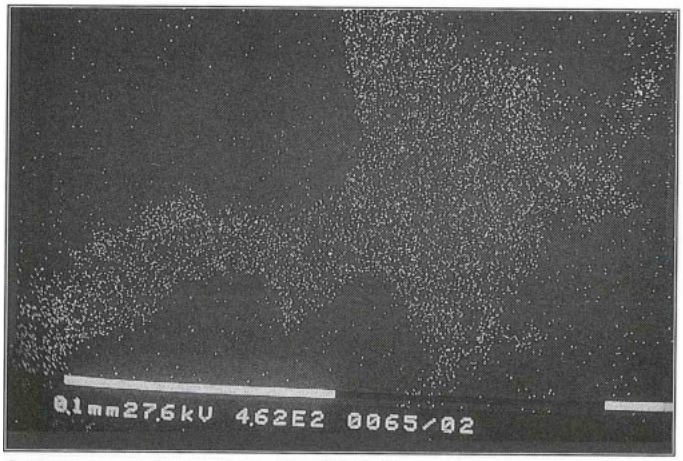

4. Association of calcium sulphate and potassium nitrate (SEM).



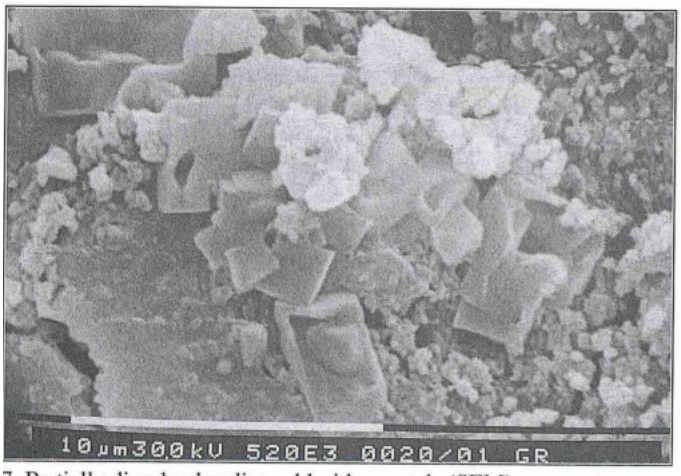

5. X-ray maps of sulphur executed on the same zone as that of FIG. 4

the frescoes at Petra alone, sodium chloride at times was found in large quantities in addition to the above-mentioned minerals (FIG. 7).

The mineralogical investigation conducted on the layer of the "clay and straw coating" added (by the Bedouins) onto the Petra frescoes have shown that the inorganic part consists of quartz and — in much lower percentages — calcite, dolomite, and traces of argillaceous minerals. The products of extraction by leaching — using distilled water — were found to consist of sodium chloride and potassium chloride. The abundance of these salts, sodium chloride in particular, on both the painted surface and the coating suggests that the frescoed room may have been utilized in the past as a salt store. No natural origin is possible, since the sandstone, from the Cambrian epoch, in which the chamber was dug out, contains absolutely no chlorides. The distance (and the elevation, around 850-1100 m above sea level) of the Petra area from the Dead Sea and from the Gulf of 'Aqaba ensures that it cannot be reached by marine aerosols. Moreover, these salts were not found at Bayḍa. Encrustations of sodium chloride, up to 1 cm thick, have instead been found in the Khazna (the Treasury) located at the opening of the Siq at Petra. May we postulate that the name of the tomb — the Treasury — was derived from the great amounts of salt that may have been stored there and from the increased commercial importance that this product may have assumed after the decline of Petra as a strategic zone and routing centre for the caravans providing communication between the Far and Near East and the Mediterranean.




6. X-ray maps of potassium executed on the same zone as that of FIG. 4.



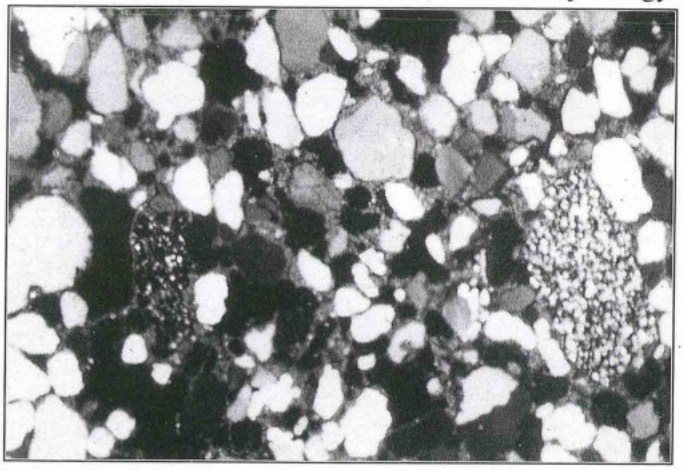

7. Partially dissolved sodium chloride crystals (SEM).

The structural and textural characteristics of the layers of mortar in the two frescoes are remarkably similar, except for the lower layer of the one from Petra, whose granulometry is slightly coarser and is less well sorted (FIG. 8).

The aggregate consists almost exclusively of quartz, while other kinds of material are very rare. Some grains of siltstone and of carbonate rock were also noted. As accessories, zircon, tourmaline, and titanite were found. The latter minerals are present, again as accessories, in the sandstones at Petra. The binder is well carbonated and evenly distributed. The porosity is low and the pore size is always small. No dissolution phenomena were observed.

The paintings were executed on a layer a few millimetres thick, formed of fragments of calcareous rock finely ground and bound with lime (FIG. 9). The mineralogical and petrographic properties reveal careful selection of raw materials as well as a good and constant technique of application of the layers of mortar at both sites. As no thorough historical and/or artistic studies have been carried out, the two works of art cannot be precisely dated, but the impression given on the whole by the available information is that the two paintings, or more precisely the underlying layers of mortar that form their bases, were realized at much the same time, if not actually by the same workers.

The mean percentage values of the semi-quantitative elemental analysis conducted on the surfaces by energy-



8. Sample of first layer of mortar underlying the Petra frescoes viewed under optical microscope. The granulometry is somewhat dispersed. Some siltstone is visible (n+, ~25x).

dispersion spectrometry are reported in TABLES 1 and 2.

**Table 1.** Petra frescoes: chemical composition of the surface (in %).

| | *P1* | *P2* | *P3* | *P4* | *P5* |
|---|---|---|---|---|---|
| Si | 27.34 | 2.95 | 19.60 | 12.62 | 4.43 |
| Al | 3.24 | 0.97 | 9.58 | 6.02 | 1.73 |
| Fe | 1.48 | 1.52 | 15.70 | 5.50 | 2.20 |
| Mg | _ | 1.24 | 0.64 | 1.39 | 0.96 |
| Ca | 67.36 | 80.29 | 41.12 | 54.38 | 74.17 |
| Na | _ | 3.04 | 2.52 | 1.48 | 5.63 |
| K | _ | 1.27 | 3.78 | 2.45 | 1.48 |
| Ti | 0.52 | _ | 1.30 | 0.85 | _ |
| P | _ | 1.44 | _ | _ | _ |
| Cl | _ | 3.61 | 2.65 | 1.05 | 3.91 |
| S | _ | 3.66 | 3.22 | 14.22 | 5.44 |

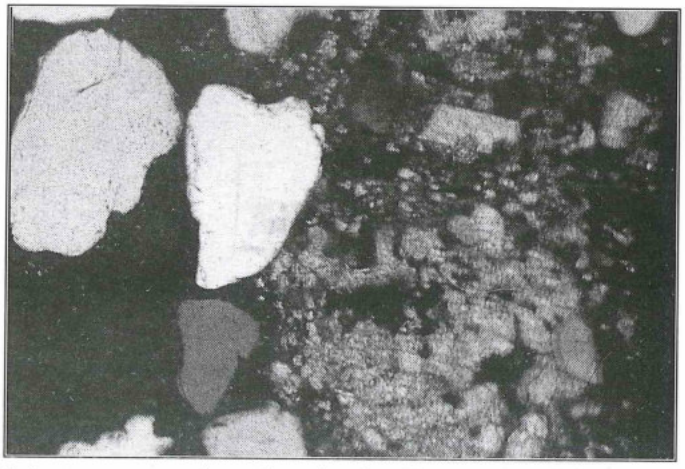
**Table 2.** Bayḍa frescoes: chemical composition of the surface (in %).

| | *B1* | *B2* | *B3* | *B4* | *B5* |
|---|---|---|---|---|---|
| Si | 4.60 | 4.89 | 11.20 | 16.84 | 6.63 |
| Al | 2.11 | 1.72 | 3.81 | 3.41 | 2.46 |
| Fe | 4.48 | 3.14 | 8.55 | 2.10 | 5.11 |
| Mg | _ | 0.21 | 0.87 | _ | 0.92 |
| Ca | 79.16 | 77.02 | 65.59 | 72.17 | 77.48 |
| K | _ | 1.19 | 4.32 | 1.04 | 1.57 |
| Ti | _ | 0.45 | 1.14 | 0.53 | 0.66 |
| Cl | _ | _ | 0.52 | 0.19 | 0.17 |
| S | 9.63 | 11.34 | 3.97 | 3.69 | 4.97 |

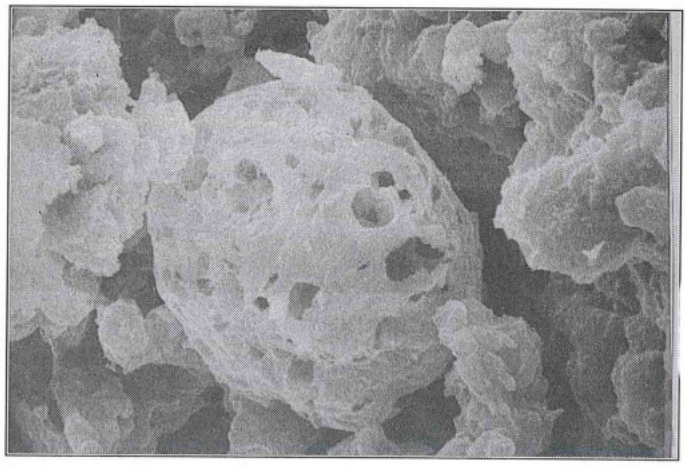
For each sample, at least five analyses were carried out over areas chosen in order to cover approximately the entire surface of the fragments (about 1 cm²). The characteristic elements produced by transformation reactions induced by deterioration, both natural and following human activity, are essentially: sulphur, indicating the presence of calcium sulphate (already identified, along with the other neoformational mineralogical phases, through diffractometry), chlorine, sodium, potassium, and phosphorus. The latter element, which was found only at Petra beneath the "clay and straw" coating, is certainly of organic origin. The remaining elements are perfectly compatible with the composition of the aggregates, of the binder, the mortars, and the preparatory layer for the painting consisting, as previously mentioned, of fragments of carbonate rocks with a low magnesium content.

## Conclusions

All the scientific analyses, as well as on-site observations, have shown the generally poor state of preservation of the two frescoes and have also made it possible to identify the causes of deterioration and related physical and chemical phenomena. Some problems, for example the loss of adhesion of the mortar to the walls — in some cases between one layer and another — and the neoformation of salts, are common to both sites. The soot deposits also are present at both Petra and Bayḍa, but in the latter case they are particularly pronounced. It was however obvious that the main cause of chemical change of the surfaces derived from the utilization of the two chambers as dwellings, probably at different periods, the last of which may have been quite recent. Smoke from the burning of wood (FIG. 10) — as well as other materials — and the cooking of food releasing steam together with nitrated substances and sulphur dioxide have led to the formation of nitrates and calcium sulphate on the surfaces. Analyses performed on sections perpendicular to the exposed surface, utilizing the SEM, have revealed the presence of these compounds even to a depth of several millimetres. In spite of the predominantly dry climate, dissolution, migration through the pores of the mortars,



9. Last preparatory layer for painted surface, made of fragments of carbonate rocks and lime (n+, ~50x).



10. Carbonaceous particles on painted surfaces at Bayḍa (SEM).

and recrystallization within them, have occurred. The situation of the wall paintings at Petra is, as regards chemical aggression, even more alarming than that of Bayḍa due to the presence, along with the other salts, of sodium chloride, whose corrosiveness and motility may have been accentuated by direct reaction with hypoazotide (generated by the combustion of wood) in the presence of steam, with the consequent formation of hydrochloric acid and sodium nitrate (Cadle 1982: 141).

As for conservative restoration, the problems to be dealt with are:

- Reattachment of the mortar that is coming away from the walls. This can be done utilizing a lime mortar around the edges of the fresco and, if necessary, in the inner zones, with localized injections of acrylic resin, mixed with inert materials selected from among the finer, purified fractions of the sandstone itself.
- Removal of the layer of "clay and straw" coating. This can be done either dry, by mechanical means, or after softening with moderate amounts of deionized water. In any case, on-site tests will have to be performed on small surface areas.
- Surface cleaning and desalinization. This step is especially important, and is the most difficult and painstaking one. It must be done in such a way as to remove even the deeply-penetrated salts, obviously without damaging the layers of paint by overly aggressive methods or products. It will be necessary to apply adsorbent pads made of Japanese paper, loaded with a saturated solution of ammonium carbonate and ethylenediaminetetracetic acid (EDTA), also containing surface active agents. In this way the combustion products of the deposits can also be removed, at least partially. Obviously, in this case also, it will be necessary carry out on-site tests on small areas of the fresco to determine the time for which the pads should be applied in order to be most effective. Laboratory experiments, on fragments of blackened, but not frescoed mortar, have yielded promising results while showing the impossibility, and this will be especially true for the painted layers, of complete removal without running the risk of damaging still further the frescoed surfaces.
- Reattaching the painted layers. This is to be carried out in the detached areas only, with infiltration or impregnation of acrylic resins in emulsion or solution.
- Temperature fluctuations: The two frescoes, although painted inside rock chambers, are negatively influenced by changes in climate. The enormous differences in temperature between day and night and the consequent different thermal gradients between the painted structures and the surrounding atmosphere can lead to condensation on the surfaces. Moreover, while the climate in general is rather dry, there are periods of very heavy rainfall — even snow is a not uncommon occurrence — and of high atmospheric humidity, which inevitably influence the micro-climate of the two chambers.

The completion of the microclimate study of the two environments, through repetition of point measurements of temperature and humidity on the frescoes and continuous recordings of the same parameters in the air inside the two chambers, will provide indispensable data for the development of a project designed to eliminate or at least limit the influence of external climate factors on the two frescoes.

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# Le relevé des peintures de Quṣayr 'Amra

Depuis mai 1989 il existe un projet franco-jordanien pour réaliser le relevé intégral des peintures de Quṣayr 'Amra. La mission est placée sous la responsabilité scientifique de M. Gh. Bisheh, Directeur du Service des Antiquités, et le travail sur le terrain est assuré par M. Cl. Vibert-Guigue, allocataire de recherche à l'Institut Français d'Archéologie du Proche-Orient. Cette mission était nécessaire du fait qu'il n'existe pas un inventaire détaillé et vraiment fiable des peintures et que celles-ci continuent avec le temps à se dégrader. Nous remercions M. Gh. Bisheh qui a bien voulu que nous présentions nos méthodes de travail et quelques observations sur les fameuses peintures omeyyades à l'occasion de ce congrès[1].

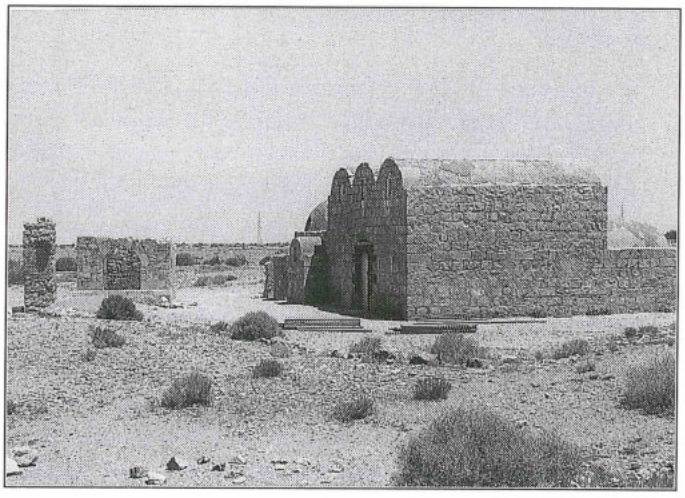
Quṣayr 'Amra se situe à 80 km à l'est d'Amman dans une zone semi-désertique. Il s'agit d'un ensemble de bains construits au huitième siècle au milieu d'un domaine (FIG. 1). L'architecture, caractérisée par de solides voûtes ou coupoles en pierre, est intacte. Elle a permis la préservation jusqu'à nos jours du plus grand ensemble pictural de la civilisation omeyyade. Près de 350 m² de peintures couvrent les parois et voûtes de toutes les pièces (FIG. 2).

Au fur et à mesure de nos relevés on s'est rendu compte que des travaux avaient déjà été réalisés sur le site depuis sa découverte. Les principales interventions peuvent se résumer de la manière suivante:

1- C'est A. Musil qui le premier travailla à Quṣayr 'Amra au début du siècle. Lui et son collègue Mielich publièrent la première monographie sur le bâtiment en 1907. Ils réalisèrent une grande quantité de relevés concernant l'architecture et les peintures. Les dessins sont en couleurs et les motifs sont pour la plupart assez bien esquissés même ceux en partie haute sur les voûtes. Mais des oublis, des erreurs d'interprétation et de restitution sont incontestables. Bien qu'ils aient tenté de nettoyer les fresques, les parties qu'ils ne purent pas représenter sont nombreuses. De même, les lacunes sont dessinées de manière schématique et ne rendent pas compte des inscriptions ou scènes animalières. Autre intervention de cette équipe austro-hongroise le découpage de scènes qui allaient être emportées en Europe.

2- Vers les années soixante (?) la protection du site fut améliorée grâce à plusieurs travaux entrepris par le Service des Antiquités. Une clôture fut installée et une digue en terre fût levée à l'ouest de Quṣayr 'Amra. On comprend toute l'importance de ce barrage lorsque des pluies importantes s'abattent sur la région[2].

3- Au début des années soixante-dix une équipe espagnole oeuvra sur le site sous la direction de M. Almagro. Elle dégagea le remblai à l'intérieur de Quṣayr 'Amra, fit des relevés architecturaux à l'intérieur et à l'extérieur des constructions et consolida une partie du bâtiment. Mais l'opération la plus spectaculaire a



1. Vue extérieure de Quṣayr 'Amra lors du déroulement de la mission.

[1] Nos remerciements vont également à M. S. Tell, ancien Directeur général du Service des Antiquités, et M. F. Qudah, Directeur par intérim du même Sevice en 1994, pour leur aide constante durant la mission. Nous exprimons notre gratitude à M. J. Seigne, responsable du centre de l'I.F.A.P.O. en Jordanie, à qui nous devons le bon déroulement de la mission.

[2] A l'origine le bâtiment était protégé des flots du wadi par un mur éperon bien conservé du côté ouest.



2. Vue des fresques à l'intérieur de Quṣayr 'Amra.



3. Carré témoin laissé par les restaurateurs montrant toute l'utilité du nettoyage des peintures (cliché pris dans la publication des travaux espagnols).

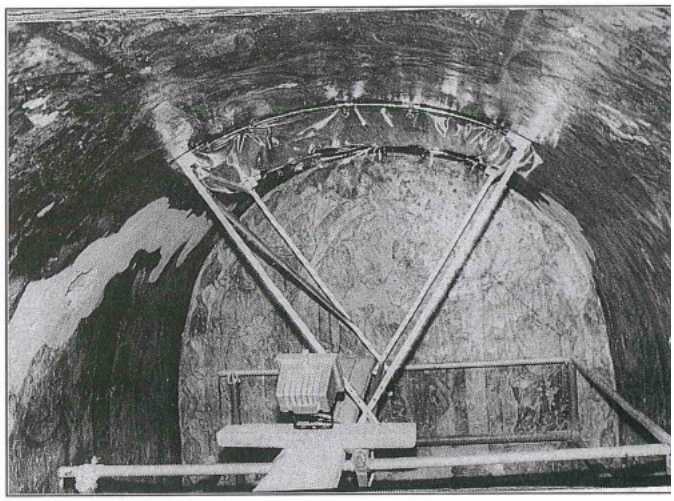
été le nettoyage des peintures. Grâce aux restaurateurs espagnols nous pouvons maintenant admirer l'ensemble des fresques qui auparavant étaient cachées par du noir de fumée. Des témoins laissés sur les parois prouvent l'efficacité de leur nettoyage (FIG. 3). Ils teintèrent également en jaune toutes les lacunes dont certaines sont encore bordées de consolidations en coton et passèrent un solide vernis sur les peintures. Après Musil, l'équipe espagnole fut la deuxième à publier un ouvrage sur Quṣayr 'Amra. Il comprend un texte avec des résumés en plusieurs langues, de nombreux clichés en couleurs des peintures (uniquement après restauration), des dessins d'architecture et des plans.

En 1989 débuta la mission franco-jordanienne dont le but principal est le dessin grandeur nature des fresques omeyyades[3]. Échafaudages et lumières artificielles sont déplacés au fur et à mesure de l'avancement des relevés à l'intérieur de toutes les pièces.

La copie des fresques se fait sur des feuilles plastiques transparentes qui sont plaquées sur les parois grâce à un ingénieux système mis au point en collaboration avec M. J. Seigne et M. F. Braemer (FIG. 4). La feuille de plastique est fixée sur des tubes en plastique souple qui sont maintenus contre les parois à l'aide d'étais en aluminium disponibles en plusieurs longueurs. Ce système permet de donner à la feuille plastique la courbure de la voûte ou de l'arc. Libéré de toute contrainte, il est possible de se consacrer à la copie des fresques en utilisant des feutres indélébiles. Tout est dessiné: aussi bien les motifs, les indications de travail des peintres que les traces de destructions dues au feu, à l'eau et à l'homme et en particulier les graffiti. Le dessin étant uniquement en trait noir les couleurs sont portées par des lettres.

Ces relevés sont ensuite réduits à l'échelle du quart au laboratoire photographique au Ministère du Cadastre à Amman[4]. Les clichés photographiques sont assemblés pour reconstituer le décor des parois. Il suffit alors de recopier l'ensemble en améliorant la qualité du dessin et en complétant par une série de conventions graphiques toutes les indications iconographiques ou techniques (tracés préparatoires, repentirs, limite de travail, sens des coups de pinceau) (FIG. 5).

La méthode de relevé utilisée à Quṣayr 'Amra est longue mais elle est la seule qui permette d'observer de près et sans ambiguïté le décor. Elle présente aussi



4. Système de relevé des peintures sur les voûtes.

3 Depuis plusieurs années nous effectuons le relevé de fresques antiques de Jordanie (à Abila, 'Ammān, Bayt Rās, Ḥammām 'Afra, Pétra, Bayḍa). La méthode est améliorée au fur et à mesure. C'est ainsi que nous sommes en train de tester une méthode peu diffusée utilisant le phénomène électrostatique. Les relevés sont tous archivés à l'I.F.A.P.O.

4 C'est pour nous l'occasion de remercier M. K. Nasrawi et son équipe du laboratoire photographique.



5. Exemple de mise au net des relevés (paroi sud de la travée ouest).

l'avantage de nous apprendre immédiatement beaucoup de choses sur la peinture omeyyade. On est en quelque sorte obligé de refaire le geste des peintres et de suivre leur progression sur les parois. L'état de conservation des enduits fait également l'objet d'une grande attention. Les peintures ont énormément souffert et les relevés graphiques tiennent compte de toutes les traces de destruction ou résultat d'intervention. Elles se résument de la manière suivante:

1- Les graffiti gravés dans l'enduit: ils apparaissent dès l'époque omeyyade, continuent à l'époque médiévale pour connaître jusqu'à maintenant un fort ralentissement. Il y a des graffiti animaliers, géométriques (*wasm*) et inscrits. Ce sont les parties basses des parois qui ont le plus souffert. Mais les graffiti autour des fenêtres situées en haut de parois ne sont pas étonnants. Ils ont été réalisés par des personnes accédant facilement de l'extérieur aux parties hautes de la construction. Maintenues en équilibre dans l'ouverture, elles étaient assez agiles pour libérer une main capable de graver l'enduit.

2- A de nombreux endroits subsistent des traces de découpages de l'enduit par plaques de 30 cm par 20. C'est Musil qui emporta en Europe ces morceaux de peintures, certains publiés dans son ouvrage, d'autres repérables par les traces d'incisions encore visibles dans l'enduit .

3- Les restaurateurs espagnols ont badigeonné en jaune toutes les zones de lacunes dans le but de donner une unité de couleur aux surfaces détruites. Quelquefois ce badigeon a mordu sur des parties intactes ou bien recouvre totalement des parties de décor qui n'auraient pas dues être cachées. De manière générale ce badigeon, ajouté au vernis qui avec le temps jaunit, crée une dominante jaunâtre .

4- Les destructions dues à l'eau ont été nombreuses. Un peu partout sous les fenêtres ou trous de lumière il y a de longues traînées verticales provoquées par de fréquents écoulements d'eau. Il y a également de grandes surfaces d'enduit où la peinture a complètement disparu du fait de stagnations d'eau sur les parements extérieurs.

5- Le feu et la fumée avaient noirci la plupart des peintures. La restauration espagnole n'a malheureusement pas pu enlever la totalité du noir de fumée, celui-ci ayant à certains endroits complètement noirci les pigments ou fait tomber ces derniers en les brûlant. Les formes peintes se devinent alors en négatif. Nous avons l'exemple d'une inscription grecque désignant une muse sur la paroi sud de la travée est. Musil a représenté sans problème particulier cette inscription peinte alors que nous avons eu du mal à la retrouver du fait que les pigments étaient entre-temps tombés (les lettres ne sont plus conservées qu'en négatif). Les

zones brûlées se situent en partie haute, principalement sur les voûtes.

6- La conservation architecturale, aussi exceptionnelle qu'elle soit, n'a pas empêché la destruction des peintures. Ainsi des basculements de paroi ou des affaissements ont provoqué d'importantes déchirures entraînant elles-mêmes de petites ou grandes fissures dans les enduits. Il y a aussi une dégradation picturale plus importante d'ouest en est. Elle est due aux vents d'ouest, souvent porteurs de pluie. Les parements extérieurs n'étant plus assez recouverts d'enduit, les peintures des parements intérieurs souffrent de l'humidité conservée dans la maçonnerie. Cet aspect de la destruction du mortier intérieur a des conséquences sur la manière de comparer les peintures. Les modifications de la couche picturale peuvent en effet rendre totalement différentes des parois peintes de la même manière: sur l'une les coups de pinceaux se devinent encore dans l'épaisseur de la peinture alors qu'ailleurs il ne reste que des couleurs lisses au toucher. Ce qu'il reste du décor correspond à la trace des pigments qui ont teinté en surface l'enduit.

7- Les oiseaux, si l'on ne prend pas garde, participent à la détérioration des fresques. Ils se nichent dans les joints des pierres des parois et voûtes et par des passages incessants provoquent la chute des enduits. Leur présence sur les rebords des fenêtres est également nuisible à cause des fientes. Les oiseaux étaient aussi à l'origine de jets de pierre, qui bien sûr, ne manquaient pas de percuter l'enduit.

La documentation graphique indique toutes ces altérations. C'est une sorte d'état des lieux pour une période donnée. Elle peut servir à comptabiliser et à caractériser les phénomènes de destruction ou à programmer une restauration sur une base immédiatement accessible. Elle peut également faciliter l'inventaire et l'étude des centaines de graffiti.

Cette patiente observation des fresques a comme objectif principal l'étude des peintures omeyyades de Quṣayr 'Amra. Il faut naturellement tenir compte de tout ce qui a déjà été écrit sur ces fresques. Mais l'approche minutieuse du décor améliorera la présentation des données et permettra d'aller plus loin dans l'interprétation. Les quelques exemples qui suivent vont dans ce sens. Ils montrent aussi comment l'analyse graphique aide à comprendre et à restituer le décor.

La quantité de personnages représentés est surprenante. Ils sont plus de deux cents, de toutes tailles et composent une multitude de scènes: scènes de cour, d'apparat, de chasse, de pêche, de danse et musique, de bains, d'artisans et scènes mythologiques avec en particulier une magnifique représentation de zodiaque sous la coupole du *caldarium*. Pour la plupart des scènes il est possible de savoir si elles se passent à l'intérieur ou à l'extérieur grâce à des indicateurs d'espace comme la végétation de plein air ou des éléments d'architecture intérieure.

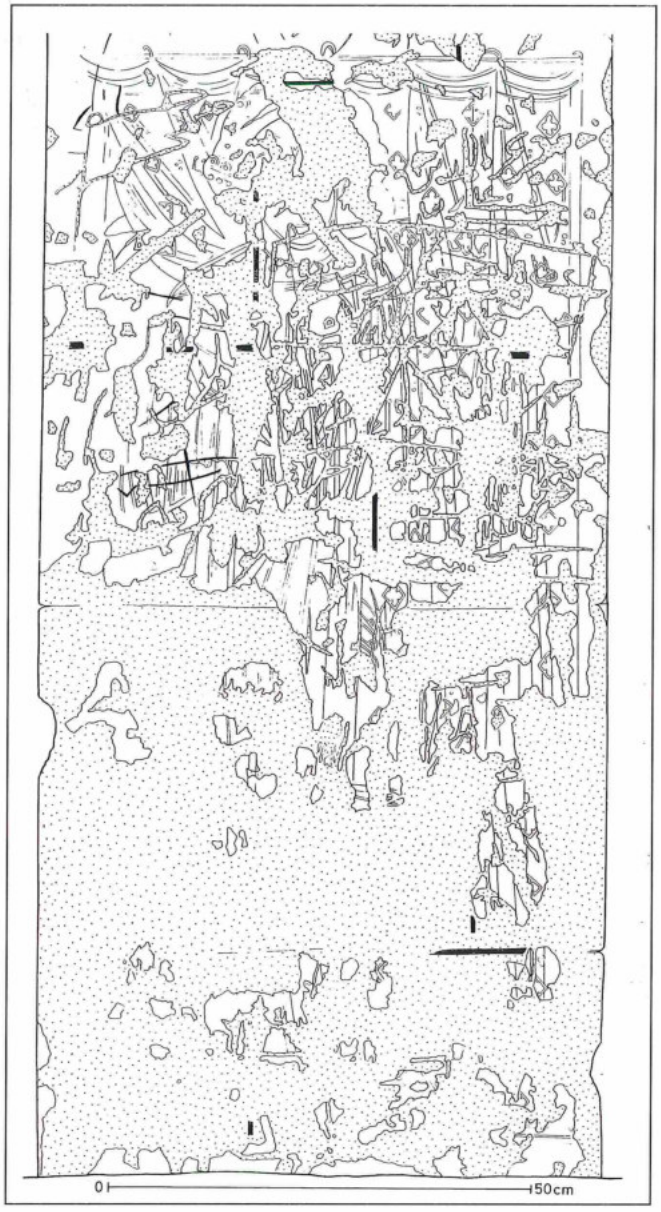
La volonté de montrer le plus de thèmes possibles, tout en évitant les répétitions et le style purement décoratif, est évidente. Si un décor doit être répété il y a une variation du motif. Cette caractéristique laisse penser que ces peintures étaient plus faites pour être lues que simplement vues.

Même les bandes d'encadrement montrent une variété. En haut du mur nord de la travée centrale un motif très abîmé est apparu. Le problème est de savoir si on doit le restituer sur les autres parois. Il s'agit d'imitations d'incrustations de pierres. Ce motif modifie la vision générale du décor et montre comment le style de la peinture peut être mieux caractérisé à partir d'un simple motif. Ici, l'influence byzantine est nette.

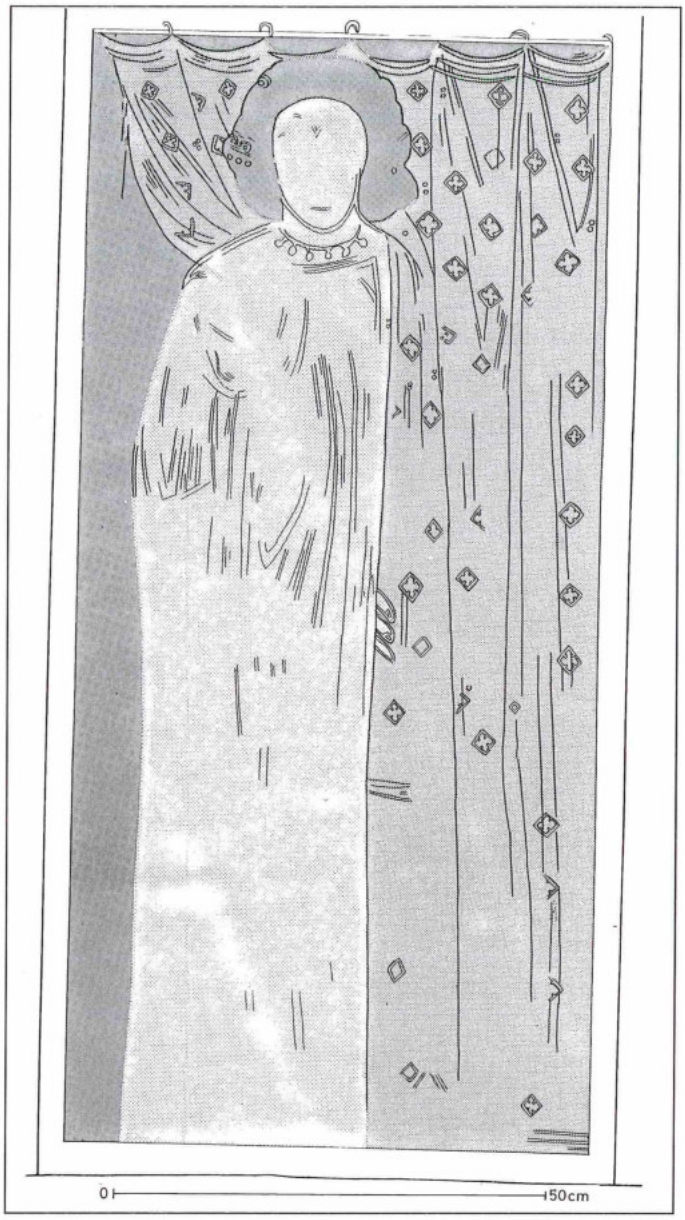
L'habileté des peintres apparaît surtout dans le rendu des tissus, qu'ils appartiennent à des vêtements ou à des tentures et dans des détails d'ornements précieux, d'architecture ou d'instruments de musique. Elle existe aussi dans la logique de préparation du décor, comme celle de la voûte d'une des pièces des bains. Il s'agit d'un réseau de losanges garnis de personnages ou d'animaux. La surface de la voûte n'a pas été recouverte d'enduit en une seule fois. Le maçon l'a progressivement enduite de mortier d'un côté à l'autre en s'arrêtant le plus souvent le long des cadres de losanges. Sur chaque plaque d'enduit des lignes ont été tracées en frappant le mortier à l'aide d'une cordelette trempée au préalable dans de la peinture rouge. Puis la silhouette des figures a été esquissée avec de l'ocre jaune. Les figures ont ensuite été peintes et juste après les tracés préparatoires rouges et jaunes ont été camouflés lorsqu'ils dépassaient trop du décor. La dernière touche de peinture a consisté à peindre les feuillages verts. Ces opérations se déroulaient alors que l'enduit était encore frais. Il s'agit donc d'une véritable peinture *a fresco* .

L'étude des décors très abîmés se fait sur place mais aussi après que nous disposions du relevé et de sa mise au net. Le coloriage des dessins facilite l'interprétation des motifs détruits. Un des panneaux de l'arc sud-est explique cette démarche. Sur place, le décor très endommagé n'était pas compréhensible. Un relevé détaillé a permis de reconnaître des éléments de décor (FIG. 6): une tenture suspendue par des anneaux, un buste et des doigts. En coloriant ces motifs et en faisant abstraction de toutes les altérations il a été possible, sur un second dessin, de faire revivre un personnage apparaissant derrière un rideau qu'il écarte de sa main gauche (FIG. 7).

De cette manière il est prévu d'identifier les motifs ou les scènes endommagées et qui pour cette raison n'avaient jamais été représentés ou étudiés. Cette démarche reflète la volonté d'obtenir l'ensemble des motifs de




6. Relevé de l'état actuel de la peinture sur l'arc sud-est.




7. Restitution du décor sur l'arc sud-est.

Quṣayr ʻAmra avant de passer à l'interprétation des décors.

Le temps pris à relever cm par cm les peintures permettra d'éviter des erreurs d'interprétation. Il a aussi montré comment Musil a pu se tromper. Gêné par les remblais qui recouvraient le décor des parties basses des parois il restitue trois frises en-dessous du panneau central, puis de fausses tentures suspendues. En réalité il y a seulement une frise surmontant des imitations de marbres et d'opus sectile. Par contre Musil a vu des motifs qu'il faut considérer comme perdus ou très peu visibles.

Dans la phase finale de l'étude le dessin de l'état archéologique servira à une proposition de restitution du décor. Chaque paroi sera montrée dans son état actuel et avec sa restitution. Des planches en couleur seront réalisées pour rendre la polychromie des lieux.

L'effort important accordé aux relevés graphiques trouve déjà des applications pratiques. Les relevés se faisant sur des feuilles qui suivent les courbes de l'architecture il est possible de recréer des volumes en donnant aux relevés la courbure d'origine. Il est alors facile de réaliser des maquettes comme celle qui a été exposée au pavillon jordanien de l'Exposition Universelle de Séville.

Pour conclure, nous voudrions nous féliciter de l'esprit de collaboration entre le Service des Antiquités de Jordanie et l'I.F.A.P.O. et préciser le point suivant. La campagne de relevés des peintures de Quṣayr ʻAmra ren-

tre dans une suite de travaux qui remontent au début du siècle. Au terme de trois ans de relevés nous avons vu que nos objectifs, le dessin puis l'étude et la publication des peintures, devaient tenir compte des interventions antérieures. Si le relevé des fresques est la première chose à réaliser, la préservation des monuments historiques[5] en attendant de véritables moyens de restauration devrait être une priorité. Depuis août 1992 le Service des Antiquités de Jordanie a d'ailleurs entrepris des travaux à Quṣayr 'Amra. Un nouveau pavement a été posé dans la salle d'audience et la petite salle à banquette. Mais ces monuments méritent que l'on s'y intéresse au cas par cas, en ouvrant un dossier sur les spécificités de la construction, l'état des lieux, le calendrier et le détail des travaux déjà entrepris. Ce type de dossier permettrait de mieux évaluer les projets à venir et contiendrait des observations régulièrement tenues à jour.

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[5] L'U.N.E.S.C.O a classé en 1984 Quṣayr 'Amra sur la liste du Patrimoine mondial.

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# Preservation of an Archaeological Heritage: 'Ayn Ghazāl

## I. Introduction

The Neolithic site of 'Ayn Ghazāl is located at the eastern edge of 'Ammān, along a major wadi to the southeast of the downtown area. Excavations by a joint Jordanian-American team are on-going at the site since 1982. They uncovered occupation from c. 7250-5000 BC. The excavated remains include plaster floors, stone walls and fire pits in various areas of the site.

In 1989, a consultant team of four faculty members from the University of Jordan (two of whom are the authors of this paper) were commissioned by the American Center of Oriental Research (ACOR) to conduct a study for the preservation and presentation of the site.

The lack of monumental architectural remains and the rather empty condition of the site were from the start a major problem in making the site comprehensible to the general public, and hence "popular". The real challenge in developing such a site was, therefore, the presentation of an important chapter in our history with little visible material evidence to support it.

From the start we understood that an interpretive and imaginative approach was needed, the little that is evident at the site is the archaeological excavation trenches and sections. Such evidence ought to be accentuated. It was also clear from the beginning that an interpretive and educational site museum should be placed somewhere on the site.

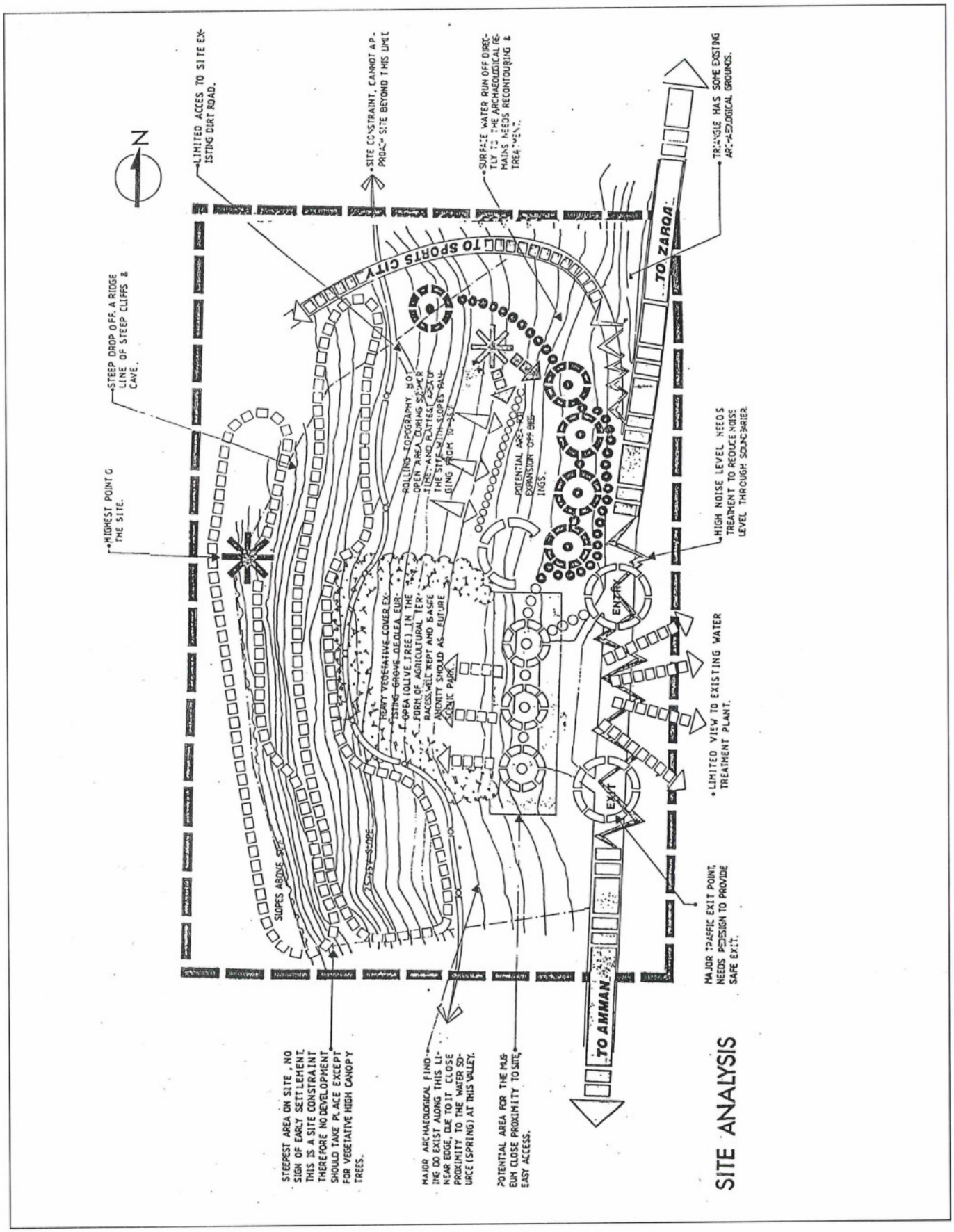
Two vital elements, therefore directed our work:

1. Creating a route capable of tying all the scattered archaeological trenches and providing some order to the movement of visitors.
2. Establishing a "centre" in the form of a site museum that serves as an entry statement to the site and a story teller, as well as housing some of the archaeological finds. The museum acts, therefore, as the major educational and information tool for comprehending the site, in addition to providing it with all the necessary services for visitors.

## II. Site Inventory and Analysis

The site of 'Ayn Ghazāl is located in the Mārkā District of 'Ammān. Its total area amounts to 100 dunums with steep topography. The site is divided into three major areas (FIG. 1):

1. *The Upper Ridge Line*: This is the steepest area of the site with outcropping bedrock. The ridge line is located along the west boundary where no signs of early settlement have yet reported. The ridge line with its surface bedrock is a site constraint.
2. *The Middle Plateau*: This area is divided into two sub areas:
   a) The farmland south of the site which is heavily vegetated with a beautiful grove of *Olea europea* (olive) and the land is terraced in agricultural method. The olive grove is well kept and could act as a site amenity that should be used as the green park.
   b) The rolling plateau north of the site is almost equal in land area to the olive grove but is covered with native grass groundcover. The land gradient ranges from 10-35%. The road and the Sports City bounds the plateau from the north and there is a dirt road that provided limited access to the site.
3. *The Eastern Plateau:* Adjacent to the major highway that links az-Zarqā' with 'Ammān. This is the most critical area in terms of the number of archaeological remains. The following remarks were made in this area:
   a) Archaeological trenches are concentrated in this area due to soil strata that clearly and visibly depict archaeological remains.
   b) There seems to be a linear pattern of archaeological remains that stretches from the parking lot to the major highway intersection in the north.
   c) The major watershed area is located along the eastern edge of this plateau, therefore endangering the remains.
   d) There are high noise levels coming from the major highway that need design solutions.


N
LIMITED ACCES TO SITE EXISTING DIRT ROAD.
SITE CONSTRAINT, CANNOT APPROACH SITE BEYOND THIS LIMIT
SURFACE WATER RUN OFF DIRECTLY TO THE ARCHAEOLOGICAL REMAINS NEEDS RECONTOURING & TREATMENT.
TRIANGLE HAS SOME EXISTING ARCHAEOLOGICAL GROUNDS.
TO SPORTS CITY
TO ZARQA
STEEP DROP OFF. A RIDGE LINE OF STEEP CLIFFS & CAVE.
HIGHEST POINT O THE SITE.
ROLLING TOPOGRAPHY. HOT OPEN AREA CURING SUMMER TIME. AND FLATTEST AREA OF THE SITE WITH SLOPES RANGING FROM 10-35%
POTENTIAL AREA FOR EXPANSION OFF BUILDINGS.
HIGH NOISE LEVEL NEEDS TREATMENT TO REDUCE NOISE LEVEL THROUGH SOUNDBARRIER.
HEAVY VEGETATIVE COVER EXISTING GROVE OF OLEA EUROPEA (OLIVE TREE) IN THE FORM OF AGRICULTURAL TERRACES. WELL KEPT AND BASIC AMENITY SHOULD AS FUTURE SCENIC PARK.
ENTRY
EXIT
LIMITED VIEW TO EXISTING WATER TREATMENT PLANT.
SLOPES ABOVE SITE
MAJOR TRAFFIC EXIT POINT, NEEDS REDESIGN TO PROVIDE SAFE EXIT.
TO AMMAN
STEEPEST AREA ON SITE, NO SIGN OF EARLY SETTLEMENT. THIS IS A SITE CONSTRAINT THEREFORE NO DEVELOPMENT SHOULD TAKE PLACE EXCEPT FOR VEGETATIVE HIGH CANOPY TREES.
MAJOR ARCHAEOLOGICAL FINDING DO EXIST ALONG THIS LINEAR EDGE, DUE TO IT CLOSE PROXIMITY TO THE WATER SOURCE (SPRING) AT THIS VALLEY.
POTENTIAL AREA FOR THE MUSEUM CLOSE PROXIMITY TO SITE, EASY ACCESS.
SITE ANALYSIS

## III. The Concept

3.1 'Ayn Ghazāl is registered as an antiquities site, and therefore should be protected against all potentially damaging development.

The Site Concept was guided by the idea of an interpretive archaeological park rather than a historic site that just needs minor upgrading and preservation. The idea is to develop the area into a place of learning about 'Ayn Ghazāl and its history, where local and foreign visitors will find it an attractive historic site that provides a clear vision of 'Ammān's early settlements (FIG. 2).

The site analysis depicts a strong linear pattern of archaeological remains, thus the prime objective of this scheme is a provision of an interpretive site system accommodating a new pedestrian movement pattern. The movement pattern has to link several excavation areas with each other, and with the museum and parking areas as safely as possible. The movement pattern will help in comprehending the totality of the site and allowing visitors to reach the middle plateau with relative ease and safety. In addition to existing and proposed sidewalks in the proposed site plan, new tracks may be developed when new excavations are conducted (as indicated on the site plan).

3.2 *Entry Points and Parking*

An important decision was taken early in the design to limit all vehicular entry in order to prevent further damage to the fragile remains. The existing parking facing the 'Ammān - az-Zarqā' highway provides a golden opportunity to accommodate both the museum and the vehicle parking, thus reducing damage to site grounds (FIG. 3).

The proposed parking area is located in a manner to serve the museum and the linear remains along the east edge, and to provide service and safe parking for visitors. This area consists of two sub-areas and accommodates a total of 20 cars and three buses. It is situated in a central area and in a location to keep land grading to a minimal.

The slopes between the parking area and the main highway are to be landscaped in a manner to help soften and enhance parking aesthetics and to prevent soil erosion.

Planting design is kept to minimal all over the site with a few exceptions. The entry plaza and slopes are covered with plant materials helpful in reducing noise levels and helpful with aesthetics of this entry statement. Cascading plants are recommended (for aroma and to prevent soil erosion) such as: *Bougainvillea spectabilis* (bougainvillea), *Lonicera japonica* (honey suckle), *Junipers conferta* (Shore Juniper) and a few columnar *Cuppressus* species are used to break the linearity of this slope and to provide vertical scale.

A typical tour starts with a visit to the museum, the visitor would then leave the museum (at a point indicated in plans on the northern edge of the museum building) and start his/her site tour.

This tour takes the visitor to several significant spots and areas where excavation trenches are preserved and made clearly visible. The visitor then will have the choice of going northwest where a lookout plaza is located and where a clear view of the entire site and museum building is possible. Otherwise he/she can return to the parking area where the tour ends.

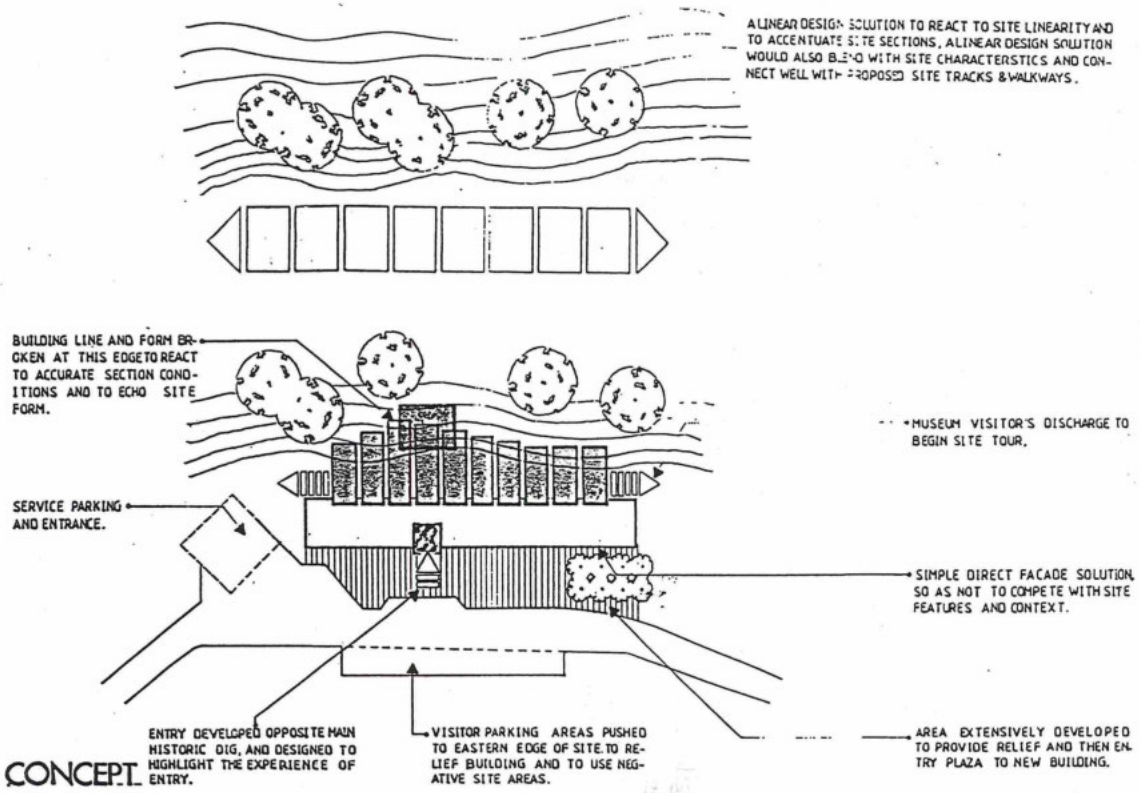
The linearity of the existing archaeological remains along the eastern edge depicts the concept of a linear circulation system, which is clearly reflected in both the museum building and the site grounds. The visitors, aided by a proper directional and information signage system, should be able to decide on the intended destination.

The entry plaza is designed to attract visitors to the museum, this is achieved by the use of native large rocks staggered in a detail hard landscape manner, in combination with a detail planting design. The use of drought resistant native plants of aromatic nature is highly recommended, such as: *Lavandula angustifolia, Rosmarinis oficinalis, Santolina champ.* Various junipers and coniferous plants will be used for their outstanding texture and pleasant smell, as evergreen plants.

The Acres (*Acre negunda*) are used as deciduous high canopy shade trees by the entry plaza. Evergreen high canopy plants are also along the northern boundary to serve as a noise buffer and to reduce wind level: Trees such as: *Gravillia robusta* (Silk Oak), *Pinus pinea*, and *Olea europea* are highly recommended. Few medium sized trees are used to provide seasonal change and to help pedestrians identify the movement pattern, these are: *Lagersreomia indica* (Grape Myrtle) and *Jacaranda mimisifolia.*

3.3 *The Site Museum/Visitors Centre (FIGS. 4-6)*

A. Location: It was felt that the most suitable spot for the museum would be a point roughly halfway along the eastern edge of the existing paved parking area. This position would not only involve the least possible damage on the archaeological site, but also better utilize an already cleared and paved surface. The location will ensure that the building could successfully connect with the site

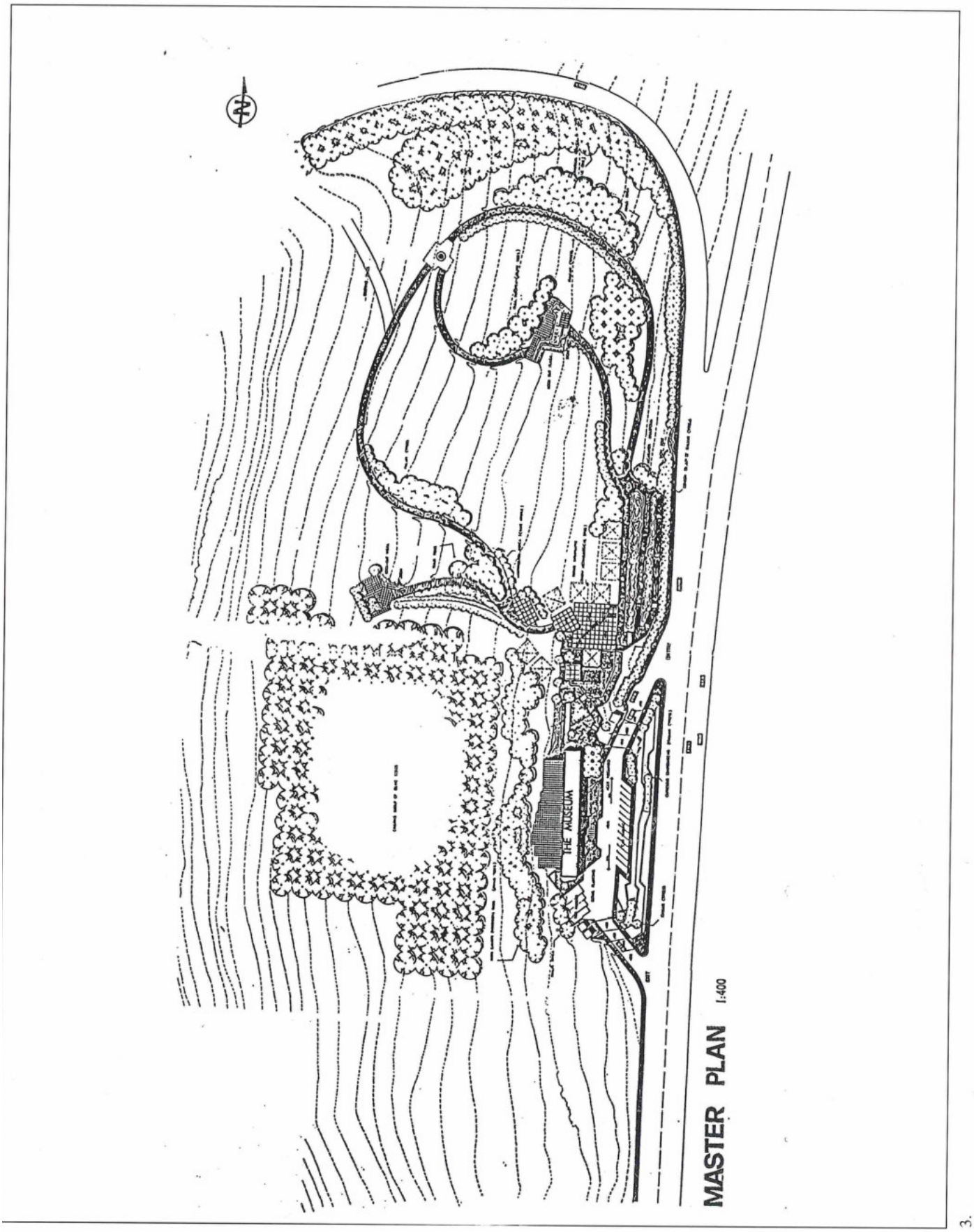



AIN GHAZAL SHOULD BE DECLARED AN "ANTIQUITIES SITE" AND SHOULD BE PROTECTED AGAINST ALL POTENTIALLY DAMAGING DEVELOPMENT.

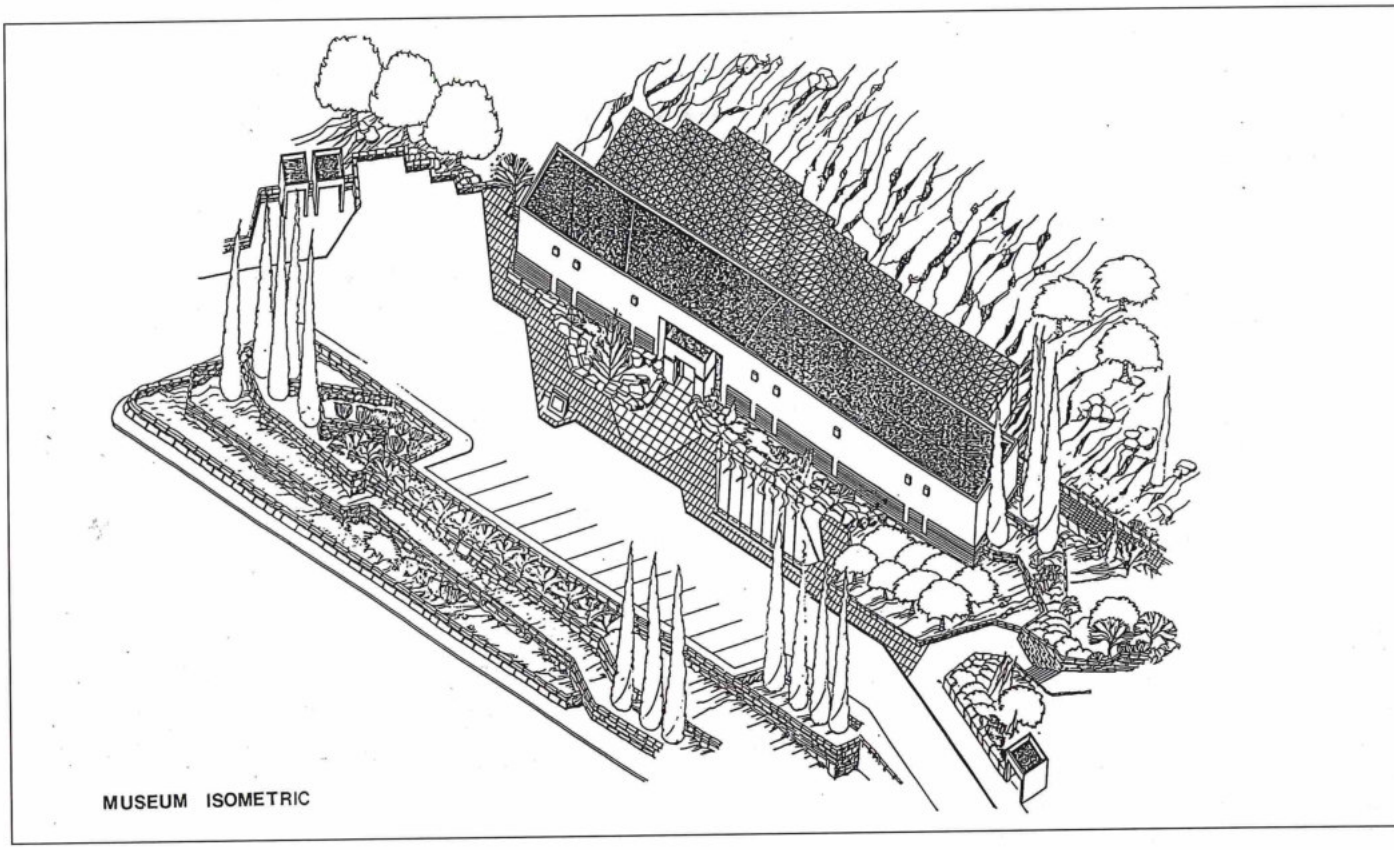
THE SITE ANALYSIS DEPICTS A STRONG LINEAR PATTERN OF ARCHAEOLOGICAL REMAINS, THUS THE PRIME OBJECTIVE OF THIS SCHEME WAS THE PROVISION OF AN "INTERPRETIVE SITE SYSTEM"

A TYPICAL TOUR STARTS WITH A VISIT TO THE MUSEUM, THE VISITOR WOULD THEN LEAVE THE MUSEUM (AT POINT INDICATED IN PLANS ON NORTHERN TIP OF MUSEUM BUILDING) AND START HIS/HER SITE TOUR. THIS TOUR TAKES THE VISITOR TO SEVERAL SIGNIFICANT SPOTS AND AREAS WHERE HISTORIC DIGS ARE PRESERVED AND CLEARLY VISIBLE. THE VISITOR WILL THEN HAVE THE CHOICE TO GO NORTH WEST WHERE A LOOKOUT PLAZA IS LOCATED AND WHERE A CLEAR VIEW TO ENTIRE SITE AND MUSEUM BUILDING IS POSSIBLE, OTHERWSIE HE/SHE CAN RETURN TO PARKING AREA WHERE TOUR ENDS.

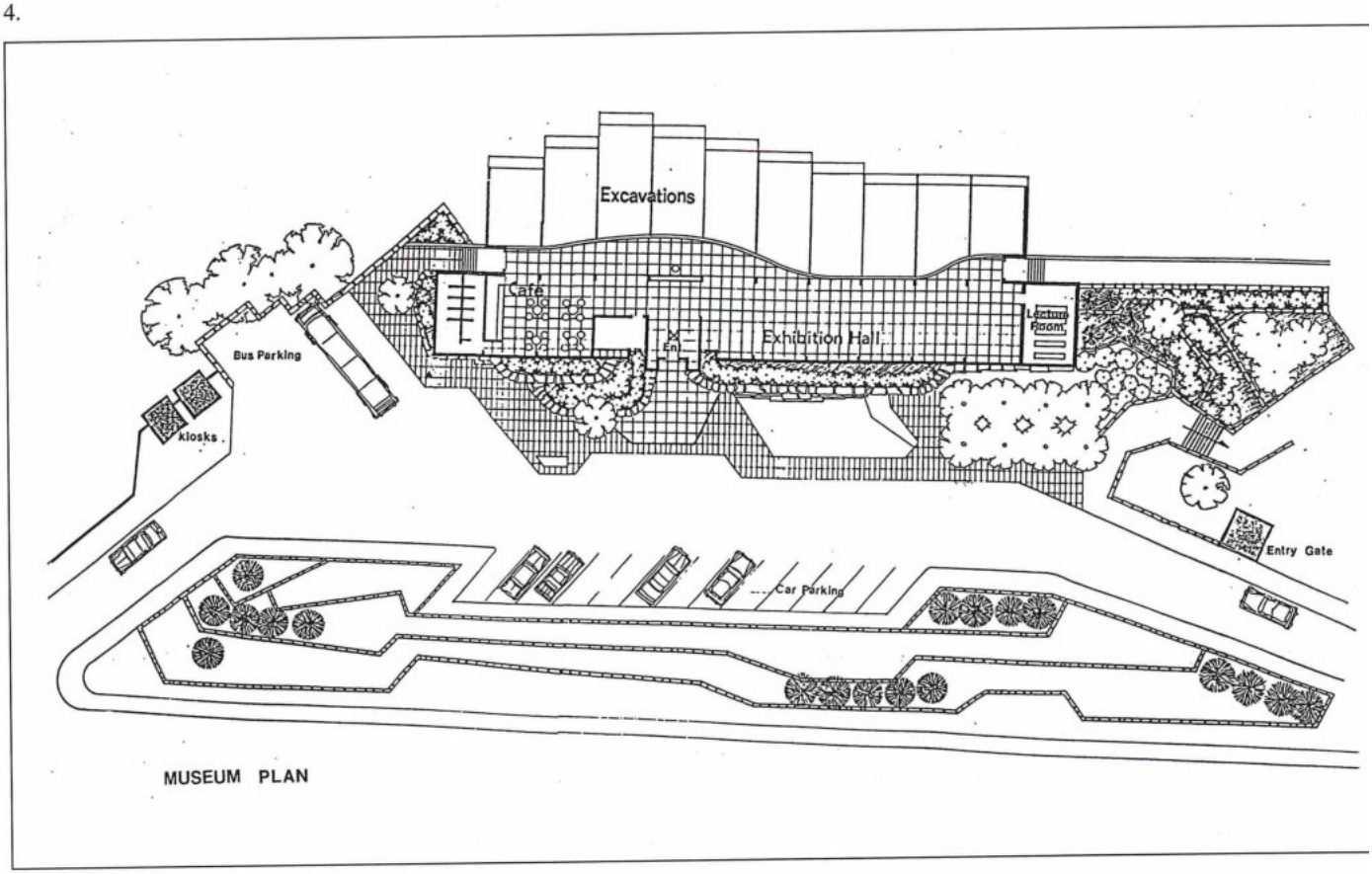
THE LINEARITY OF THE EXISTING ARCHAEOLOGICAL REMAINS ALONG THE EASTERN EDGE DEPICTS THE CONCEPT OF A LINEAR CIRCULATION SYSTEM, WHICH CLEARLY SHOWS ON BOTH THE MUSEUM BUILDING AND THE STIE GROUNDS.




3.


MUSEUM ISOMETRIC

4.


Excavations
Café
Exhibition Hall
Lecture Room
En
Bus Parking
kiosks
Entry Gate
Car Parking
MUSEUM PLAN

5.

layout (walkways, routes, rest areas, etc.), and ensure that a site tour would always start with a museum visit.

B. The Architectural Solution: The architectural solution has to address, and successfully react to a number of vital issues:
   1. The very distinct site characteristics/sections at location chosen.
   2. The wealth of archaeological remains fully or partially visible in site sections at location chosen.
   3. The lack of any visitor facilities on site (for example, information, toilets, café, etc.)
   4. The need for a building that would address all the above and yet be neutral, humble enough in character so as not to compete with the site or over-power its value.

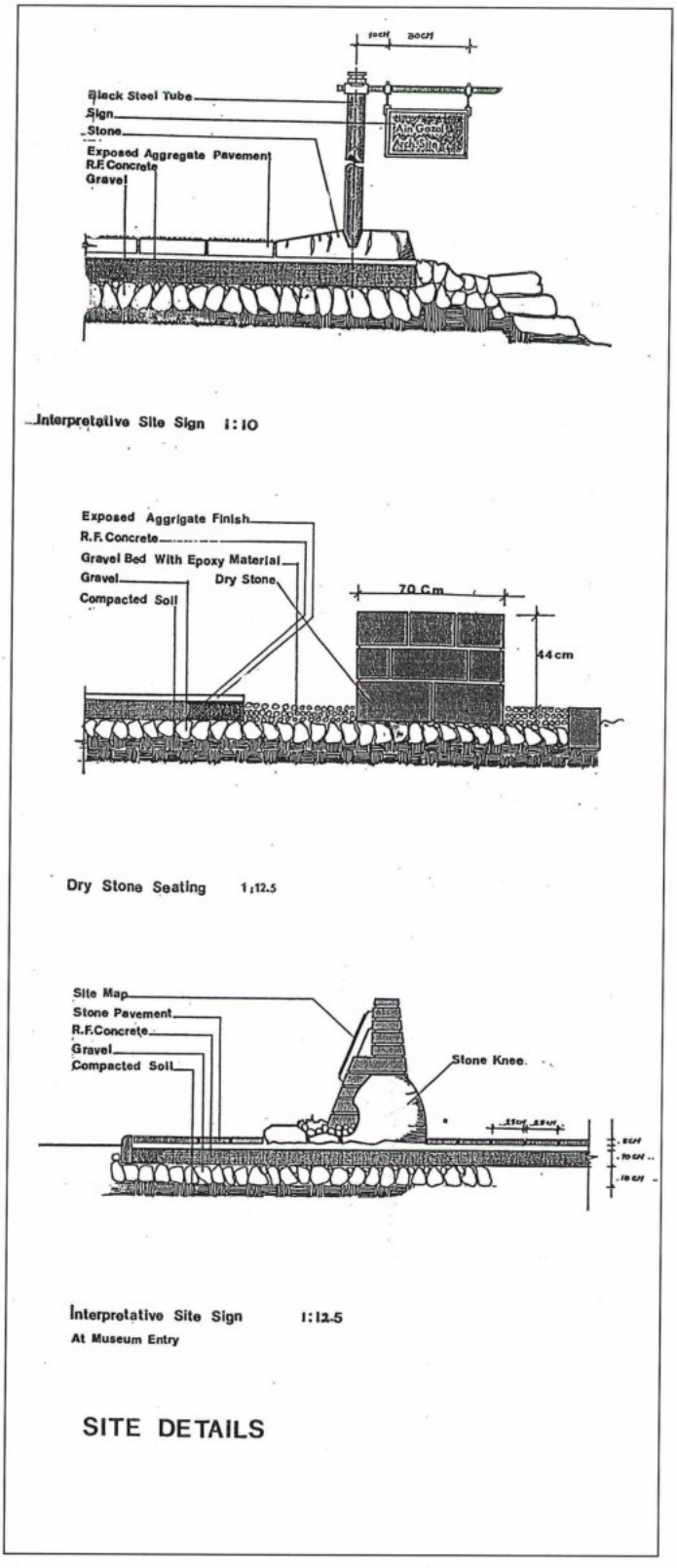
The above issues were addressed through a linear design that sits comfortably along the fairly steep sections along the eastern edge of the existing parking lot (FIGS. 4-6). The building was given two main parallel "bodies": the first houses all proposed exhibition and service facilities, runs parallel to site sections and is clearly modern in appearance to highlight its detachment from the original site history. The second body (also parallel to site sections) connects the first body with the actual site edge through light structures incurring as little damage on the site as possible, allowing natural light to penetrate and highlighting the very particular nature of the sections. Building elevations were designed to convey a neutral, modest effect with an entry clearly yet not loudly visible.

## IV. Conclusions

This work is the second in the series of consulting work aimed at providing concepts for the design development of archaeological sites in 'Ammān. Soon after the University Consulting Team submitted its proposals for the development of the Citadel area in 'Ammān, the same group consisting of Prof. Khair Yassin, Dr. Mohammad Kadhim, Dr. Taleb Rifai and Dr. Kamel Mahadin, was commissioned by the ACOR to conduct a study aimed at providing concepts and plans for the development of 'Ayn Ghazāl.

This work stressed the importance of preserving archaeological and historic sites and the dire need to establish preservation policies for Jordan's archaeological sites and historic remains within rural and urban settings. The 1989 preservation master plan of the Citadel grounds and the work submitted in this paper clearly shows the efforts of the Department of Antiquities, the University of Jordan and the other agencies to preserve these sites.

Such work is clearly a comprehensive collaboration between planners, architects, landscape architects, historians and archaeologists whereby issues related to these disciplines are addressed in the 'Ayn Ghazāl study.

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# Town Planning in the Neolithic — is 'Ayn Ghazāl "Normal?"

The Neolithic period, especially the early aspects of it, represents people's first successful attempt at sedentary village life. Although scholars have long debated semantic differences between terms such as "towns," "villages," or "cities," the fact remains that during the aceramic (pre-pottery) Neolithic, a common settlement type consisted of clusters of substantial buildings that presumably were occupied year round by at least some of the population. In some areas, by the time of the late, or ceramic Neolithic, a substantial decrease in settlement size can be observed. In this paper, I examine, on a broad level, some of the aceramic Neolithic settlements that have recently been investigated in Jordan. These reflect early attempts at town planning that differed substantially from contemporary developments elsewhere in the Near East. Observations in this contribution are restricted to generalizations and are admittedly somewhat speculative. Specific details and exceptions are not addressed here; rather the primary intention is to provoke discussion and suggest possible directions for future research.

One of the first major Neolithic settlements ever excavated was Jericho (Kenyon 1957). This huge *tall* consists of substantial levels of both aceramic and ceramic Neolithic materials. There appears little doubt that the aceramic levels (divided into Pre-Pottery Neolithic A and B phases) represented a substantial settlement covering some 10 acres and including some sort of town wall. Although the significance of Jericho cannot be underestimated, some researchers felt that an unfortunate historic precedence had been established resulting in the perception that all Neolithic settlements were large towns, such as Jericho. Subsequent research over much of the Levant, and the Near East in general, demonstrated, however, that perhaps Jericho was in fact the aberrant settlement type and that a more modest town or village was the norm. This was exemplified by sites such as Bayḍa or Nahal Oren, for example. Additionally, it has been shown that several small, non-architectural aceramic Neolithic sites also were a common site type (Simmons 1980).

The result of this more contemporary research was a better balanced view of settlement types for the Neolithic (e.g. Moore 1985). It was realized that a wide range of site types characterized the Neolithic, and that huge sites such as Jericho were perhaps not "typical" or "normal." This perspective, however, now is in need of serious revision with the recent excavations of major, and large, settlements in Jordan that have occurred over the past 10 or so years.

What this research has done is to demonstrate that even Jericho was small by comparison to some of the Jordanian sites. The Jordanian sites that stand out most are 'Ayn Ghazāl, Basṭa, Wādī Shu'ayb, Abū Ṣuwwān, and Kharaysin, although few have been thoroughly investigated. The intent of this paper is not to discuss these sites individually or in great detail; numerous preliminary reports are available (e.g. Edwards and Thorpe 1986; Gebel *et al.* 1988; Rollefson and Simmons 1988; Simmons *et al.* 1988a; 1988b; 1989). Rather, the implications of the distinct settlement type represented by such sites will be examined. Can they be considered as "normal" Neolithic communities?

First, it is necessary to characterize these large sites. None have been excavated with as much vigor as was Jericho, but a substantial body of well-controlled data does exist. Most information is available from 'Ayn Ghazāl; Basṭa also has been intensively sampled. Much of the following discussion is based on our research at 'Ayn Ghazāl, although the other sites appear to exhibit similar patterns. All of these sites share the following general characteristics:

1. They all are large. 'Ayn Ghazāl, for example, covers over 30 acres, making it three times the size of Neolithic Jericho. Wādī Shu'ayb and Basṭa also exceed Jericho's horizontal dimensions.
2. Although these sites are huge, they are not "*tells*" in the proper sense. They do not appear to contain deposits as thick as Jericho's, although test excavations at Wādī Shu'ayb have demonstrated a depth in excess

of eight meters.

3. The Jordanian sites do not appear to contain early phases of the aceramic Neolithic. That is, there is no Pre-Pottery Neolithic A present, and even the PPNB deposits date from the middle to late range of that phase.
4. Unlike Jericho, these sites all appear to be abandoned after the Neolithic period.
5. Unlike Jericho, massive architectural features do not characterize the Jordanian sites. This does not mean that these were "substandard" or impoverished towns, however; the material culture at the sites is extraordinarily rich. For example, nothing in the Near East has paralleled the exquisite 'Ayn Ghazāl statues.

These are some of the major characteristics of the Jordanian sites. They differ substantially from coastal Levantine sites, as well as from those located further inland. What are some possible explanations to account for these major distinctions in settlement type over a relatively restricted geographic range? The remainder of this paper presents some general observations that may aid in the explanation of this phenomenon.

It would appear that the initial development of most Neolithic communities occurred in the better watered areas of the Levant; that is, the Levantine coastal region up to the natural divide formed by the Jordan River. Although a range of ecological zones were inhabited during the aceramic Neolithic, the majority of principal sites are situated in regions with relatively easy access to water. Even Jericho, which today might be considered in a marginal environment, was located in an oasis area and within relatively easy travelling distance to more hospitable environmental zones, especially to the west. This latter observation is significant, as it allowed access to wider catchment regions within the relatively restricted microenvironments that characterize the Levant.

There is a different pattern in the large Jordanian sites, however. The largest of these, 'Ayn Ghazāl, is located in a somewhat precious ecological setting, despite its proximity to a major river (Wādī az-Zarqā'). In terms of rainfall, for example, 'Ayn Ghazāl is situated at the minimum (250 mm) isoheyt for non-irrigation agriculture. This is a crucial factor for peoples who subsisted to a large degree on domesticated plants. From 'Ayn Ghazāl eastward, severe desert environment is rapidly encountered.

Generally similar patterns can be observed at the other large Neolithic sites in Jordan. The location of each site, of course, obviously allowed access to a selected region of microhabitats, but in the "big picture," they tend to be located in marginal zones. Why is this?

It would appear that the key may be found in both the chronology and later history of these sites. As noted earlier, the Jordanian sites are relatively late developments in the aceramic Neolithic sequence. That is, PPNA sites are not present, nor, usually, are early PPNB manifestations. Sites such as 'Ayn Ghazāl were occupied from c. 7500 BC until 5000 BC; this time span covers the mid and late ranges of the Neolithic Period (both aceramic and ceramic phases). Unlike sites to the west, at least some of the Jordanian sites (e.g. 'Ayn Ghazāl and Wādī Shu'ayb) contain a transitional phase (the "Pre-Pottery Neolithic C") between the aceramic and ceramic Neolithic. To the west, many researchers have posited a chronological hiatus between these two phases (e.g. Perot 1967; 1968; Mellaart 1975: 67). Furthermore, available evidence indicates that after the Neolithic, the Jordanian sites were abandoned (e.g. Simmons *et al.* 1988b: 39; Simmons and Kafafi 1988: 38). This is a different pattern from what can be seen at some of the western sites, including Jericho. Finally, although this may be a function of inadequate survey rather than cultural reality, the smaller "village" types of aceramic Neolithic sites so common in the more western reaches of the Levant are rarer in Jordan.

As an explanatory model, the following interpretative scenario may be considered. If initial Levantine Neolithic development occurred in the western Levant, the natural population increase associated with Neolithic economies could ultimately have depleted local microenvironments and stretched carrying capacities to their maximum. A subsequent adaptive response may have been to expand further east, to the edges of where a "traditional" Neolithic economy could still be practiced. This does not mean the western Levant was abandoned; clearly it was not. But a partial population reshifting could have eased pressure in the western region. The "gap" between aceramic and ceramic Neolithic phases that is seen in the west may have been a reflection of this event, representing a re-adjustment to new economic parameters. Large sites such as 'Ayn Ghazāl may have served as population "magnets" from places like Jericho. The consequence of this was that the former expanded at the expense of the latter, perhaps resulting in temporary abandonments at some of the western sites.

A move to the east was not without difficulties, however. Such regions were more environmentally precarious. One adaptation to this ecological constraint may have been the consolidation of populations into larger villages, or towns, such as 'Ayn Ghazāl or Baṣṭa. This could have allowed for scarce resources to be pooled. Thus it may be that later Neolithic groups were forced into population aggradation. Such a situation would have created social organization pressures previously unfelt, but also may have had the advantage of forcing more cooperation and the development of more efficient exploitation technologies and land use patterns.

The generally marginal Jordanian Plateau and ad-

jacent areas may not have allowed for the luxury of both smaller villages and larger towns spread throughout the region. The Neolithic groups were faced with a decision: either live in smaller communities or congregate into larger towns such as 'Ayn Ghazāl. Either response could have been taken, with perhaps different outcomes. The suggestion here is that the decision was to aggregate into larger settlements.

For arguments' sake, one can assume that this was the case. This could have resulted in the development of large, spread out settlements like 'Ayn Ghazāl. Massive defensive structures would not have been necessary, since previous smaller social groups had by now aggregated into a large unit, thereby lessening the chance of inter-community conflict.

Initially, this pattern was adaptive, although it required a modification of existing subsistence strategy. For example, throughout 'Ayn Ghazāl's aceramic development, there is a remarkably wide range of resources being exploited, both domestic and wild. This could be a reflection of a more efficient economic strategy.

But something happened to change this. By the end of the aceramic Neolithic, there are dramatic economic and, presumably, social shifts. During the Ceramic Neolithic, 'Ayn Ghazāl's economy was much more focused, and principal economic resources were restricted to but a few species, with an emphasis on sheep/goat. Although farming still occurred, a new emphasis on pastoralism developed. As has been detailed elsewhere (e.g. Kohler-Rollefson 1988; 1992; Rollefson and Kohler-Rollefson 1989), what had started out as mutually compatible economic systems of agriculture and animal husbandry turned into a mutually exclusive system. No longer could the already marginal environment, stretched to its limits by large aggregated groups of humans, allow for both strategies to be viable in the same locality. This situation was exacerbated by climatic conditions leading to a steady increase of arid conditions (cf. Davis *et al.* 1990). Thus the previously under-exploited desert areas were now more intensively occupied by Neolithic pastoralists, while the better watered, but still marginal, core area maintained an agricultural focus.

A response was for the evolution of two economic strategies during the Ceramic Neolithic, one based on farming and the other on pastoralism. This is essentially the development of the classic Near Eastern dichotomy of the "desert and the sown." This clearly had substantial impacts on settlement structure. Sites such as 'Ayn Ghazāl continued to be large, but we can see a deterioration in the organizational structure previously extant. Ultimately, as aridity increased and agriculture became even more difficult, the pastoralists may have had the adaptive edge. This resulted in the eventual abandonment of the large Neolithic towns. Subsequent cultural evolution during the Chalcolithic and later periods witnessed a new type of adaption and settlement type.

The scenario described above is offered as one explanatory model to account for the presence and ultimate demise of the large Jordanian Neolithic towns. It is fully realized that this is a simplistic model that requires substantial refinement to either verify or refute it. It does, however, offer one explanation to account for observed patterns in the archaeological record. Thus the question "is 'Ayn Ghazāl normal?" can be answered in the affirmative, in that it represented an adaptation that was successful for over 2000 years. Phenomena such as 'Ayn Ghazāl were one adaptive response to destabilizing conditions brought about by both human mismanagement and climatic deterioration.

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# Building on Marl: The Case of Bāb adh-Dhrā‘

Environmental archaeology as practiced today assumes that the physiographic history of sites has a necessary role to play in explaining how sites were used by their human occupants. Whether research is focused on village or urban settlement, a starting point is the recognition that the natural features of sites had to be dealt with if settlement was to be successful. Natural vegetation and stony material had to be brought under control, trees had to be cut, and decisions had to be made about what parts of the site might be included within the perimeter of defense structures, if any. Subsequently, the site might continue to be affected by changes in the natural conditions, and this too would affect the settlement history.

As far as the Early Bronze Age urban sites of Palestine are concerned, much of what went into their planning remains unknown. What we do know is that the urban sites of this period were far from being haphazard constructions, and that they were designed with some care. In fact, it is possible to infer how Early Bronze Age site planning took place under certain conditions (Amiran 1970: 90-95). We also possess evidence to suggest how technicians of this period managed some of the practical aspects of construction in the face of particular challenges.

Regarding the natural features of a site, Rosen's study of the geoarchaeology of settlements has shown how human activity and the physiography interacted with each other. The natural conditions affecting settlement would have included the site's condition at the time settlement first began. But it would also have entailed environmental changes during the duration of settlement. Rosen (1986: 57) mentions groundwater fluctuation, soil development, erosional episodes, stream alluviation, and colluviation, all of which could shift over time, causing significant changes for those living at a site.

Since we are concerned here with the Early Bronze Age, a look at several excavated Early Bronze Age urban sites in different regions will illustrate the ways Early Bronze builders accommodated the architecture of their settlements to the conditions of the sites themselves. We shall then turn to a unique site in regard to a demanding physiography, that of Bāb adh-Dhrā‘.

## Sites with a Stable Natural Base

In the hilly areas west of the Jordan River, where towns or cities like ‘Aī, Megiddo, or Ṭa‘annak were established, Early Bronze urban builders adapted their constructions to the natural features of this mountainous region. Although there were difficulties in building settlements here, an advantage as far as construction was concerned was the solid base of Upper Cretaceous limestone bedrock (Orni and Efrat 1976: 55). Pristine topsoil covered the bedrock unless removed by erosion, whereas cultural sediments from previous settlement might also have built up, contributing to the formation of the prominent *tulūl* of ancient Palestine (Rosen 1986: 9-24; Butzer 1982: 77-97). But it was the consolidated limestone bedrock of the hill country that provided the stable natural footing for laying up the great defensive walls known at Early Bronze sites, as well as stone walls for many of the interior structures.

The Early Bronze Age constructions at Tall Ṭa‘annak illustrate the influence of these natural conditions on construction. The earliest city wall of the EB II was laid directly on the solid bedrock (FIG. 1; see Lapp 1964: 10; 1967: 5, FIG. 2), the builders themselves having evidently cleared the soils above the bedrock. This earlier wall was over 4 m wide. Above this early wall was a later phase EB II or early EB III wall, a little less than 4 m in width, composed of interior and exterior faces with a massive core of rubble between. No clear information was obtained for the superstructure of the later of the two defensive walls (Lapp 1967: 7), nor for that of the earlier wall. Although bricks found on the floor of a tower associated with the later wall indicated a superstructure of mudbrick (Lapp 1964: 10; 1967: 7), the stratigraphy related to the fortifications suggested that the Early Bronze defensive walls at Ṭa‘annak were made of stone all the way to the top. Many of the other structures within the Early Bronze Age city were also made of stone, although




1. Early Bronze Age city wall at Tall Ṭa'annak, built directly on the bedrock of the site.

mudbrick was sometimes used in the upper sections of walls of domestic buildings.

Early Bronze Age 'Aī was another site of this type in the limestone bedrock hill country. The first city wall, Wall C, was constructed near bedrock, and even the huts of the preceding village at 'Aī were either removed or cut into as the Wall C builders placed the foundation for their first defensive system as close to the bedrock base as possible (Callaway 1980: 20). Wall B used much of Wall C in its rebuilding, while Wall A represented a new construction above the former. Information was apparently not available for the superstructure of the defensive systems at 'Aī, but stone to the top would have been possible, given the solid bedrock base on which the walls were built.

A different example by reason of its location in an-Naqab is the Early Bronze Age city of Arād, built on a hilly area of Eocene chalk (Amiran 1978: 2). Only a small amount of Late Chalcolithic occupation preceded the use of this site in the Early Bronze Age, so that the builders of the latter period were able to lay the wall foundations close to the natural base of the site, with only a minimum of cultural debris below. Amiran's opinion was that the wall was of stone to its full height, since there was no evidence of the use of brick (Amiran 1978: 11-12).

These examples show that at many sites the Early Bronze technicians were able to assume a solid footing for their stone construction, given the natural conditions of the bedrock. They were aware of these advantages, and it is clear that such conditions simplified their work, because the locations where they built could be termed stable locations. That is, they were locations with a solid core of either hard bedrock or some sort of naturally compacted sterile conglomerate that would provide the best kind of support for heavy wall and building construction made of stone.

**Sites with an Unstable Natural Base**

The Jordan Valley and the southeastern Dead Sea Plain provided very different conditions from those of the hill country. In this region any type of true bedrock was so far below the surface that it could play no role as a stabilizing factor for construction. Rather, the natural soils characterizing much of the Jordan Valley generally, including those prime locations that were chosen for settlement, were laminated marls, gravels, sands, or conglomerate, all of which were laid down by the Pleistocene Lake Lisan between the Sea of Galilee and the Dead Sea (Orni and Efrat 1976: 91-98). These lacustrine deposits, having dried out after the earlier lake's retreat, offered conditions wholly different and certainly much less secure than those found in the hill country

At Jericho the effect of the relatively unstable topography on the settlement can be seen in a number of ways. The original site consisted of an alluvial tongue encroaching on the sterile lake deposits (Vita-Finzi 1978: 56). The town walls of all periods at Jericho were built of mudbrick, sometimes placed on a thin foundation of one or two courses of stone (Kenyon 1960a: 105-106). While it is true, as Kenyon noted (1960a: 105), that clay for unbaked mudbrick was the natural building material available in the area, the availability of this material alone does not seem to account for the extensive use of brick rather than stone, particularly in the fortifications. For one thing, stone is readily available as well in nearby wadis. But more importantly, the extensive use of mudbrick at this site must have been dictated by the potential problems that heavy stone walls would have created at a site composed of the kind of weak sedimentary base found at Jericho.

Other excavated sites in the Jordan Valley also show that brick was the main material used. Stone might some-

times be found in the foundations but normally not all the way to the tops of walls. Althoug the final publication of excavations at Tall as-Sa'īdiyyah contained little detailed geological information about the site (Pritchard 1985: 1), the natural makeup apparently consisted of conglomerate gravel, sand, and marl (Quennell 1952), which again would have made it an unstable site for heavy stone construction. The data from the Early Bronze levels have not yet been published, but it is interesting that the later builders of the Iron II city wall of Stratum VIIe employed a mudbrick superstructure on a stone foundation (Pritchard 1985: 4-5). Tall Dayr 'Allā was another Jordan Valley site whose constructions were largely of mudbrick (Franken 1976: 7).

**The Unstable Site of Bāb adh-Dhrā'**

At this point we may turn to Bāb adh-Dhrā' as a site representing an extreme example of instability. In fact, it was the physiography of Bāb adh-Dhrā', along with the fact that it was clearly not a *tall*, that led the early investigators to conclude that the remnants of wall ringing the site must have defined an enclosure rather than the defense system of an Early Bronze Age city (Schaub and Rast 1989: 17).

What the Early Bronze Age occupants found in the natural conditions of Bāb adh-Dhrā' was a series of marl knolls overlooking the Lisān plain to the west. Located on the south edge of Wādī al-Karak, several of these marl hillocks were sufficiently interconnected in an elliptical shape to make possible the construction of a continuous wall around their edge, and indeed this occurred as early as EB II when the first wall was built, to be succeeded by a later one in EB III.

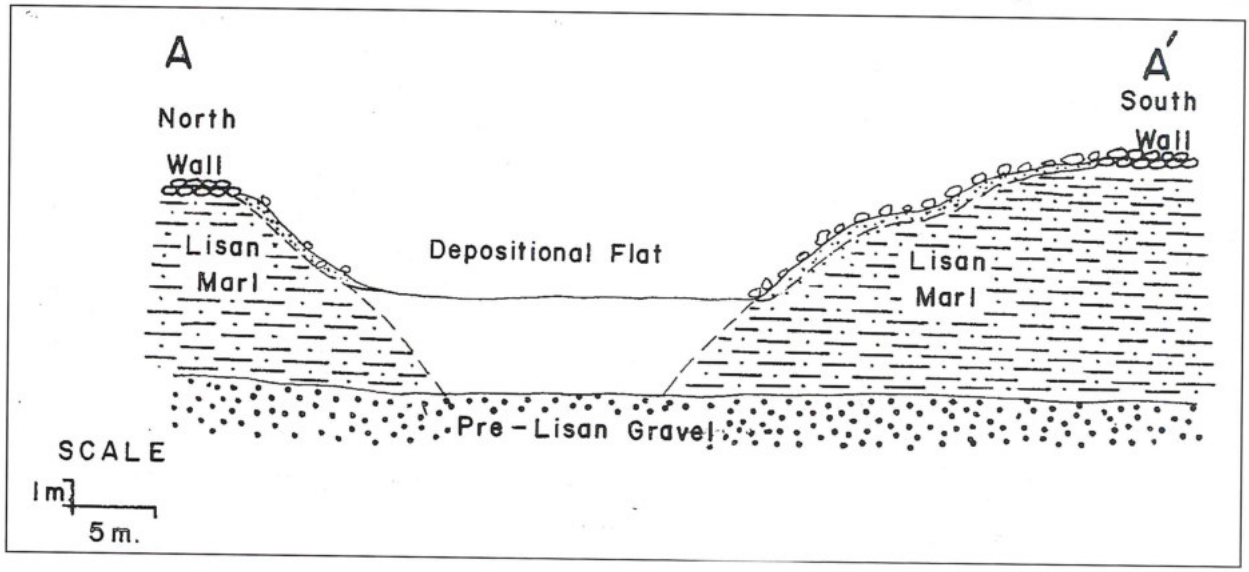
The instability of the natural site, however, was accentuated by the fact that the upper sediments of the site were of Lisan marl, from the highest surface elevation of -208 m to the base of the marl deposit at approximately -221 m (FIG. 2; see Donahue 1980: 46-49, FIGS. 19, 21-23; 1981: 144-146, and FIGS. 7-8). That is, the site's physiography most affecting the settlers was the 13 m of marl in its upper part. Capping the marl at some points was a layer of gravel that also provided difficulties for construction in some cases, as did the occasional troughs of channel gravel found within the marl deposits.

For the earliest Early Bronze Age occupants, those of EB IA who used the location as a burial site, this pervasive marl proved ideal for their traditional mode of interment, which consisted of digging underground tombs of the shaft and chamber type. Since the Lisan marls are impervious to water, the tombs were usually found to be well preserved wherever the blocking stones in the doorways had remained in position.

But it was also these same qualities of the marl that made the use of the site a difficult one for the subsequent EB IB village, and above all for the urban expansion that occurred during EB II and III. The poor condition of the EB IB village structures suggests that erosion of the soft marl was an ongoing problem for the EB IB occupants (Donahue 1980: 49). In addition, the marl was uncomfortable for year-round living since it was quickly pulverized when trampled on during dry seasons, or it became a quagmire of mud when walked on during wet seasons.

Only with ingenuity, therefore, could an urban site have sprung up on these less-than-ideal features. Thus Bāb adh-Dhrā' has presented an unusual opportunity to study the manner in which Early Bronze Age builders were able to adapt to a site that lacked the more secure properties that technicians in the hill country could depend upon at their sites. Nonetheless, a sizable number of inhabitants (estimated at approximately a thousand people at any one time during EB III) found the site inviting enough to try it.

There were compensations for these urban builders,




2. Geologic cross-section showing the depth of Lisan marl at Bāb adh-Dhrā' at the western end of the site (reproduced from Donahue 1980: 48, FIG. 22).

however. Bāb adh-Dhrā' had the advantage of a good water supply, probably by means of the same perennial spring that discharges into Wādī al-Karak at the base of the site today. The plain around Bāb adh-Dhrā' could be counted on for cultivation if water for irrigation could be brought to it. A fair stand of trees was also available for use as timber, as the evidence of felled wood found in the recent excavations has shown. The one thing that would have dissuaded the group from building a city there would have been the insecure make-up of the mostly marl and gravel site, and it was to this feature that the engineers of Bāb adh-Dhrā' brought some resourceful solutions.

**Engineering Techniques Employed at Bāb adh-Dhrā'**

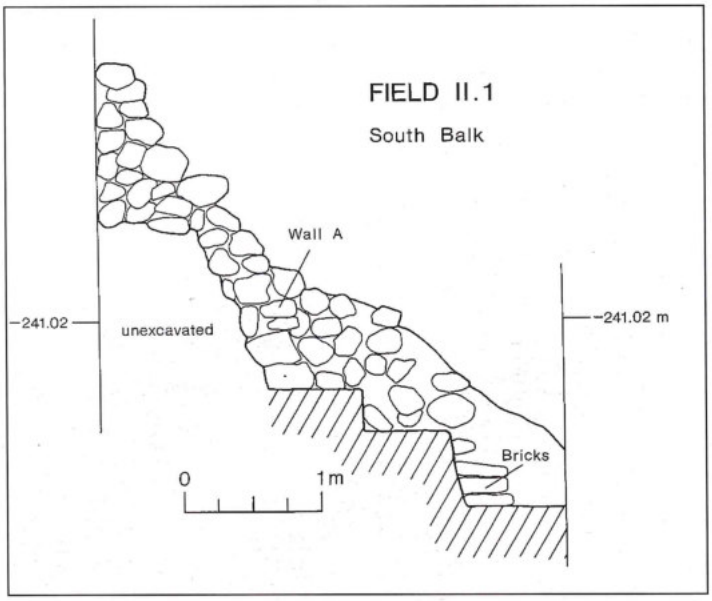
In what follows the techniques employed by the Early Bronze builders to control the recalcitrant natural marl will be discussed in relation to defenses, retaining systems, and pavements.

*Defenses.* First of all, it has to be said that the abundance of stone in the adjacent Wādī al-Karak must have been enticing to the Early Bronze Age builders, for it would have been considerably easier for workers to haul stones a short distance from the wadi than to have to gather clay and go through the tedious process of making bricks. Of course, the prevalent Lisan marl was also available for making bricks, and evidence has appeared that during the village phase of EB IB, many bricks were indeed made from this marl. But analysis of bricks of the subsequent periods of EB II and III suggests that clay beds in the wadi were sought out, so that a good bit of effort had to be put into obtaining the clay from these more distant sources, in addition to the actual manufacture of the bricks. In any case, the brick-making industry for construction flourished at Bāb adh-Dhrā' during the entire Early Bronze Age.

Why, then, did the Early Bronze Age occupants resort to such an extensive use of mudbrick at the site? The explanation that we propose here is that the widespread use of brick was a technical solution to the difficult features of the marl make-up of the site. Simply put, bricks were not as heavy as stone, and thus the effect of the weight of mudbricks laid on or into the marl would be less serious than that of many courses of stone laid upon such an unstable base.

The first city wall at Bāb adh-Dhrā' (Wall B), built during EB II, was made entirely of mudbrick from the foundation to the top. Subsequently in EB III the city wall (Wall A) had a 7 m wide stone foundation, but what is notable is that this stone foundation was only several courses high, sometimes even only one or two, along the higher elevations of the site, whereas in the two depressed areas at the west and east ends the stone foundation had to be built up to at least ten courses to even out with the natural ridge. This indicates that the builders were really working with a plan for a mudbrick city wall in EB III, and that the stone foundation served the purpose of providing a solid platform for the mudbrick wall. Geological observation showed that the stone base of the EB III wall along the entire south side made use of tabular stones bonded with sand and perhaps mortar into the natural marl below (Donahue 1981: 146-148 and FIG. 11). That the superstructure was of mudbrick was evident from the heaps of desiccated brick remains found to the sides of the city wall at all points excavated (Donahue 1985: 136-137).

When the Early Bronze Age wall builders dealt with the east side of the site, they found that the marl hillock here posed a difficult problem. A wide, flat ridge on which to lay the base of the wall did not exist at this end as it did on the south. Rather the marl sloped sharply inward toward the interior of the city, so that it was impossible to build a level stone foundation as on the south end. To overcome this problem the builders employed a notching technique. That is, they cut a series of steps into the slope of the marl in order to mortar in place the foundation stones on this slope (FIG. 3). This technique was found along an entire section of the eastern wall on the interior. With these boulders bonded into the slope, it was possible to build up the stone foundation to the normal level, adding once more the mudbrick superstructure, a resourceful solution to what could have been a serious deterrent to the construction of the city wall on this side. Needless to say, the technique was not foolproof, and it probably was not long before the wall here began to experience severe deterioration.




3. Section drawing through Field II at Bāb adh-Dhrā' showing the stepping cut into marl to lay the stone foundation of Wall A along the slope.

*Retaining Systems.* Over shorter or longer periods of time serious erosional problems occurred in all parts of the city, including the interior, due to the brittle character of the marl. The city builders were aware of this as an inevitable contingency. Along one area on the interior of the city they placed a retaining wall of mudbrick along the entire slope. This allowed for domestic structures to be built on areas that would otherwise have been threatened with serious erosion. That the system of retaining walls of this type was effective was evident from a mudbrick building whose walls and floors were well preserved, discovered immediately behind the retaining wall. At the same time, the excavations showed that one entire section of this retaining wall had at some point slipped into a horizontal position away from the slope, with the result that structures behind it were either poorly preserved or entirely eroded.

In an area on the west end of the site the Early Bronze builders used supporting walls of mudbrick along the slopes in order to create more stable possibilities for structures built in this area (FIG. 4). Part of the area was already a considerable incline at the time of settlement during EB III, and it was evident that the supporting walls had a significant function in making the erosion-prone slope livable by stabilizing it. The supporting walls were bonded into the slope behind, and crosswalls of buildings could then be tied into them. This procedure was extremely valuable, and the small section excavated in Field XIX suggests that the same system was used all along this area of the site.

*Pavements.* The most challenging aspect of occupying the site of Bāb adh-Dhrā', however, would have been simply having to live on the extremely chalky marl and occasional pockets of loose gravel. Even though the Early Bronze occupants may have been more patient than moderns with this unpleasant feature, their builders clearly took pains to do something about it.



4. Mudbrick buttressing used along the slopes of Field XIX at Bāb adh-Dhrā'.

The best preserved place where their construction of an expansive brick pavement could be traced was in the court around the sanctuary in Field XII. In connection with the excavations around the sanctuary it was found that the entire courtyard was paved, with horizontal lines of bricks appearing regularly in all areas of the court excavated. This was the only place where such pavement was found, and it may be that it was the special character of the sanctuary area that produced such a pavement.

**Summary**

What is notable at Bāb adh-Dhrā' is the great amount of mudbrick that was employed. In two cases stone foundations were found — in the city wall of EB III, and in the sanctuaries of EB II and III. This would indicate that stone foundations were used for special structures, and from surface remains it is evident that there were other important buildings built in this manner. Stone was also used for the exterior faces of the two towers at the northeast end of the site, although alternating courses of brick and wooden beams were used to create the solid interiors of the towers. The majority of buildings, however, at least those that belonged to the ordinary population, were of mudbrick from the foundations upward, and this indicates that brick was preferred because it worked better than stone on this marl site.

Corresponding to these building techniques in the town were those used in the construction of the charnel houses of EB II and III. The usual procedure at other Early Bronze Age sites was that burials were made in natural caves, or in artificial chambers such as those cut into the soft limestone *ḥuwwār* at Jericho (Kenyon 1960b: 1-2). The Early Bronze II and III tomb builders at Bāb adh-Dhrā' rose to the challenge of a site with no caves, and one where room in the marl for further underground tombs had been depleted by the previous EB IA and IB tomb diggers. Thus they adapted the idea of a building in which to house their dead, basing the idea on the rectangular houses they were accustomed to in real life.

As public buildings, the charnel houses were often quite elaborate. They were constructed of custom-made bricks produced apparently by the same brick-makers who supplied these materials for the city construction projects. Slabs and lintels that framed the doorways were skilfully prepared. Above all, these mortuary buildings show once again that it was in mudbrick that the Early Bronze people in the Southeastern Plain of the Dead Sea excelled. And, once again, their attention to the craft of brick-making and brick-laying seems to have been dictated to a large degree by the requirements of this site.

As a final note, it is instructive to compare the nearby smaller site of Numayra with Bāb adh-Dhrā'. The best

explanation for the founding of Numayra during the EB III is that this new town was colonized by settlers who moved from Bāb adh-Dhrā'. It is interesting that even though Numayra has an abundance of natural stone material available, and that the natural site consists of compact gravel and sand at least 50 m deep to the base of the adjacent wadi (Donahue 1985: 137-139), the Numayra builders made bricks from their local clay with which to lay up the superstructures of many of their buildings. If any site would have been conducive to using stone up to the tops of buildings, Numayra would certainly have been it. Thus we would have to assume that the builders at Numayra followed the tradition of mudbrick construction learned at Bāb adh-Dhrā'. In fact, we might conclude that the Numayra builders were greater traditionalists than the technicians at Bāb adh-Dhrā', and that it was the dexterity of the Bāb adh-Dhrā' technicians in relating to their difficult marl site that facilitated urban occupation there for more than half a millennium.

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# EB IV Tombs at Khirbat Khanāzīr: Types, Construction, and Relation to other EB IV Tombs in Syria-Palestine

## Introduction

The excavation of the EB IV cemetery at Khirbat Khanāzīr, located in the Southern Ghawr of Jordan to the southeast of the Dead Sea, took place, under the directorship of W. E. Rast and R. Thomas Schaub, from December 1989 - January 1990. The writer was field director of Fields B and E. He also participated in work undertaken in Fields C and D. The present paper's main objective is the description of the four different, EB IV tomb types excavated at Khirbat Khanāzīr, the manner of their construction, and their relation to other EB IV tomb types in Syria-Palestine.

We are dating these tombs to the EB IV period, without further specification, on the basis of their associated pottery. We found no other pottery during the excavations of Khirbat Khanāzīr. (For a general description of this pottery see MacDonald *et al.* 1992: 200-201, PL. 14).

For contextual purposes we will first provide a general description of the EB IV tomb types of Syria-Palestine.

## EB IV Tomb Types of Syria-Palestine

Dever (1987) and Palumbo (1991) list four and three tomb types respectively for the EB IV Period of Syria-Palestine. The former lists the four types as the built-chamber tomb, dolmens, cairns or tumuli, and, by far the most common, the shaft tomb (1987: 9-11). The latter, on the other hand, dealing specifically with the Southern Levant, lists the EB IV tomb types as dolmens, cairns, and shaft tombs (1991: 78, 125). The difference lies in the fact that the built-chamber tomb, which Dever lists, appears to be confined to Upper Syria (Dever 1987: 9).

Dever describes the built-chamber tomb as "a large, rectangular subterranean chamber, lined and roofed with stones slabs, usually accessible by a square shaft" (1987: 9; see also 10, FIG. 1a). He describes the dolmens as "above-ground chamber tombs, either elliptical or rectangular, constructed of megalithic uprights and roof slabs" (1987: 9; see also 10, FIG. 1b). The "cairns or tumuli are similar to the dolmens, though much smaller, consisting of a slab-built, rectangular chamber above ground level, mounded over by a heap of smaller stones" (Dever 1987: 9; see also 10, FIG. 1c). He describes the shaft tomb, by far the most common EB IV tomb type, as "consisting of a rock-cut vertical shaft, normally leading through a small stone blocked doorway to a single lateral chamber but occasionally to two or four chambers" (1987: 11; see also 10, FIGS. 1d and 1e).

Kenyon classified all the tombs of the Intermediate Early Bronze-Middle Bronze Period (our EB IV) which she excavated at Jericho in her 1952-54 and 1955-58 seasons into seven categories (1960: 180-181; 1965: 34). For the most part, however, the great majority of these seven tomb types are the so-called shaft tombs which consist of a shaft which leads to a chamber in which the dead person is interred. The passage between the shaft and the chamber is usually sealed by what is called a blocking-stone.

In the northern cemetery of Baysān, the standard entry device of all the EB IV tomb groups is a squarish or rather a rectangular shaft (Oren 1973a: 19). The shaft is connected to the chamber by a long and narrow passage which Oren refers to as a *dromos*. The only distinction between tomb types A (single-chambered shaft tombs), B (double-chambered shaft tombs), and C (multi-chambered shaft tombs) is based on the number of burial chambers (Oren 1973a: 19-25; 1973b: 22, FIG. 1).

At Ṭiwāl ash-Sharqī, with the exception of two of the tombs, namely, NE8 and SE14, which should more correctly be described as "graves", "the tombs were of the shaft tomb variety, a vertical shaft giving access to a chamber by way of a small entranceway" (Tubb 1990: 10). However, Tubb cautions that this nomenclature "can only be applied in the broadest sense, for many of the tombs were found to have been cut into existing hill slopes, and in such cases the vertical element of the shaft was reduced to that of a 'semi-shaft'" (Tubb 1990: 10). However, because the number of the tombs which Tubb excavated at the site represents such a small proportion

of the potential total in the cemetery, he makes no attempt to construct a typology of tomb architecture (1990: 11).

Lapp excavated two EB IV tombs, namely, A 52 and A 54, at Bāb adh-Dhrā', north of Khirbat Khanāzīr (Schaub 1973; Schaub and Rast 1989: 473-483; for A 54 see p. 482, FIG. 277). Both are of the shaft tomb variety.

**The EB IV Tombs Types at Khirbat Khanāzīr**

The EB IV tombs of Khirbat Khanāzīr are much more diverse than the categories of shaft tombs which Kenyon excavated at Jericho during the 1960's. Moreover, they do not fit neatly into the groupings of Dever and Palumbo. For example, there appears to be three different tomb types in Field B alone. Besides this, there is another EB IV tomb type in Field E. We will examine each of these four tomb types.

*Tomb Type I*

This first tomb type consists of what appears to be a rectangular, stone structure having well-constructed and well-defined exterior walls (FIG. 1). However, there is, within the structure and below ground level, a shaft and a tomb chamber. The entire structure is made of unhewn stone which is readily available immediately to the east. We excavated four, namely, A.1; B.1; C.1; and D.1, of this tomb type. B.1 is typical of this group. It is described here because the author was involved in its excavation.

Externally, B.1 measures 9.83 m (E-W) on the north side; 9.00 m (E-W) on the south side; 4.38 m (N-S) at the west end; and 3.88 m (N-S) at the east end (FIG. 1). Parts of the external walls are fallen. However, the northeast corner, the best preserved of the four, stands c. 1 m high on the exterior. While the exterior walls of the structure are smooth, the builders made no attempt to construct interior walls of the same character since it appears that the rectangular structure served only to demarcate the place of the burial. Interiorly, the structure consists of piles of stone covering a chamber and a shaft which are below ground level. Both the chamber and the shaft are covered by flagstones/capstones. Within the structure, at ground level, the chamber and shaft combined measure 3.38 m (E-W) x 2.25 m (N-S) (FIG. 1, section A-A). Internally, at floor level, the chamber measures 1.55 m (E-W) while the shaft measures c. 0.35 m (E-W) wide. The chamber is c. 1.10 m deep. The entrance or passageway between the shaft and the chamber measures 0.50-0.35 m wide and is c. 1.00 m deep. Thus, internally, B.1 consists of a chamber on the west and a shaft on the east. They are joined by a passageway (FIG. 1, section B-B). The internal walls, especially the north one, of the chamber curve inward at the top. This construction feature probably made it easier to cover them over with flagstones/capstones at ground level. At the time of our work the chamber was filled with windblown soil and some stones as well as burials and associated artifacts. However, the shaft segment of the tomb was blocked with large stones.

*Tomb Type II*

B.2, B.3, and B.5 are also EB IV shaft and chamber tombs which are in ways similar to, but also different from, Tomb Type I. A good example of Tomb Type II is B.3. It consists, at ground level, of two segments, both semicircles of stones (FIG. 2). At this level, the tomb, including stones which form the rim, measures c. 3.45 m (N-S) x 1.90 m (E-W). This can be broken down into the shaft, measuring c. 1.15 m (N-S) x 1.75 m (E-W), and the chamber, measuring c. 2.00 m (N-S) x 1.90 m (E-W), which even at ground level are separated by a line of stones measuring c. 0.30 m wide. Within the tomb, at floor level, the shaft and chamber measure c. 0.55 m and c. 1.65 m (N-S) respectively (FIG. 2, section A-A). There is still, at this level, the 0.30 m wall separating the two sections of the tomb. The passageway between the shaft and the tomb measures 0.60-0.65 m wide, is 0.70 m high, and, as mentioned previously, is 0.30 m thick (FIG. 2, section B-B). The depth of the shaft is c. 1.33 m while that of the chamber is c. 1.53 meters.

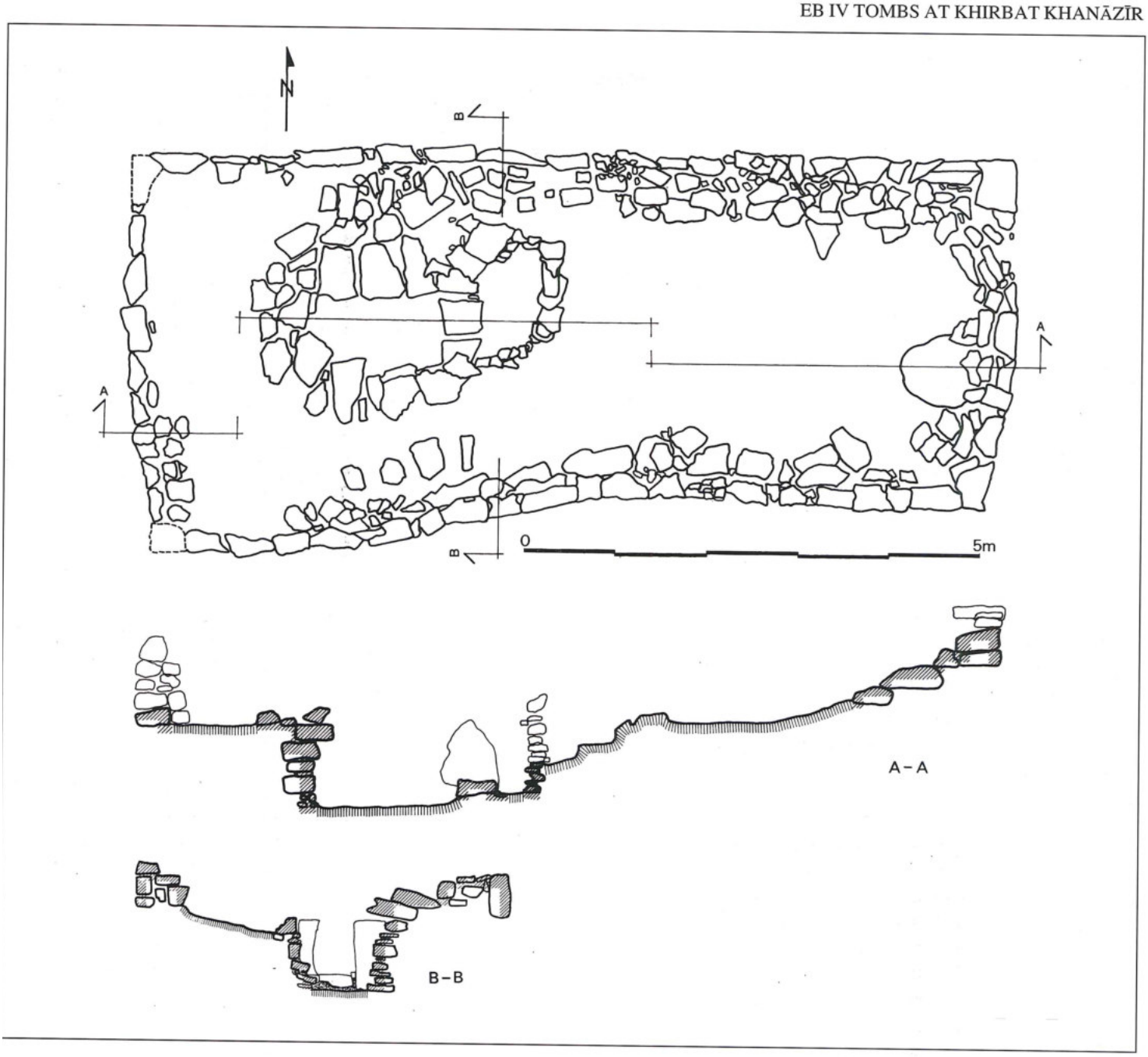
*Tomb Type III*

Tomb Type III, represented by E.1 (FIG. 3), consists of a pile of stone, in the shape of a rectangle, not unlike that of Tomb Type I. Exteriorly, the structure measures c. 4.50 m (N-S) x 2.50 m (E-W) while the cist, in which the burial was placed, measures c. 2.45 m (N-S) x 1.00 m (E-W) (at its greatest width). The depth of the cist is c. 0.70 m from the top of the stone wall to the flat-lying stones. Thus, the cist of the tomb is very shallow. The stones which form the exterior of the tomb now stand, in some place, to c. 0.50 m above the present ground level.

*Tomb Type IV*

We excavated a fourth type of tomb as B.4 (FIG. 4). We are presently calling this an EB IV tomb. However, we found no pottery from any period associated with the very poorly preserved, human-skeletal remains in this tomb. We are calling it EB IV, for the present time, because of its association with the other EB IV tomb types at Khirbat Khanāzīr.

B.4 is a long, wall-like structure, measuring c. 16.50 m (N-S) x 2.50 m (E-W) externally and c. 15.25 m (N-S) x 0.75-0.85 m (E-W) internally. It, like the other tomb types previously described, is made of unhewn stone. Internally, at a balk which we cut at 4.70 m from the south end, the east wall still stands seven while the west wall stands five courses high. The interior walls are well built with smooth surfaces at the areas where we excavated.

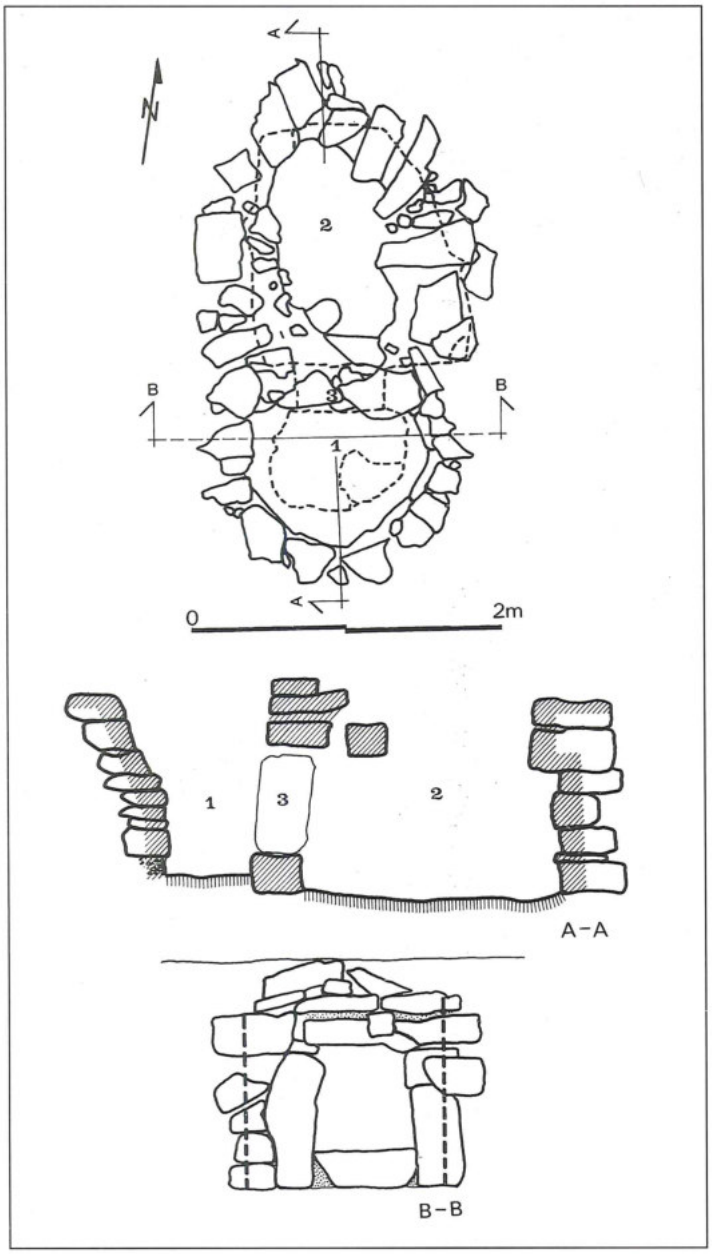



1. B.1, top plan and sections.

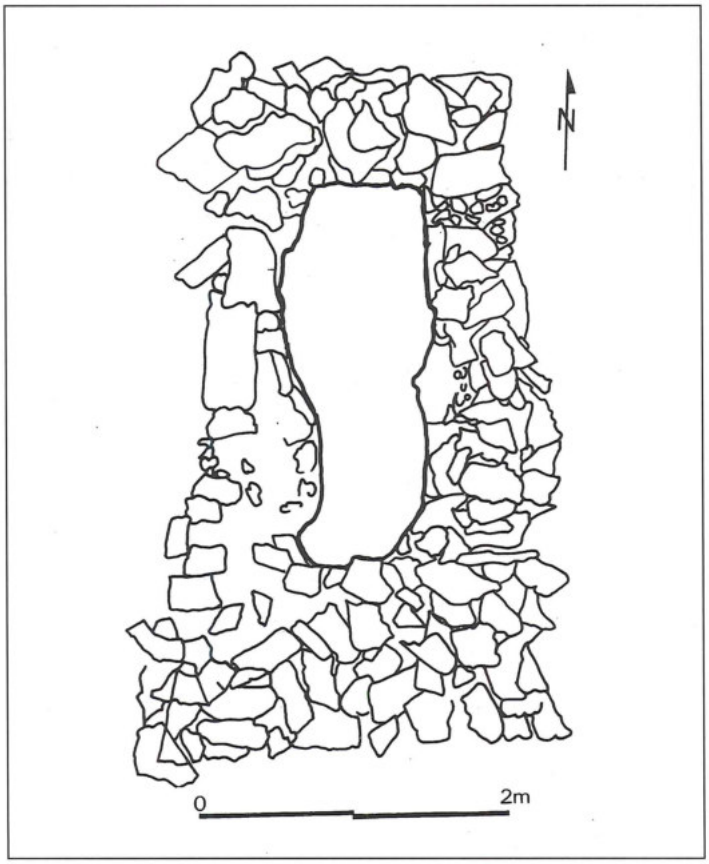
The stones which form the walls are of varying sizes. The depth from the top of the east wall to the floor is c. 0.87 m while that of the west wall is c. 0.73 m. However, both walls were probably originally the same height. The exterior walls are constructed of the same type of stone. They are in the form of three steps with two risers. Our excavations revealed that there is evidence of what appears to be corbelling, or at least flat lying stones, which once served as the roof of the structure. However, since the interior width of the structure is only 0.75-0.85 m, it would not be difficult to roof it with readily available stone. Conversely, it is possible that what we identified as possible corbelling are actually stones in association with the burials within the structure.

**Construction Technique of the Four Tomb Types**

It appears that in the construction of Tomb Type I, i.e., A.1; B.1; C.1; and D.1, and Tomb Type II, i.e., B.2; B.3; and B.5, the tomb builders dug a large hole over 1 m deep. They lined the sides of this hole with unhewn stones making the interior walls as smooth as possible. They next constructed a wall to separate a larger burial chamber from a smaller shaft. They left a hole or passageway in this wall to permit "communication" be-




2. B.3, top plan and sections.

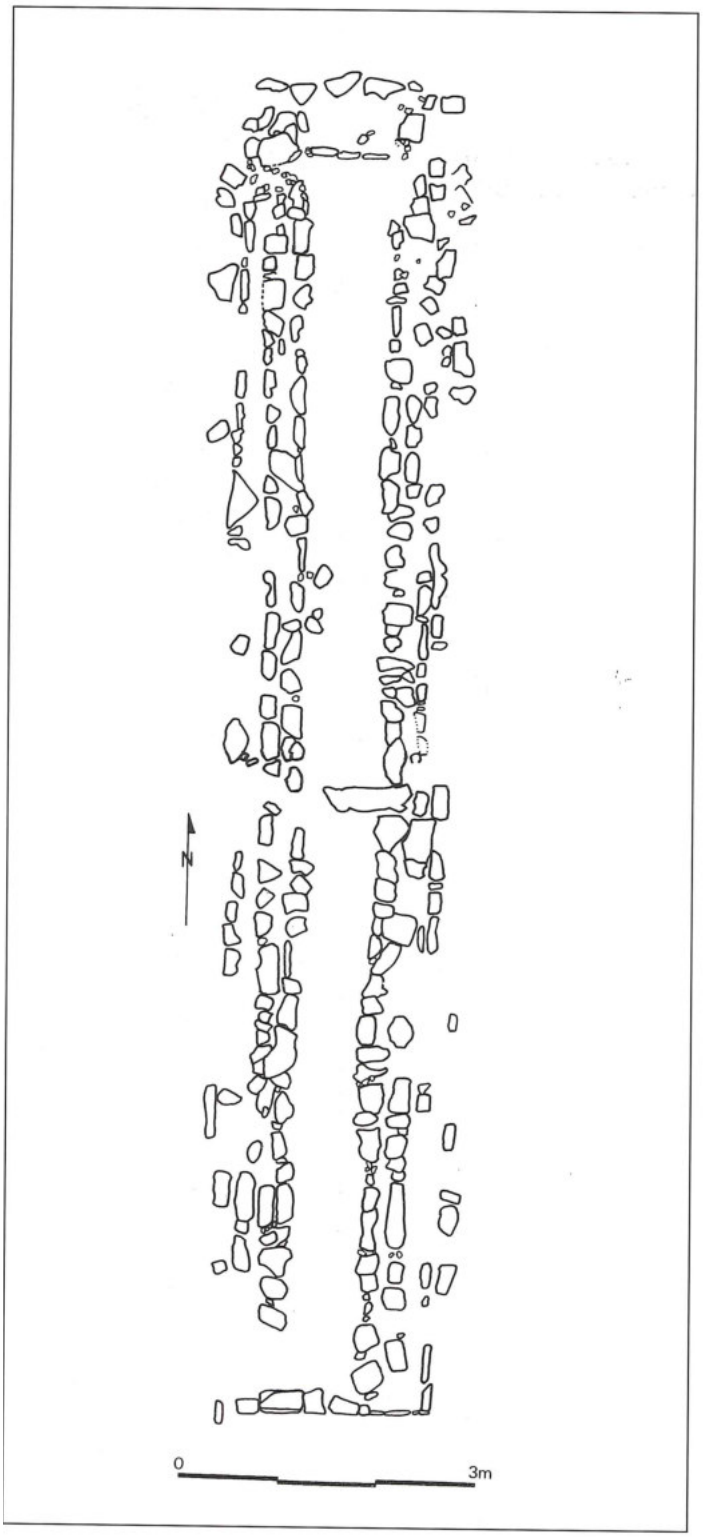



3. E.1, top plan.

tween the two segments of the tomb. They put down flat-lying stones to serve as the floor of the tomb. Some walls of the burial chambers appear to curve inward towards the top while the others are perpendicular. This was probably done to make it easier to construct the roof of the chamber which consisted of flagstones/capstones. The much smaller shaft, on the other hand, is often funnel-shaped. It too is covered over with flagstones/capstones. The passageway/doorway between the chamber and the shaft was filled with stones, rather than with one blocking stone, after a body or bodies were placed in the tomb. This resulted in blocking off the chamber from the shaft. The latter was also filled with stones before its entrance was covered. In the cases of A.1, B.1, C.1, and D.1, the builders next piled stones over the chamber and the shaft and enclosed them in seemingly rectangular structures. However, the piles of stones and the rectangular structures are not part of B.2, B.3, and B.5. Otherwise, it appears that Tomb Types I and II are constructed similarly.

It is probable that the builders of Tomb Type III, i.e. E.1, dug a rectangular hole in the ground. This was not deep since they soon hit bedrock. Some of the bedrock in the southeastern interior of the tomb appears to have been cut away. Since the bedrock sloped towards the northeast, the tomb builders put soil to level off the bedrock in the central and northern segments of the cist. They then put flat-lying stones in these areas to serve as the floor. They also lined the sides of the cist with flat, unhewn stones. The body or bodies were then laid on the flat stones and covered over with soil and stones to about ground level. More stones were then used to demarcate the place of the burial.

To construct Tomb Type IV, i.e. B.4, the "trough-like" structure, the tomb builders dug a trench, running north-south. They then built two walls of stones, facing each other, about 0.75-0.85 m apart. They next put a floor between them. They then built a second and third wall to the exterior of these inner walls. This gave the impression of steps or terraces. After burying an in-




4. B.4, top plan.

dividual or individuals, the builders then covered the bones, probably disarticulated, with fine sand and large stones. The entire structure was then covered over with large stones.

**Concluding Comments**

Tomb Types I and II can, in general, be categorized as shaft tombs. In the case of Khirbat Khanāzīr, however, they resemble miniature, subterranean houses. They all have a very distinct passageway/doorway which consists of door posts, a lintel, and a threshold. There is, thus, an impression given that one is, indeed, entering a house. The passageway/doorway leads from a small, stone-built shaft, usually not more than 1 m deep, to a larger, burial chamber/room. One "steps down" from the shaft into the chamber. Both the shaft and the chamber are roofed-over by large flagstones/capstones. There must have been the intention of imitating houses/dwellings since it was not necessary to use both a shaft and an associated chamber for burial purposes. Thus, the site appears to be town/city of the dead (Dever 1987: 15). The pastoralists, who expended so much effort in constructing these tombs, probably returned year-after-year to bury, in permanent dwellings, those of their number who had died during the intervening period.

Tomb Type III is of the cist type. However, it has, as noted above, some similarities to Tomb Type I. On the other hand, this tomb type is quite different from the EB IV cist tombs close by Rujm Khanāzīr, immediately to the north (MacDonald *et al.* 1992: 260, Site No. 109 and 261, Site No. 119).

A parallel that we found for Tomb Type IV, namely, B.4, is Bidya 1 located 38 km north of Fujairah in the United Arab Emirates (al Tikriti 1989: 102-103 and PLS. 61 and 91). Bidya 1 is a long, collective tomb within an Islamic cemetery which is still in use today. Its upper chamber has parallels to B.4. Although it is almost twice as long as B.4, the construction technique is similar. Parts of both tombs are above and below ground level. B.4, like Bidya 1, appears to have been covered over by flagstones in antiquity. Moreover, both have stone floors. The building material for both appears to be local. The orientation, that is, north-south, is similar. The condition of the human bones in B.4 and Bidya 1 is also similar. The bones in both cases are only in small fragments and the numerous skulls uncovered are in a poor state of preservation. Moreover, Bidya 1 dates to the beginning of the second millennium BC. This is the time to which we are dating B.4. The major areas of dissimilarity is in two-level nature of the Bidya 1 tomb and the number of burial goods found relative to B.4. The latter was almost devoid of grave goods.

Thus, from the above, it appears that there are four different EB IV tomb types at Khirbat Khanāzīr. As noted above, none of these tomb types fits neatly into the tomb types which Dever, Palumbo, Kenyon, Oren, and Tubb describe. Furthermore, the tombs excavated at Khirbat Khanāzīr are unlike those EB IV shaft tombs, namely, A 52 and A 54, which Lapp excavated at Bāb

adh-Dhrā'. The EB IV cist tombs at Rujm Khanāzīr are constructed of cobble-stones capped by flagstones. This then is a fifth type of EB IV tomb present in the immediate vicinity of Khirbat Khanāzīr. Thus, it seems unwise to attempt to categorize too strictly the EB IV tomb types of Syria-Palestine.

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# The Architecture of Edom

The best historical sources for southern Jordan in the second and early first millennia BC are Egyptian (Kitchen 1992). It is in these sources, at the end of the Late Bronze Age (c. 1200 BC), that we first meet the terms Edom and Seir — Seir was apparently a term for part of Edom, which later became synonymous with Edom. Eventually, the kingdom of Edom, as we know it from Old Testament accounts, extended from Wādī al-Ḥasā in the north to Wādī Ḥismā in the south, and in its later history Edom extended west across Wādī 'Arabah (Bartlett 1989: 33ff.). At the end of the Late Bronze Age, though, there is nothing to suggest that the term "Edom" meant anything more than an area — there is no indication at all that Edom was an independent kingdom under its own ruler.

Present archaeological evidence suggests that at this time Edom was largely non-settled, although there may have been some settled occupation in the Iron I (c.1220-1000 BC) in the north, on the banks of Wādī al-Ḥasā in the best agricultural land. The biblical evidence suggests a degree of centralisation in Edom by the mid-ninth century BC. Although the lack of a single complete excavated Iron Age sequence in Edom precludes a definitive chronology, present evidence suggests that the bulk of the settlement sites do not predate the seventh century BC. It is only at this point that we can talk confidently of an Edomite state (Bienkowski 1992).

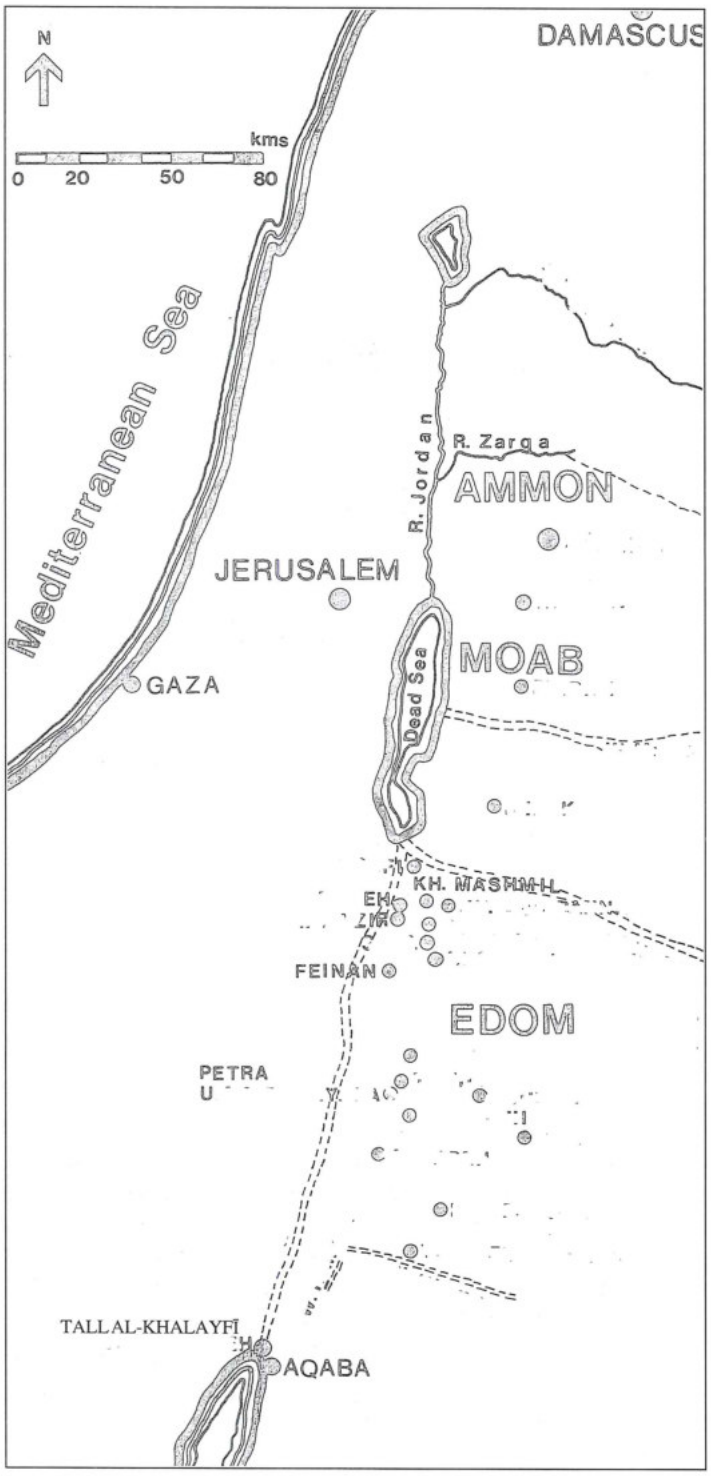
The factors leading to Edomite statehood were the stability of Assyrian control and improved economic opportunities (Bienkowski 1992). The economic opportunities were the resumption of mining at Faynān in the Iron II period (certainly by the seventh century BC but possibly in about 900 BC according to recent C14 dates; cf. Hauptmann and Weisgerber 1992) and the Arabian trade in luxury goods, particularly frankincense, which cannot be firmly dated before the eighth or seventh centuries BC, although it may have been in place earlier (Bienkowski 1992: 9, n. 7).

Edom first paid tribute to the Assyrians in the reign of Adadnirari III in 796 BC, and became an Assyrian vassal following Tiglathpileser III's campaign in 734 BC. However, Edom retained its independence and autonomy, and there is little evidence of direct Assyrian involvement in Edomite affairs (Millard 1992). On present evidence, it was only under Ashurbanipal in about 660 BC that Assyrian troops actually entered Edom — and even that evidence can be questioned. There is no evidence of Assyrian forts and garrisons throughout Edom, or indeed any of the other Transjordanian states, as has often been claimed (Bienkowski 1992: 3-5). So long as the vassal state paid its tribute regularly and its king appeared when required, Assyria would not interfere in its affairs. Indirect Assyrian influences might well appear in the material culture of those states, but these are selective borrowings which do not imply a permanent, institutionalised Assyrian presence. But overall Assyrian control did have a stabilising effect: the system of vassaldom prevented fighting between vassal states, and the economies were a little more settled because the Assyrian requirements for tribute meant that they had to generate a stated amount each year to send to Assyria or risk a punitive campaign. So once the Assyrians had established a network of vassal states bordering their provinces, this would have produced a degree of political and economic stability which no doubt contributed to national development in the Transjordanian vassal states (Millard 1992).

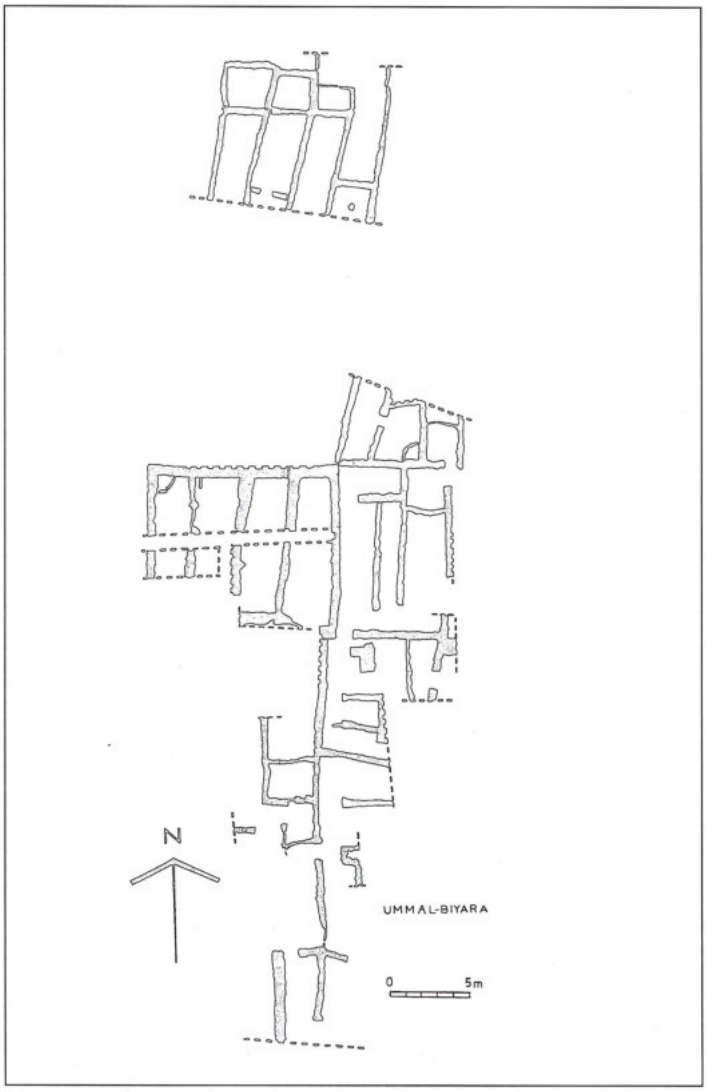
Nevertheless, Edom never became fully urban. The only settlement site that might be called "urban" is Buṣayra (Buseirah), probably the Edomite capital, which is a special case. The remainder of the settlements in Edom, which date to the seventh and sixth centuries BC, were mostly open villages and farms, sometimes located on almost inaccessible mountain tops. So far, none of the sites which Nelson Glueck identified as Iron Age "border forts" in Edom has been excavated, so we do not know if they were really forts or if they were even occupied in the Iron Age — but the evidence for a "string" of border forts is not compelling (Bienkowski 1992: 4). Furthermore, it is probable that a proportion of Edom's pop-

ulation remained pastoralist and non-settled.

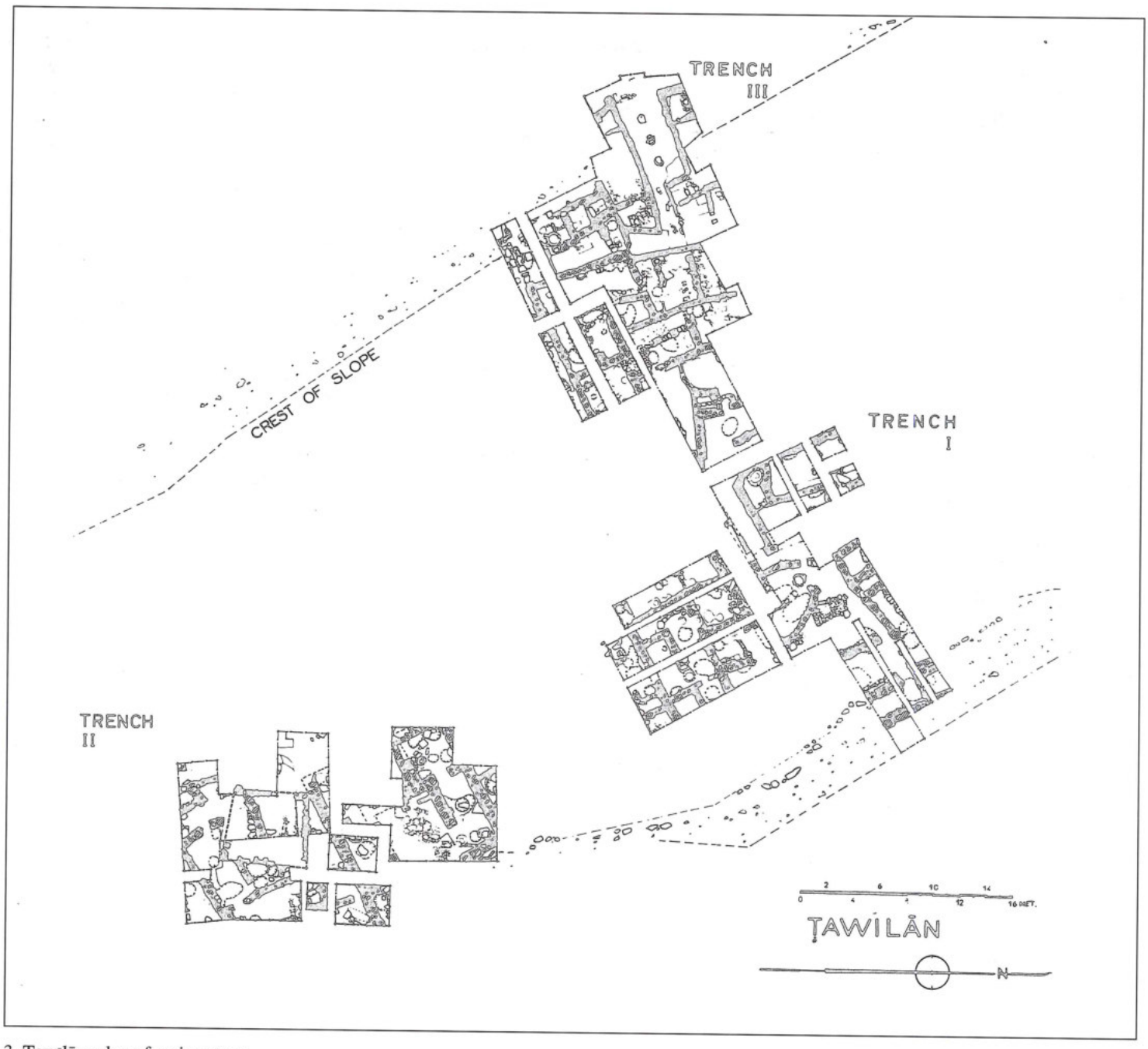
Apart from Buṣayra, the excavated sites south of Wādī al-Ḥasā which have definite Iron II architecture are: Umm al-Biyāra, Ṭawīlānō Tall al-Khalayfī (Kheleifeh) and Ghrāra (FIGS. 1-4); from surveys we can also add some data from Khirbat al-Mughayṭa, Khirbat 'Ishra, Ba'ja III, as-Sāda (Umm al-'Ula) and Jabal al-Quṣayr (Bienkowski 1990; Hart 1987; 1988; Pratico 1985; 1993; Lindner 1992; forthcoming). Although many details of plans are different, there are some common characteristics in the architecture of these sites, which in many ways do not differ from the general Iron Age tradition of the southern Levant. The environmental setting of Edomite sites lends itself to building in stone rather than mudbrick. Invariably there are dry-stone masonry walls, normally one course wide, of irregularly sized and roughly dressed stones, irregularly snecked. Large stones often rested on smaller ones. There is some evidence for the use of plaster on walls. At Ṭawīlān, one house is particularly well built, with a wall two courses wide and stone paving (FIG. 3, Trench II north), although generally floors were on bedrock with occasional plastering or packing. Pillars were occasionally used, for example at Ṭawīlān and Ghrāra (FIGS. 3-4), the main building at the latter having a central pillared courtyard. The pillars — a standard Palestinian Iron Age form — would probably have been




1. Map of Edom and surrounding areas.



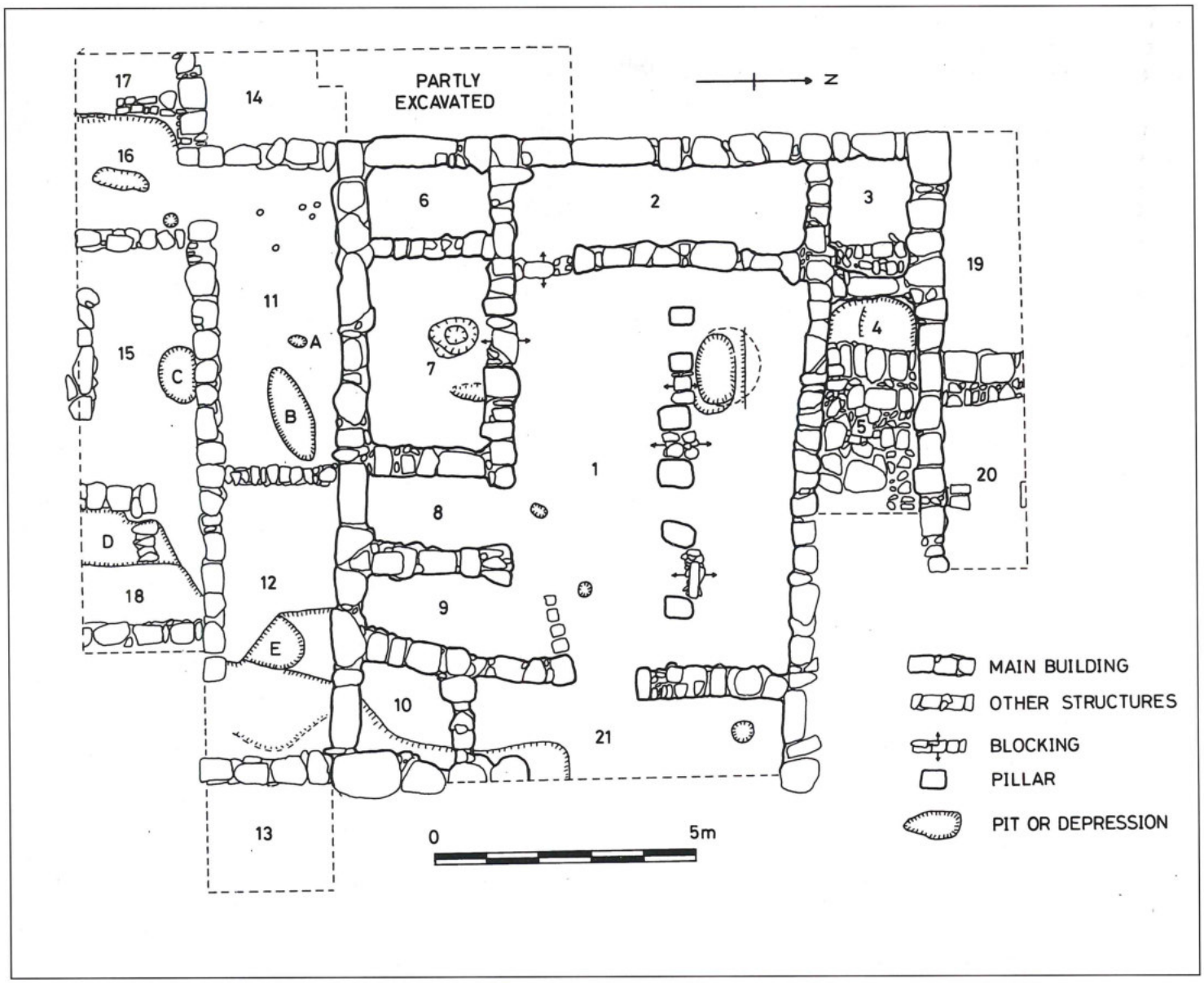

2. Umm al-Biyāra.




3. Ṭawīlān: plan of major areas.

roof supports, but they are not very stable and are unlikely to have carried either a very heavy or a large roof. Building plans are generally rectangular, sometimes with long corridor-like rooms with smaller rooms adjoining, although within this there was considerable variation. At Ṭawīlān alone there were four types of building plan, and some of the walls may have been no more than partitions (FIG. 3). The three large enclosures with massive walls at Khirbat al-Mughayṭa, possibly for animals, recall the plan of Iron II Mishor Haruah in an-Naqab (Hart 1987: 38-42 and FIG. 10; cf. Braemer 1982: 265-266). Ghrāra had towers at the corners of its main building (FIG. 4). All these sites seem to have been agricultural and domestic, in general, judging from the presence of querns, grinding stones, loom weights, spindle whorls and cisterns.

Umm al-Biyāra (FIG. 2), Ba'ja III, as-Sādah and Jabal al-Quṣayr are linked in that they are all "mountain-top" sites in or near Petra, and their Iron Age pottery was overwhelmingly plain, with little or no painted pottery — at other Edomite sites painted pottery is plentiful. This might be due to a chronological factor, and on this basis Stephen Hart has suggested that painted decoration on Edomite pottery did not become common until after the Umm al-Biyāra settlement ended, possibly in about




4. Ghrāra, Area A (from Hart 1988: 92, FIG. 3).

the mid-seventh century BC (Hart 1989: 78, 82). While this remains a possibility, there are other factors to be considered. A regional difference is discounted, since nearby Ṭawīlān had a high percentage of painted pottery. A difference based on site location is a possibility: all four are on high mountains; at as-Sādah, Jabal al-Quṣayr and Umm al-Biyāra there are large rectangular buildings with long corridor rooms (Zeitler 1992; Lindner forthcoming), perhaps reflecting the paucity of timber for roofing; while at Ba'ja III and as-Sādah other habitations were rock shelters. Explaining this difference is another matter, but the remote location and difficult access may suggest deliberate inaccessibility and seclusion from the sites on the Edomite plateau, and from any centralised control from the capital Buṣayra. In any case, we do not know how centralised a state Edom ever became, and there is much to suggest that statehood — and by implication central control — was fairly superficial (cf. Knauf 1992: 52).

Tall al-Khalayfī, about 500 m from the north shore of the Gulf of 'Aqaba, remains an enigma. Pratico's reappraisal (1985; 1993) proposes two major occupational phases: a casemate fortress with a six-roomed building in the centre; and a fortified settlement in an insets/offsets design with a four-chambered gate. All the construction is in mudbrick. The dating is still fairly flexible, but appears to be between the eighth and sixth centuries BC, although the end-date may even go down as far as c. 400 BC (Sauer, pers. comm.). Whether or not al-Khalayfī was an Edomite foundation is debatable: if

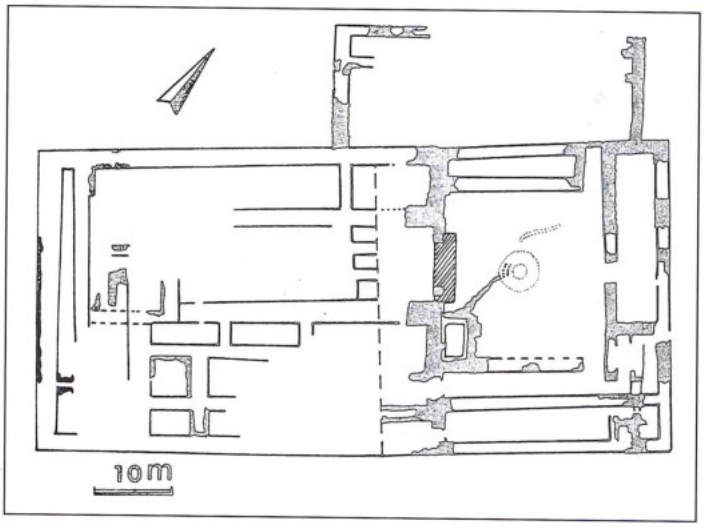
we restrict Edom proper to the area north of Wādī Ḥismā (Bartlett 1989: 34), then al-Khalayfī was not technically in Edom, although in an age of ever-changing boundaries that did not mean very much. Pratico has compared the casemate fortress to the an-Naqab fortresses, but has called the groundplan "chronologically, functionally, and typologically irrelevant" (1985: 15; 1993: 31). Bartlett suggests that the fortified settlement represents an Edomite rebuilding (1989: 125, 133-134), but again there are similarities with Arad, Tall al-Qudayrāt and Horvat 'Uza in an-Naqab (Pratico 1985: 15ff.; 1993: 28-31). The function and origins of al-Khalayfī remain uncertain. Bartlett has called it a fortified caravanserai (1989: 36). It may have been connected with the Arabian trade: although the route of the Arabian trade through Transjordan in the Iron Age is speculative, in later periods Elath was one of the links on the route between Ma'ān and Egypt and Gaza (Eph'al 1982: 14-17).

Brief mention should be made of the cultic site of Horvat Qitmit, about 10 km south of Arad in an-Naqab, not in Edom proper. The excavator identified this as an Edomite shrine on the basis of more than 500 figurines and "cult" vessels (Beit-Arieh 1991). The site comprised two complexes, each with a number of rooms, a courtyard and various installations. Most of the "cultic" finds were from Complex A. There was a mixture of Palestinian Iron Age pottery and "Edomite" pottery — although all of the latter was locally made. One ostracon bears the name "Qos", the Edomite god, and the name is also found in an inscription on the rim fragment of a krater. While this may be evidence for an Edomite shrine, and of the movement of the Edomites west across Wādī 'Arabah, it is not beyond dispute. Just because we call pottery "Edomite", it does not mean that wherever we find it, it is Edomite. There is nothing to indicate that this pottery was of necessity confined to any ethnic group, rather than being the standard Iron II painted pottery of an area extending beyond Edom proper. To avoid confusion, we should not give this pottery an ethnic title such as "Edomite", but call it "Buṣayra painted ware", after the site where it was first identified or where it is most common, following the practice elsewhere in the Near East, e.g. with "Jemdat Nasr pottery" (Bienkowski 1992: 7). The presence of the name "Qos" is not by itself compelling evidence: the name is found in Edom, an-Naqab and later in al-Ḥijāz (Bartlett 1989: 200-207), evidence for its use is still fairly sparse and uncertain, and we cannot automatically conclude that its use indisputably indicates an Edomite, nor that its mere presence at a shrine makes the shrine itself "Edomite". The same argument holds for the "Edomite" script: its usage may be geographical rather than ethnic, and it cannot automatically be used as an argument for the presence of Edomites.

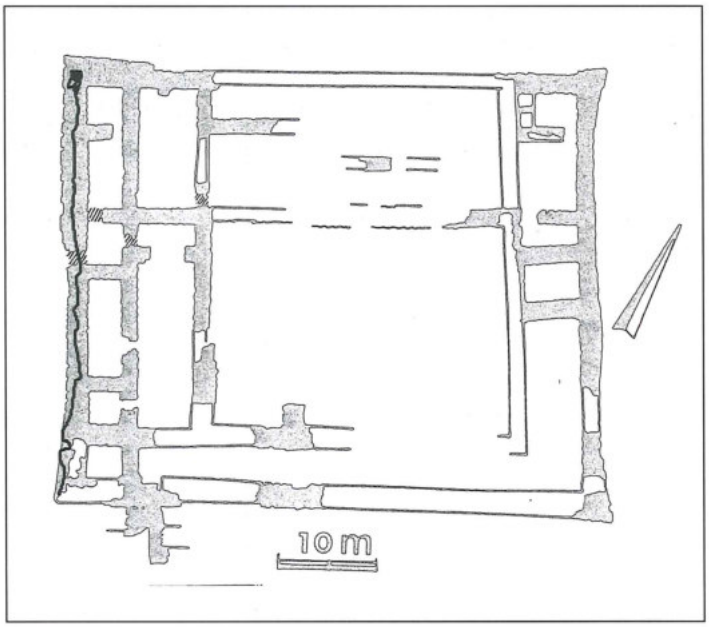
The major buildings at Buṣayra remain quite unique in Edom. Excavations revealed what might be an administrative centre dominated by two or three large buildings and fortified by a town wall (Bennett 1983; Bienkowski 1990: 101-103). There is evidence for a division of the city into Upper and Lower Towns. The Upper Town consisted of the "Acropolis" (Area A) with buildings that have been described as palaces or temples, built on a deep fill or mound (FIGS. 5-6). The Lower Town consisted of what might be ordinary domestic buildings on the terraces surrounding the "Acropolis" (Areas B and D), similar to those elsewhere, for example at Ṭawīlānń The Upper Town was cut off from the Lower Town by a battered enclosure wall, which has been traced between Areas B and A. Area C also probably contained a public building (FIG. 7). There appear to be several architectural phases; present evidence suggests that the buildings date from the seventh century possibly into the Persian period (Bienkowski 1990: 102-103).

It is the buildings in Area A (the "Acropolis") which have been the subject of most comment (FIGS. 5-6). What must be stressed, even now, 20 years after they were first excavated, is that the stratigraphy of stone on stone is so enormously complex that it is extremely difficult to extract the plans of the buildings and to reach conclusions on phasing. This paper has nothing new to say about the plans or phases, only about how the buildings might be interpreted.

There appear to be two main phases, called Building B and Building A. Building B's overall dimensions were 77 x 38 m (FIG. 5). It had two entrances on the northeast side, both off centre, approached by a ramp. In the main central courtyard was a cistern into which water flowed through one or two drains, one emerging from another room. At the end of the courtyard was a flight of shallow steps flanked by plinths, possibly forming the bases of two columns. These steps led into a long narrow room.




5. Buṣayra, Building B.



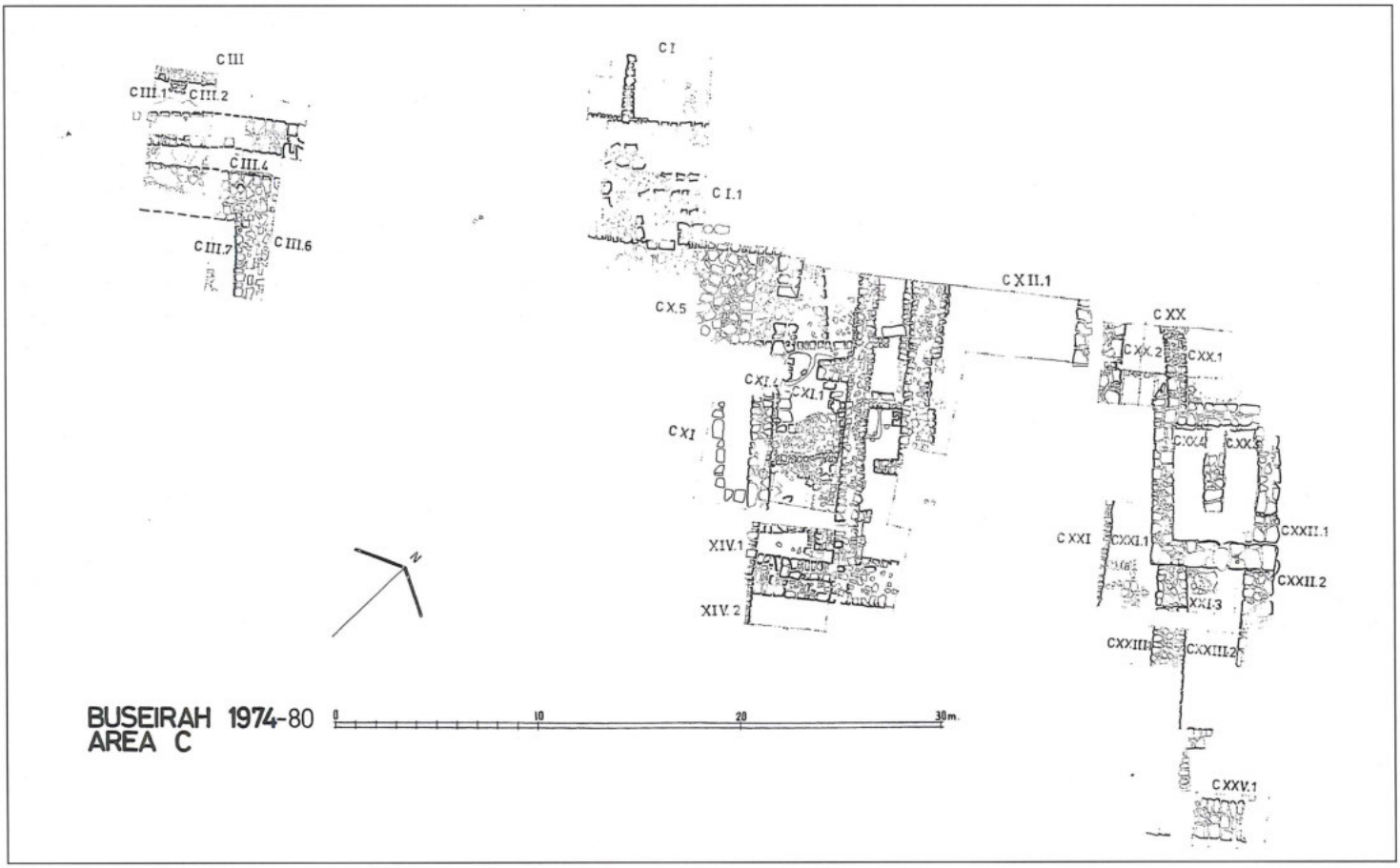

6. Buṣayra, Building A.

All the floors and walls were plastered. There was some evidence for a mudbrick superstructure.

Building A (FIG. 6) was built on top of Building B, and was smaller (48 x 36 m). There was a large central space, with surrounding rooms or corridors. The corners of the walls seem to curve outward, hence its colloquial title, the "Winged Building". The main entrance was now on the opposite, southwest, side.

Crystal Bennett compared the plans of these buildings both to Assyrian "open-court" buildings and to the *bit hilani* of Syria (Bennett 1974: 4; 1982: 187). The building in Area C (FIG. 7) seemed similar in construction to Building B especially; since it contained a lavatory and bathroom, this was paralleled with the first appearance of these amenities at Khorsabad and Nineveh (Bennett 1982: 187). Building B's function as either a temple or a palace was proposed (Bennett 1977: 9; 1978: 169).

The present writer is prepared to accept a generic similarity with the so-called Assyrian "open-court" buildings in Palestine, as at Megiddo, Hazor and Lachish (cf. Amiran and Dunayevsky 1958; Aharoni 1975: 34-40; possibly also the building at Ayyelet ha-Shahar, east of the mound of Hazor [Reich 1975] and maybe others, cf. Kletter 1991: 45 n. 7; Kempinski and Reich 1992: 214ff.). Each of the buildings is slightly different in plan, but the essential features at Buṣayra, either in Building B or A or in both, are much the same: a more or less rectangular shape, a more or less central open




7. Buṣayra, Area C

court (if we assume this space at Buṣayra was indeed open), an off-centre entrance, the presence of a drainage system, thick inner walls, and a double row of rooms. There is a broad family resemblance to Sargon's palace and residencies at Khorsabad, living quarters at Assur, houses at Tall Ḥalaf and Babylon, and the Assyrian palace at Til Barsip (Amiran and Dunayevsky 1958).

What is most striking, however, is that the layout of the buildings at Buṣayra is also reminiscent of the Assyrian preference for an upper and lower city. At Khorsabad, the royal palace was on a platform, level with the city walls, together with a religious precinct including a ziggurat. Beneath, at ground level, was the fortified citadel, comprising a number of minor palace and other temple buildings. At Nineveh, the city's most important buildings were on Tall Kuyunjik — the palaces of Ashurbanipal and Sennacherib, and the temples of Ishtar and Nabu. At Nimrud, the mound formed from the remains of earlier settlements was reshaped and revetted to form a raised citadel for the main palaces and temple buildings (cf. conveniently Lloyd 1984: 193-201). The same was true of the north Syrian Assyrian provinces, e.g. Tall Ḥalaf, Zinjirli or Til Barsip, although many of these had a pre-Assyrian Iron Age origin (cf. Mazzoni in press). The palace was always on a citadel, but almost nothing is known of the lower cities (cf. conveniently Frankfort 1969: 169-174). In Assyria itself, the lower city seemed also to have public buildings or residencies of officials, and we do not know where the ordinary people lived. At Buṣayra, what we seem to have is an artificial mound specially built for Building B to create a "citadel" and so a distinction between an upper and lower town. This is not unusual in the southern Levant — a related concept might be the Ophel of Solomon's Jerusalem. The Lachish "residency" too stood on an elevated platform (Aharoni 1975: 34). The Stratum III citadel at Hazor was on the western edge of the Upper City (Yadin 1972: 191-192). Both "open-court" buildings at Megiddo (1052 and 1369) stood on artificial fills surrounded by sloping buttress walls (Lamon and Shipton 1939: 70-71). The Moabite "palace" at Dhībān possibly had a similar plan, and stood on the summit of the mound, though on bedrock (Morton 1989: 244-245, FIG. 13).

This pattern strongly indicates that we should consider Buṣayra Buildings B and A as palaces. It is acknowledged that the Assyrian and north Syrian citadels usually comprised temples as well as palaces; but given the plans of the Buṣayra buildings and their relatively small size, it is hard to see how they could have a dual function. Reich (in Kempinski and Reich 1992: 219-220) implies that Building B was a temple on the basis of parallels to the entrance plan at Assyrian and provincial temples (see also Bartlett 1989: 188-190). This proposal cannot be discounted, but Building B's situation as the only structure at Buṣayra on a raised citadel, separated from the Lower Town by a wall, in conjunction with the parallels cited above, does suggest that a palace is a more likely identification. If there was a temple at Buṣayra, perhaps to Qos, then it is probably to be sought elsewhere. What then of the Lower Town at Buṣayra? Area C certainly had a public building, following the Assyrian and north Syrian pattern. Were Areas B and D also the residencies of officials, or those of ordinary people? We do not know the answer, but there is nothing in the evidence at present to discount the possibility that Buṣayra ever housed more than just the Edomite king and his court (and possibly his army?). It is possible that Buṣayra was essentially a "royal city", but only the central part has been excavated, the rest being hidden under the present-day village to the south. What is unexcavated may be quite different from what has been excavated.

Nevertheless, we cannot automatically conclude that the layout and building plans at Buṣayra were directly influenced by Assyria. We can accept that they are something foreign to Edom, but they are another example of selective borrowing, something foreign which the kings of Edom thought it was good to imitate (as indeed the Assyrian kings imitated the columned porticos of north Syrian palaces, cf. e.g. Frankfort 1969: 80; Postgate 1992: 261). We know from records that tributary kings met Assyrian kings at certain times, and occasionally probably went to Assyria — delegations of high officials, including those from Edom, are certainly attested (Weippert 1987: 100 n. 36) — and this gave them opportunity and inspiration for active emulation. Nicholas Postgate gives a vivid description of this process: "we should not see the client rulers as cowering in their citadels waiting to be irradiated with Assyrian influence, but absorbing the scene in Nineveh, fingering the tapestries and envying the silverware" (Postgate 1992: 260). It is equally possible that any influence at Buṣayra came from north Syria or Palestine, where similar architecture is known, or even southern Syria, although we simply have no evidence at present for Iron Age town plans from there. There was probably a fashion in palace plans in the late Iron Age, perhaps originally Assyrian — though conceivably even north Syrian — but now widespread and adapted to local circumstances. We should not attribute too much significance to detailed differences in plans, nor necessarily conclude that they were the result of direct Assyrian influence.

Seen as part of a process linked to the *pax assyriaca,* though, these "borrowings" acquire wider significance. Urbanisation was part of Assyrian state ideology. Assyrian methods were to settle people down and increase economic output and efficiency.

Assyrian town planning can be seen throughout the

provinces, e.g. in the Khābūr region, where the layout of upper and lower city and the building plans are similar to Buṣayra, e.g. at sites such as Tall Shaykh Ḥamad (the Assyrian Dur Katlimmu) and elsewhere (cf. Kühne 1991; Kühne in press). Although Edom was not under direct Assyrian rule, similar processes may have been at work. Present evidence suggests that settlement in Edom greatly increased under the stability of Assyrian control and the economic opportunities this offered — and so the end result was similar to that actively encouraged by the Assyrians in their provinces. As we have seen, there is little evidence of direct Assyrian involvement in Edom. Nevertheless, the Assyrian empire was largely responsible for creating the conditions in which Edom became a state — and thus indirectly responsible for increased settlement and even for the nature of the buildings at Buṣayra, although urbanisation as such never took hold. We should perhaps visualise the newly enthroned kings of Edom, treated to exotic gifts of gold and silver by the Assyrian king in their role as vassals (cf. Weippert 1987: 100), seeking to emulate their peers and literally to elevate themselves in the eyes of their subjects by building a palace of the latest fashion on an artificial citadel at Buṣayra. Outside the royal centre, ordinary Edomites settled in open villages and farms — and some probably did not settle at all — untouched by the pomposity and grand aspirations of their rulers.

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# City Planning and Architecture at the Iron Age City of al-Bālū‘ in Central Jordan

The site of al-Bālū‘ is located south of Wādī al-Mūjib at about 5km east of Jabal Shīḥān, which is the highest point in Arḍ al-Karak of Central Jordan. The excavation at al-Bālū‘ owes its importance to the fact that it is the largest Iron Age ruin in Central Jordan, covering almost all the periods of occupation from the Early Bronze Age to Mamluk times (Worschech 1989: 111-121; 1990: 86-113). However, the Early and Middle Bronze Ages — as well as the Iron Age occupation when the city was at its prime — are well represented, while evidence for the classical periods only comes from pottery finds, especially in the southwestern quarters of the site (Worschech 1986: 292), where there are also the remains of the large Mamluk village which was called " Shīḥān" by Medieval Arab travellers (Sourdel-Thomine 1953: 18).

## City Planning at al-Bālū‘

The ancient site of al-Bālū‘ is situated in the midst of fertile land above the breathtaking gorge of Wādī al-Bālū‘. The walls of the gorge are formed by the typical basalt-pillar formations which served as natural quarries. The site is strewn with unhewn blocks which stem from the destroyed walls of the city's houses and installations.

A surface survey of al-Bālū‘ in 1986 has revealed that the older part of the city is the area immediately east and west of the impressive *qaṣr*, which may have seen some rebuilding activities in the Nabataean or Early Roman times. Here also Late Bronze and Early Iron sherds were picked up. The older part of the city had a defence wall of the casemate type with a small gate towards the east. During the Iron IIA-B period the city limits were extended eastward and another defence wall was built, thus enlarging the city by about 200m². The entire east-west extension of the city was about 450-500m in the Iron II period. Many of the wall lines can be traced on the surface, giving an idea of some of the building complexes and their locations without any excavation being necessary. Here the pottery is entirely of Iron Age date.

The results of the surface surveys indicate that there are two areas of occupation (FIG. 1): 1. the town which had spread around the *qaṣr* during the Iron I. In this area west of the *qaṣr* Iron I and Late Bronze pottery was picked up by several surveys. Excavations in Area AI have produced mainly Iron II sherds but there is also evidence of early Iron Age pottery.

Structures belonging to this period may be sealed below the stratum of the partially uncovered house complex in Area AI; 2. the more recent town area was growing eastward from the *qaṣr* during the Iron II period. In this eastern part of al-Bālū‘ there are units of living areas as well as courtyard-like open spaces separating housing areas.

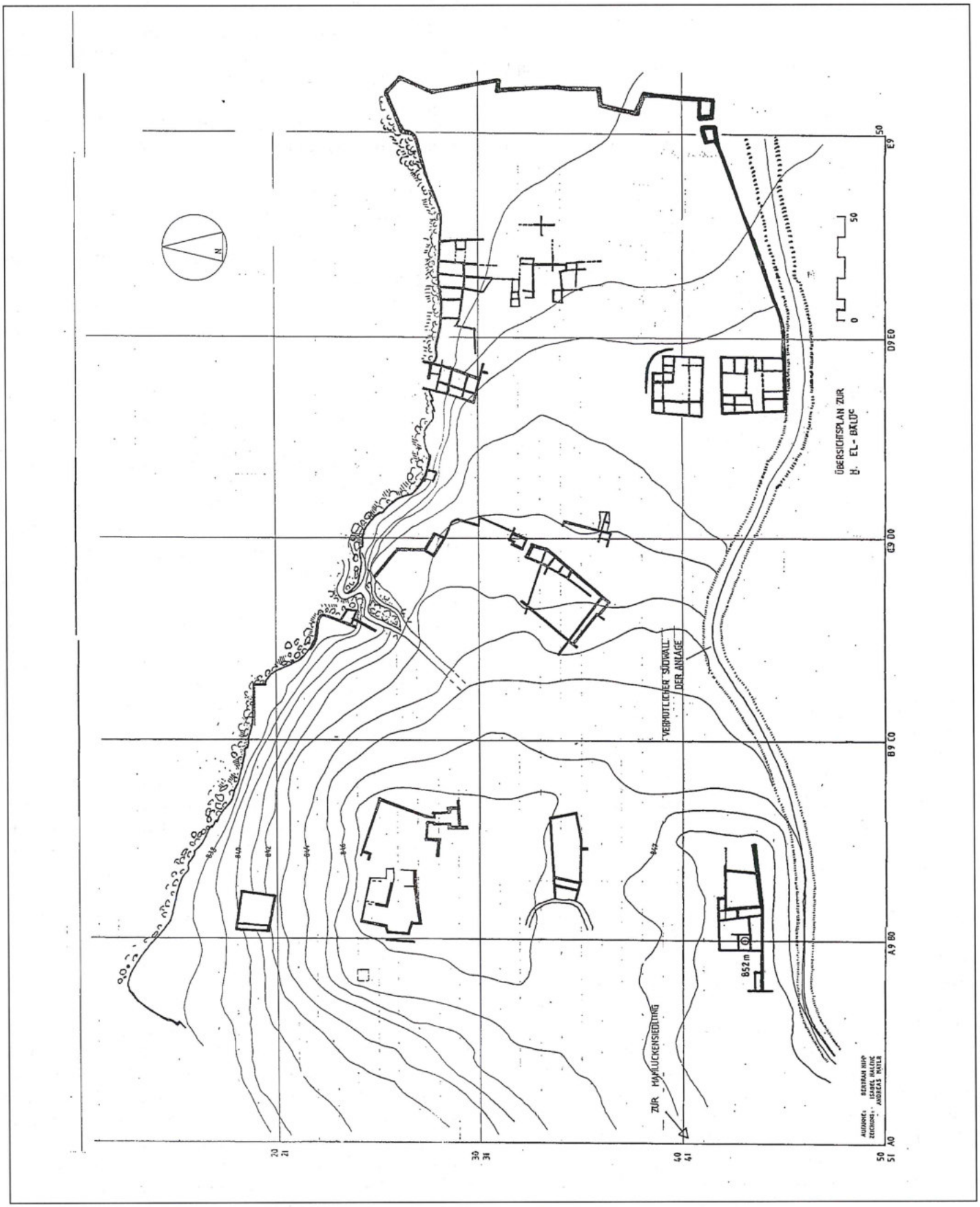
The defence walls are of the casemate type encircling the old town and its later extensions towards the east. Gates were located at the older city wall and at the later southeast corner of the city. The east wall appears to have had no casemates, however, there the defence wall was 2m wide and had bastions.

The decision to excavate in the area east of the inner city wall (Areas CI and CIII) was made, because here the rock fall was not as heavy as elsewhere on the site and also because the wall lines on the surface give a general idea of the type of building which was to be excavated.

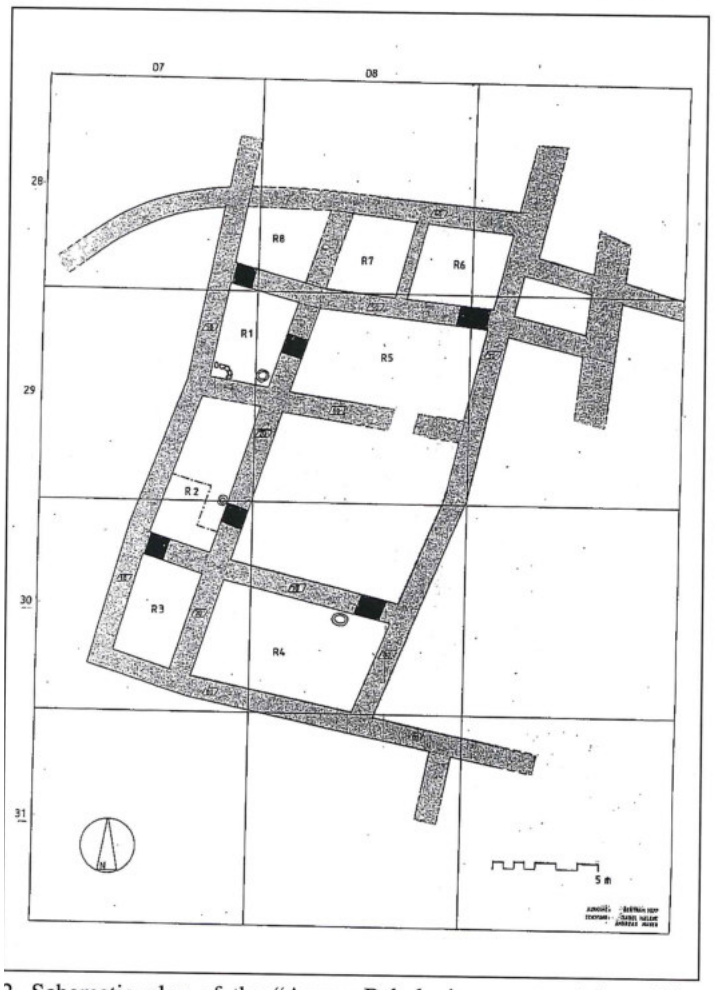
## Areas CI and CIII — The Assyrian-Type House and the Casemate Wall

We called the house complex to the east of the casemate wall the "Assyro-Babylonian courtyard house" (FIG. 2), because of its resemblance to house types from Assyria. It is definitely not a three or four-room house of the Palestinian type (cf. Fritz 1983: 36-38). The pottery found in the hitherto excavated rooms (R1-4) dates to the Iron IIB-C period — containing also fragments of the Assyrian-type carinated bowls — thus linking the house type with the Assyrian or Babylonian presence in Palestine in the eighth to sixth centuries BC.

The architecture of this building demands attention, since this house complex as well as the architectural features in Areas AI and CIII are still standing to a height of




1. Plan of Khirbat al-Bālū'.




2. Schematic plan of the "Assyro-Babylonian courtyard house" in Area CI. The black sections of the walls indicate the positions of doorways.

1.50-1.80m. They reveal aspects of the building techniques of the Iron Age people in Moab using only unhewn stones for their building activities.

*The Technique of Wall Construction*

The material used for building the walls was the basalt rocks from the natural quarries forming the steep banks of Wādī al-Bālū'. The stones were not dressed but fitted according to space and size needed.

The unhewn basalt blocks of the walls were set on outcrops of the bedrock. In some places the bedrock was cut to form the foundation wall on which the basalt walls were erected. In order to give the walls more stability and to even out the rather rocky ground of the bedrock, layers of plaster were placed between the bedrock and the first row of stones.

At al-Bālū' two kinds of building techniques for the construction of the walls can be discerned: 1. the *main walls* were erected by carefully placing the stones in rows above each other. Small wedge-like stones were used to fill the gaps and to balance out the heavy basalt rocks; 2. the *partition walls* were built without systematic placements of rows of stones. They were placed as size and space required, hence, the absence of wedging stones. The main walls were built covering the entire length of the house with the partition walls set between them abutting against the main walls (FIG. 3).

*The Corners of the Main Walls*

At places, where the main walls met, two construction techniques were combined (FIG. 4): 1. *overlapping* of the stones of alternating rows, which mesh with each other; and 2. sometimes stones were also set *diagonally* connecting the two walls. These techniques can only be seen with the main walls, which were thus firmly interlocked giving the house greater stability.

*The Doorways*

Doorways were located in the corners of some of the rooms, a feature which is typical of the Assyrian-type house (FIG. 2) (Fritz 1983: 38). The size of the doorways is rather uniform: the height is between 1.20-1.40m, and the width is between 0.80-0.90m. Of the nine entrances identified so far, five were excavated with their lintels still *in situ*. In three entrances the thresholds were also found *in situ*. A door socket was discovered inside the entrance in Wall 20.

Doorways built in the corners of the rooms are only found in the partition walls, while in the main walls (i.e. W20) the doors were set almost in the centre of the wall. In the Assyrian-type house, *ṭawābīn* were found inside the rooms close to all entrances.

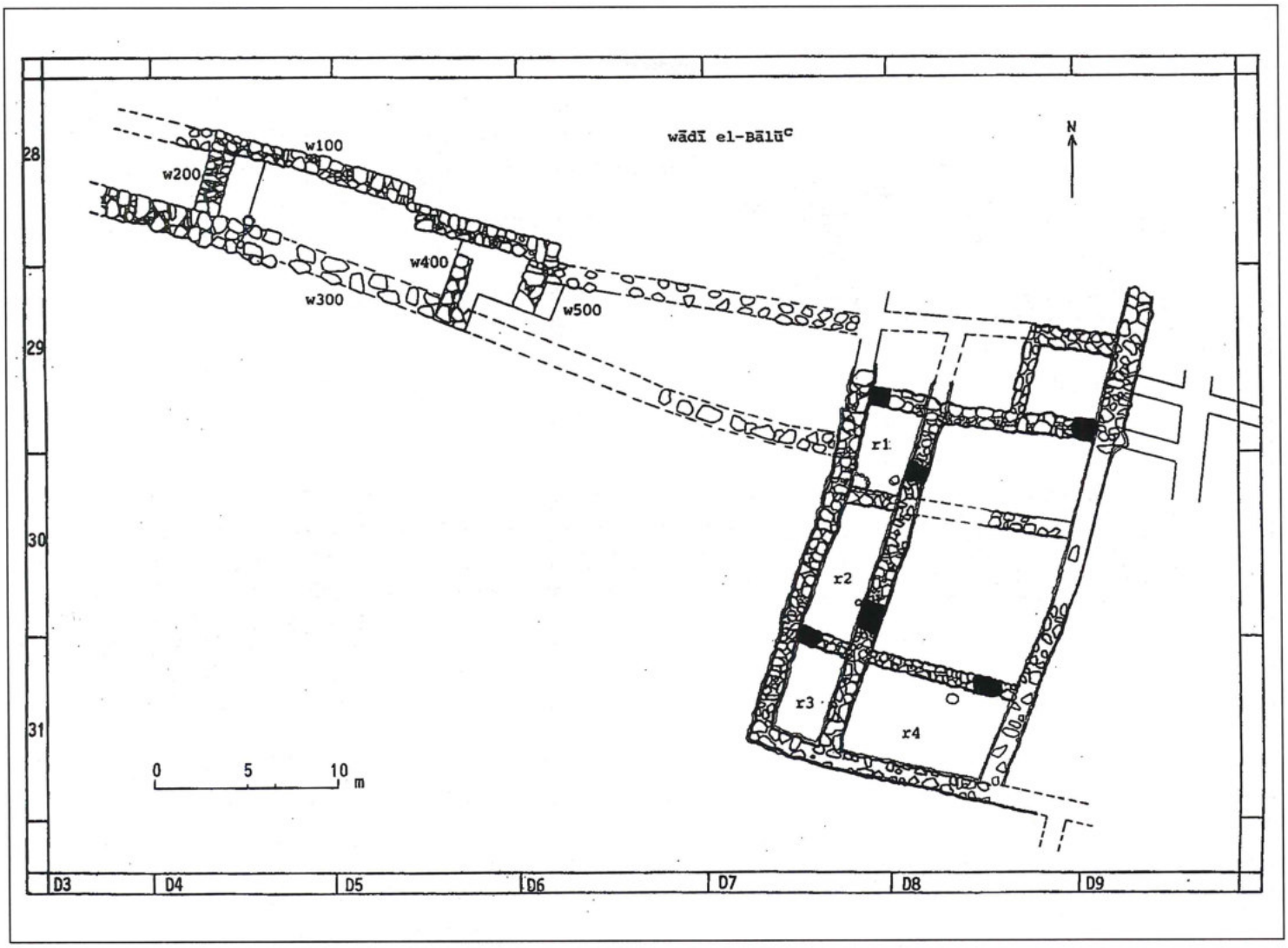
*The Construction of the Floor*

Although the floors were reached in almost all squares opened so far, only the floor in R1 of the house complex shows specific construction techniques, while the others consisted of beaten earth and a layer of plaster. The floor in R1 was constructed by alternating layers of *ḥuwwar*, sand, and ashes (compare Msās, Bi'r as-Saba'). This method was still used at the turn of the century when the houses of the "old villages" in Jordan were built.

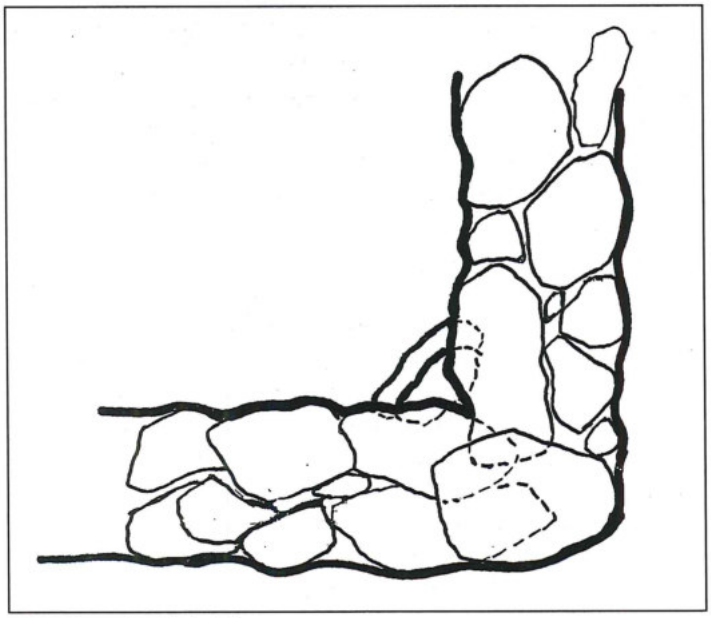
*The Paravant or Screening Wall*

The floor of R1 is c. 1.80m lower than the floors of R2, R3, and R4. There is a sudden rise of the bedrock from R1 to R2. In order to cover the rugged and cracked surface of the natural rock, an artificial wall of basalt rocks was built to screen out the bare bedrock. This screen of head-sized stones forms a thin line (c. 0.30m wide) at the bedrock level. In R2 this screening wall was covered by another wall line, being the north wall of the "reception hall". Of this north wall two stones have remained.

From this it can also be concluded that the ceiling of R1 was much lower than that of R2, R3 and R4, which




3. Areas CI and CIII: The casemate wall and house.



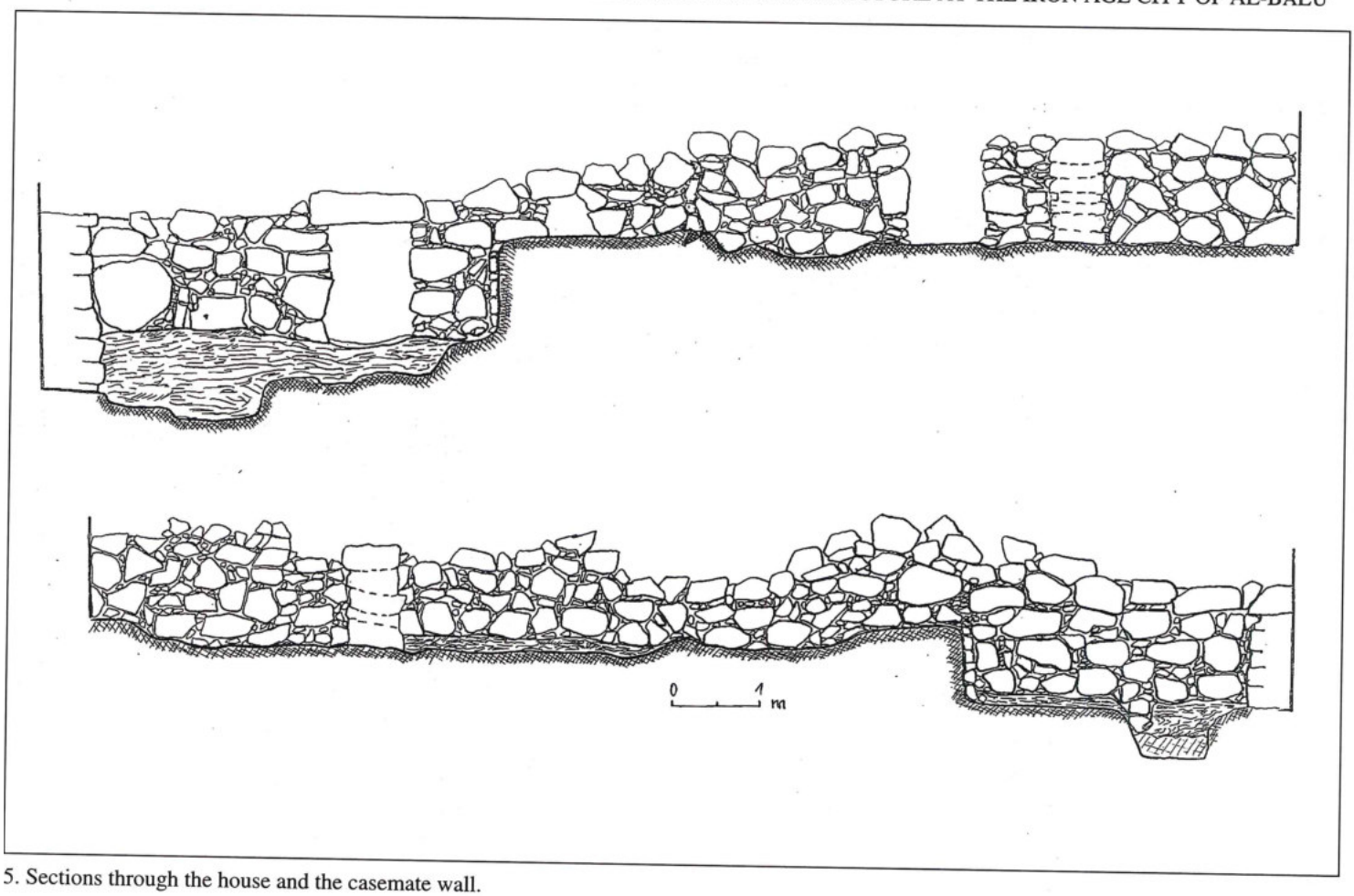
4. Main walls joining in a corner.

have the same floor level (see artist's conception of the house and the casemate wall, FIG. 5).

## Area CIII

The northern defence wall of al-Bālū' can be followed westwards from the house complex. About 30m west of the house, W. F. Crowfoot did a sondage in 1933 (Crowfoot 1934: 76-84). To the east of his sondage area, two sondages were done in 1991. The excavations revealed two partition walls between the walls of the casemate-type defence system. The outer wall, located immediately at the edge of the escarpment to the valley of Wādī al-Bālū' is about 1.20m wide while its parallel wall is about 2m wide. The partition walls measure between 1.40 and 1.60m. The width between the parallel walls is about 3.20m.

Although the casemate wall was not fully excavated, its dimensions are impressive. The eastern sondage area is especially worthy of note, because here the casemate




5. Sections through the house and the casemate wall.

room seems to have been used as a storage area for large jars and kraters. An abundance of sherds have come to light, but unfortunately no complete vessels. This room was destroyed by fire as shown by the thick layer of ashy debris on the floor.

Further investigations are necessary in order to reach any definite conclusions with regards to the Assyro-Babylonian house complex and the casemate walls. But what has been excavated so far is rather promising for the future.

In conclusion it can be said that the verdict which W. F. Crowfoot passed upon the site of al-Bālū‘ in 1933: ‘...for future excavations Balu‘ah does not appear to the writer to be attractive ... the prospects of important finds are not obviously promising” (Crowfoot 1934: 77), does certainly not hold true and has already been disproved. It is hoped that excavations adding to our knowledge of the Iron Age period in the ancient Moabitis can be continued at al-Bālū‘ in the near future.

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# Mesha's Citadel Complex (Qarḥoh) at Dhībān

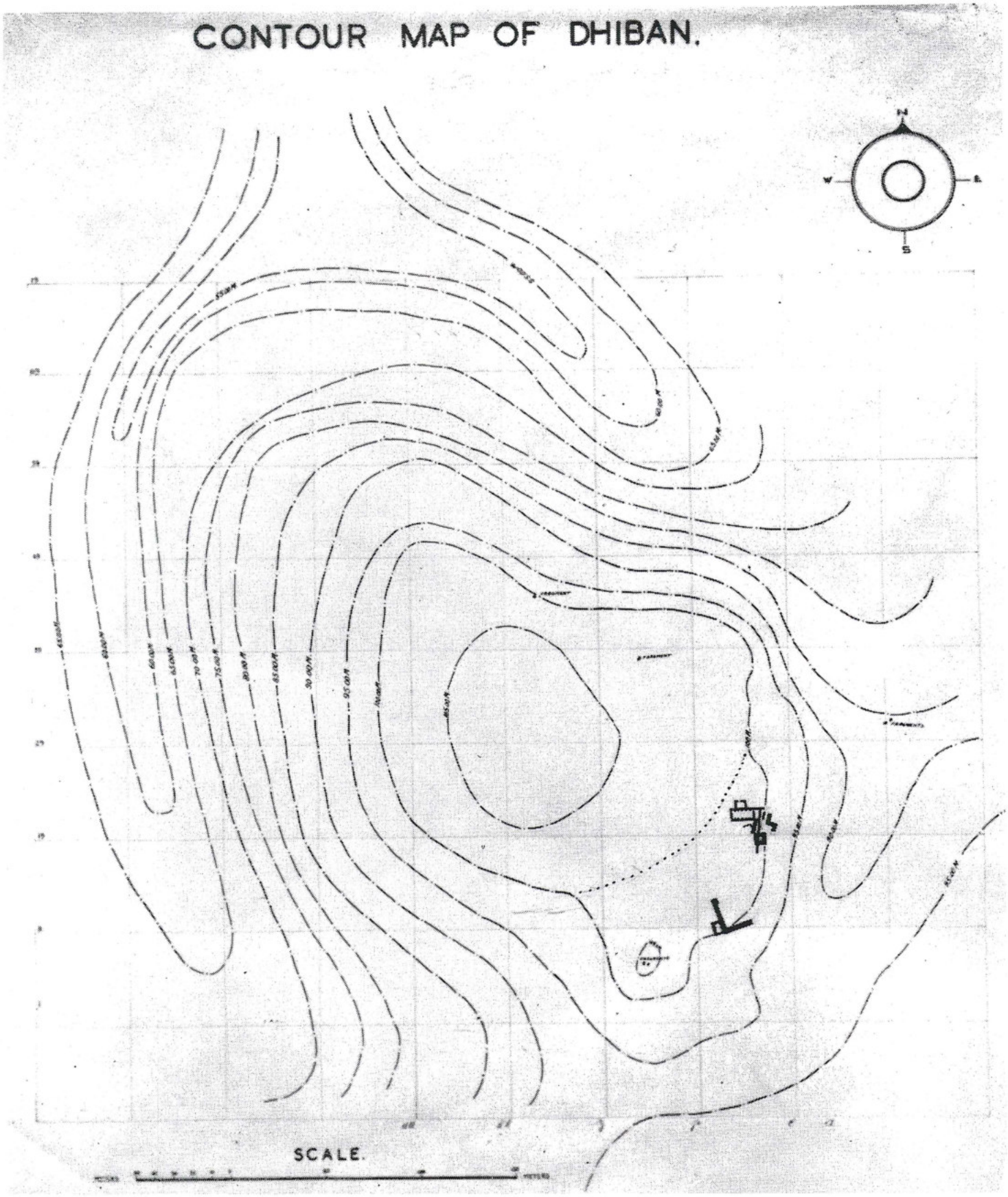
The article on Mesha's building programme at Dhībān (Tushingham 1990) was intended to reaffirm the location of Qarḥoh in the southeast quadrant of the *tall* (FIG. 1). This area, excavated in the years 1950-1953 by Winnett, Reed and Tushingham produced clear evidence that, while there was some building activity in this area before Mesha, the major construction to be ascribed to him consisted of a massive artificial fill retained (at least in part) by a great battered wall. It was, in fact, only the platform or podium, with a surface at about 99.00 m-100.00 m (based on a datum established in 1950) on which all construction rested. We found no buildings of the time of Mesha, such as were to be expected from his inscription (Dearman 1989: 93-98), with the possible exception of the square stone tower enclosed by the battered wall. It was this lack of evidence for buildings that led Morton (1989: 239) to shift excavation to the top of the mound in 1955, 1956, and 1965.

We believe that the lack of such evidence is not difficult to explain. If Mesha's building programme was on the scale and of the quality we can infer from the Inscription and from the evidence of the fill and its magnificent revetment, we should probably assume that there were vertical defence walls rising from the top of the battered wall, and that the palace, citadel, towers, gate, reservoirs, etc., were probably built of worked stone. In addition, Mesha's new quarter included private houses, for he gave instructions that each should be provided with its own cistern (*MI*: 25). These houses would not have been built on the same "royal" scale as Mesha's other constructions, but space for them must be assumed.

We know nothing about internal events at Dhībān after Mesha's death (changes of dynasty, local wars, etc.) which could have damaged the buildings, nor the extent of the destruction carried out by Nebuchadrezzar in 582 BC. Certainly the royal quarter would have been a prime target for such depreciations. The history of the city for the next 500 years is a blank: it appears to have been deserted. Erosion, no doubt, could wreak havoc, but the stonework would have been looted for all sorts of purposes. Finally, with the occupation of the *tall* by the Nabataeans, it would be normal for them to use whatever ruins remained as a quarry for their own buildings. In one specific case, the retaining walls of the Mesha podium including the battered wall, were apparently cut down to allow for the construction of a grand staircase leading up from the south to a paved court lying west of the Nabataean temple (*Dhībān I*: 44; *Dhībān II*: 36-45).

Why, however, should there not remain traces of the foundations of Mesha's buildings? If they were built after the fill was in place, there should be foundation trenches or robber trenches marking their presence, but none has been recorded. There is, however, the possibility that the foundations were built concurrently with the insertion of the fill of the podium. There is only one conceivable example of this: the so-called apsidal structure at the southwest corner of the Nabataean temple. Its foundations rest against the inner component of what we have reconstructed as a casemate wall retaining the fill on which, eventually, the Nabataean temple would rest, but which is, we believe, part of Mesha's retaining wall (*Dhībān II*: plan 3; Section G-G). There are, it is true, other walls included in the fill but all of these, we think, were built before of concurrently with the insertion of the fill.

In what follows, we present our calculations for the cubic mass of the artificial fill in the podium in the *excavated* areas in the southeast quadrant based, to be sure, on incompletely known bedrock configurations. Secondly, we note that there is clear evidence that Mesha's podium extended north and west of the excavated area and, by using evidence from Morton's city gate complex on top of the *tall* as a guide, make a conjecture of the original limits of Qarḥoh. We shall make certain assumptions about the depth of the fill in these unexplored areas (minimal, we trust) and estimate the cubic metres of fill within these limits. From these two figures — the more-or-less accurate estimate of the cubic content of the fill based on incomplete data and, secondly, on more conjectural ideas of the limits of the new royal quarter and assumed bedrock levels, we should be able to conceive




1. Contour map of Dhībān (*Dhībān I*: PL. 22).

of the magnitude of Mesha's basic building operation — that is, of the artificial podium — and work out the man-hours involved.[1] The result should give us some indication of the architectural and engineering skills and the manpower and financial resources at Mesha's disposal in Moab in the ninth century BC.

The person responsible for this aspect of the report is Peter Pedrette, who was the surveyor and architect for our excavations at Dhībān in 1952. Tushingham is responsible for the archaeological data; Pedrette is responsible for the estimates of quantity derived from them. We may, then, proceed to the data to be derived from the excavated areas.

*I. The Southern ("Gateway") Area* (FIG. 2)

The area measures 24 m from west to east (west side of Area C to Section G-G [*Dhībān II*: Sections]) and 20 m from north to south (Areas B and C to south end of Section G-G).

The surface of the artificial fill established by Mesha as the podium of his new royal quarter is fixed at 100.00 m or more in level by the sealed top of the bin (*Dhībān II*: Section H-H); further, the fill must have reached at least the preserved tops of Wall 12 (99.80 m) and Wall 20 (99.75 m). Bedrock levels average 97.77 m north of retaining walls 12 and 7 but fall to 91.58 m at the base of wall P (the battered wall) (TABLE 1). It is assumed that the slope from north to south was sufficiently gradual (a descent of 7 metres in 16 running metres), or traversed a more-or-less level "shelf" to make these walls somewhat stable (Wall 12 is 3.4 m thick but the width of wall 7 is unknown). They were built of unmortared rubble and could have supported the fill on only a temporary basis, even though the fill here was less deep (average north of walls 12 and 7 is only 2.25 m) than in Area IV. The builders obviously recognized the problem and established the battered revetting wall P here (the equivalent of wall III still upstanding further north). Pedrette estimates the volume of fill in this area at 2318 m³ (TABLE 1).

**Table 1.** Area I: The Southern ("Gateway") area. Volume of artificial fill.

| | | |
|---|---|---|
| Surface area: 20 x 24 m | = | 480 m² |
| Average bedrock level north of walls 2 and 7: 97.60, 98.50 and 97.22 m | = | 97.77 m |
| Level of bedrock at south | = | 91.58 m |
| Average of highest and lowest levels of bedrock | = | 91.57 m |
| Podium level=100.00 m; by deducting average rock level, depth of fill | = | 4.83 m |
| Volume of fill: surface area x average depth | = | 2318 m³ |

*II. The Nabataean Temple Area (East and Northeast of the Preceding)*

This area runs from the church wall north of wall B (N) to wall O (S) of the casemate, and from the line of Section G-G east to wall O (E) (east side of temple), c. 24 m x 24 m (FIG. 2 and *Dhībān II*: Sections).

The artificial fill surface reaches 100.00 m beneath the temple (*Dhībān II*: Sections A-A and C-C, which show the foundation trenches for the temple walls cut into this earlier fill). Unlike the "Gateway" area, the supporting structure is now a casemate wall with a total thickness of 5.5 m built on bedrock at level 97.12 m, which falls off abruptly to 92.78 m and, finally, to 91.58 m (*Dhībān II*: Section G-G). This casemate system still provides support for the basic podium on the south and southeast of the Nabataean temple. We assume that it was the presence of an almost sheer declivity in bedrock (unlike a more gradual descent in the "Gateway" area) which led Mesha's engineers to opt for a casemate wall, but we have also considered the possibility that the casemate wall may have been part of a gateway situated in our Area III north of the Temple area.

We have no evidence for the level of bedrock beneath the Nabataean temple, but excavation through the fill reached 96.00 m without reaching it. This level assumes a drop-off in bedrock level from that evidenced in the "Gateway" area. We have, however, assumed a bedrock level of 96.00 m for this whole area. On this basis, Pedrette has estimated the volume of fill in this area at 2304 m³ (TABLE 2).

**Table 2.** Area II: Nabataean Temple area. Volume of artificial fill.

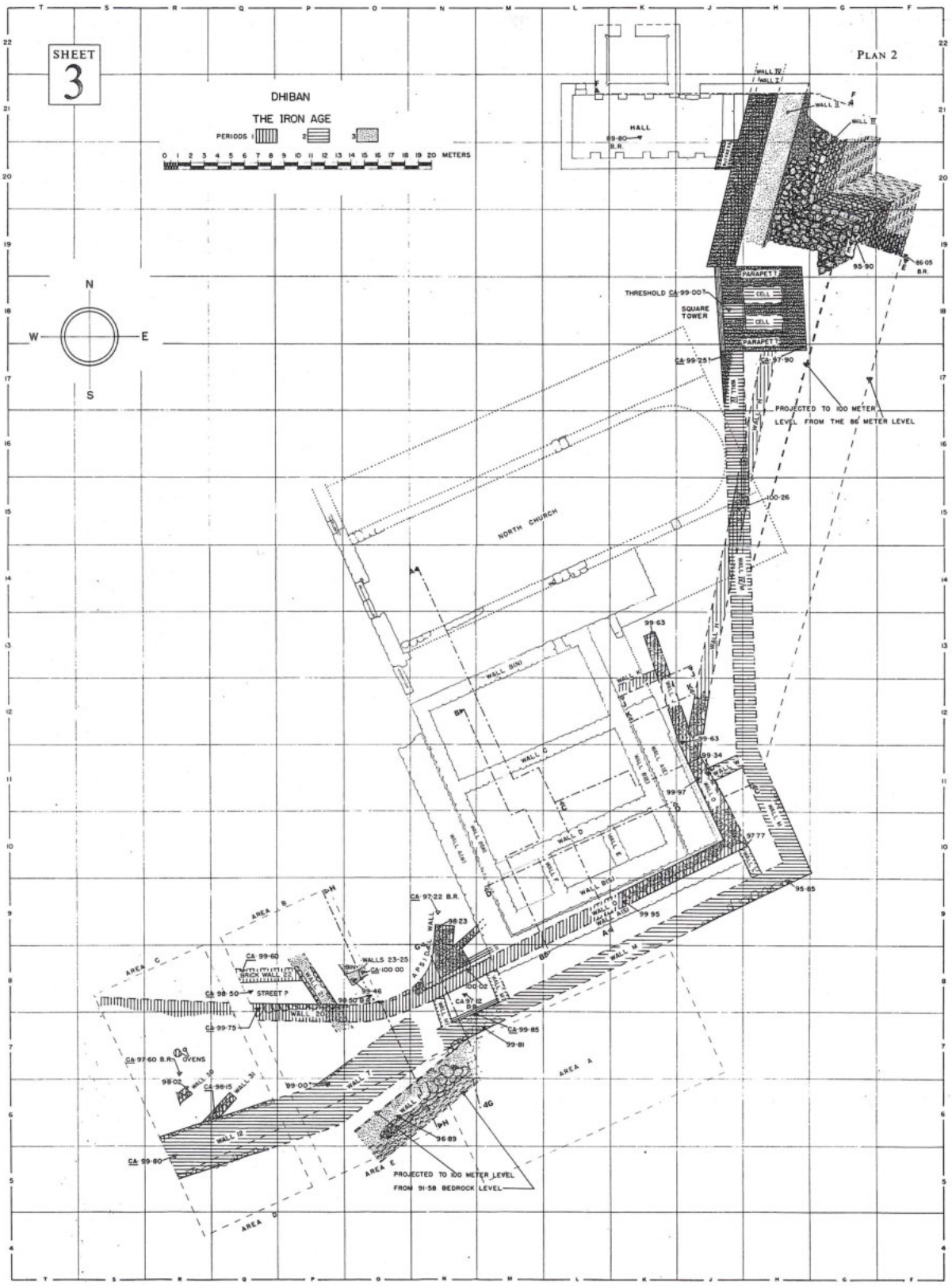
| | | |
|---|---|---|
| Surface area: 24 x 24 m | = | 576 m² |
| Levels of bedrock unknown: conservative assumed level | = | 96.00 m |
| Podium level=100.00 m; deducting 96.00 m depth of fill | = | 4.00 m |
| Volume of fill: surface area x average depth | = | 2304 m³ |

*III. Area Immediately North of the Temple Area* (FIG. 2)

This irregularly-shaped and little-known area measures 30 m from the south wall of the tower to wall W and extension (southeast of the temple) and about 10 m west from the east wall of the tower.

We have no direct evidence for the surface of the fill and only very indirect evidence for bedrock levels in this area. Visual evidence from observation of the present contours of the mound suggests that retaining walls of some kind were located here, and we can assume that the surface of the fill here would be similar to that beneath

[1] While the terms "man-hours" and "man-days" are used throughout this paper, they are to be interpreted as including the labour of women and children. All such citizen-labour would be available when crops or animals did not need tending. Also, there would be prisoners of war as, for instance, Israelite captives (*MI*: 25-26), and other foreigners.




2. Areas excavated at Dhībān in 1950-1953 (*Dhībān II*: plan 2).

the Nabataean temple to the south and in the levels met with in Area IV to the north — i.e. 99.00-100.00 m. In the absence of direct evidence for bedrock levels we assume an average base level of 96.00 m as in the Temple area to the south. The volume of this fill would be 1200 $m^3$ (TABLE 3).

**Table 3.** Area III: North of Temple area. Volume of artificial fill.

| | | |
|---|---|---|
| Surface area: 30 m x 10 m (average) | = | 300 $m^2$ |
| No direct evidence for level of bedrock; assumed as in Area II | = | 66.00 m |
| Average depth of fill as in Area II | = | 4.00 m |
| Volume of fill: surface area x average depth | = | 1200 $m^3$ |

*IV. Area to the North of III* (FIG. 2)

This area includes the tower and the Hall, but excludes the hypocaust north of the Hall. The area measures 20 m north to south and 25 m west to east. The surface of the fill is c. 100.00 m and bedrock slopes from 89.75 m under the Hall to 86.05 m at the base of the battered wall (*Dhībān II*: Elevation and Section F-F).

We have, in the past (*Dhībān II*: 22), assumed that such measurements below and east of the Hall were evidence for a bay — a tributary valley running up into the mound from the main valley delimiting the mound on the east. Such a bay, perhaps, formed a natural (and fortified) south line for the older Moabite city excavated in part by Morton (1989). It would have been filled in when Mesha created his new quarter to the south. We must now reconsider the evidence from the tower. Winnett excavated the north chamber of the tower to a depth of 11 metres (i.e. to a level of 89.00 m) without reaching its bottom. That bedrock to the east, c. 86.00 m at the base of the battered wall, continued at this level further to the south is supported by the subsequent clearing of the wall by the Department of Antiquities. Bedrock beneath the tower appears, therefore, to be rising at a rate similar to its rise under the Hall. We can, therefore, agree with Winnett that the tower was at least 13 m high (*Dhībān I*: 15, fn. 5). With Winnett, too, we find it "difficult to conceive of any function for a free-standing tower" — particularly with its entrance at c. 98.00 m or some 10 m above its base.

We suggest (Tushingham 1990: 185) that the tower was built to serve as a sort of vertical buttress to support the "temporary" retaining, or stabilizing walls to north and south of it while fill was being inserted behind them and the battered wall was being built to brace or shore up the whole construction. If so, we can assume that the configuration of bedrock east and west of the tower was similar to that north of it, i.e. that bedrock was sloping upward from about 86.05 m to 89.75 m over an east-west distance of 25 m. This conclusion, too, leads to the assumption of a very broad valley leading up into the mound from the valley delimiting it. Pedrette estimates the volume of fill in this area at 6050 $m^3$ (TABLE 4). The *total estimated volume of the fill in the areas excavated* is, therefore, 2318 $m^3$ + 2304 $m^3$ + 1200 $m^3$ + 6050 $m^3$ = 11,872 $m^3$.

**Table 4.** Area IV: Tower and Hall area north of III. Volume of artificial fill.

| | | |
|---|---|---|
| Surface area: 20 m x 25 m | = | 500 $m^2$ |
| Average of bedrock levels, 89.75 m and 86.05 m | = | 87.90 m |
| Podium level=100.00 m; deducting 87.90 m depth | = | 12.10 m |
| Volume of fill; surface area x average depth | = | 6050 $m^3$ |

## Hypothetical Reconstruction of the Area of Qarḥoh

We have assumed that the depression under the Hall (our Area IV) continued southward under Area III. There is also evidence for an extension of the conditions under the Hall towards the north. Abutting the north wall of the Hall is a room measuring approximately 6.30 m east-west by 5.20 m north-south (*Dhībān I*: 17-18, PL. 24:2). Winnett identified it as a hypocaust and superimposed a caldarium of a bath north of the Hall that extended beyond the excavated area. The floor of the hypocaust, at 97.65 m coincides with the base of the north wall of the Hall, which suggests that we can extend evidence for the fill below the Hall towards the north to underlie the other elements of the bath. The fact, also, that the great battered wall, after a sharp re-entry to the west, continues northwards, strongly supports the continuation of a substantial fill behind it.

There is, however, new evidence for our hypothesis from Morton's excavations. We cannot be sure, from Morton's published work, where exactly his Nabataean and Moabite "Northern Entranceway" was located, but his section and description (Morton 1989: 242-243: FIG. 4: Section H) are of great importance. His section (elevation?) shows that the highest preserved structural feature (the Nabataean gate) reaches 101.63 m. We note that his Moabite wall XIX (which is part of his Moabite gate) rests on bedrock and the road *through* the Gateway was on the surface of bedrock which rises towards the south. At the extreme southern end of his section, this road-surface has already reached about 98.05 m and could reach at least 99.00 m as the occupation level of the city inside the walls.[2] This is very close to the levels of Me-

[2] On a visit to Dhībān after the Conference, Mr. Pedrette took sights which demonstrated that the easternmost face (Wall X) of Morton's (1989: Section H, FIG. 4) crosses the 95.00 m and 100.00 m contour lines in the contour plan of *Dhībān I*: PL. 85.

sha's Qarḥoh to the south. We can probably assume, therefore, that Mesha's intention was to make the occupation surface of his new royal quarter accord with that of the older city to the north.

We believe that we are in a position to extrapolate from these results and estimate the size of Mesha's royal quarter. For this we should now examine the contour map (FIG. 1). The areas we have treated above constitute a rather exiguous perimeter, on the east, southeast and south, of a "bulge" — a projection of the 100.00 m contour line. The extension north of the Hall to accommodate a bath complex almost coincides with the sharp deviation of the contour line from what we would expect. In the Gateway area, we know that Wall 12 continues to the west beyond our excavation and either meets or encompasses the small knoll marked by the 105.00 m contour line.[3] The contour line then turns sharply north to rejoin the assumed original 100.00 m line of the original city wall. We now hypothesize that the great bulge of the 100.00 m contour line to the south constitutes the area of Mesha's Qarḥoh, and we have drawn a broken line on the contour map (FIG. 1) to suggest the possible south wall of the earlier Moabite city to which Mesha's royal quarter was an annex.

If it is necessary to justify such a hypothesis, we need only note several supporting arguments:

1) The Mesha Inscription was composed after Mesha had consolidated his kingdom. His building programme assumes a period of prosperity and confidence in the future.
2) As a result of his conquests, there would be the manpower and resources to carry out such works.
3) Prosperity would have led to an increase in the population of Dhībān and required an expansion in living space for the population. Note the reference (*MI*: 24-25) to houses being built in the new quarter.
4) A new quarter would have been required to accommodate government officials and staff (the bureaucracy) for the administration of the kingdom, a resident defence force (for the citadel), and public buildings, which would reflect both the new status of the city as the capital of a prosperous state and the glory of its god, Chemosh, who — through the might of Mesha — had made all this possible.

If the area on the *tall* covered by the "bulge" represents the extent of Mesha's annex, we may accept Pedrette's calculations (TABLE 5) for the area covered, the average depth of the fill, and its volume. We may, also, assume that the great battered wall surrounded the new quarter, except at the north where it adjoined the original city and its wall, even if — as in the case of a gate entering the quarter — a similar defensive complex were involved. If the size of Mesha's quarter as we propose is accepted, we can hope that some trace of the buildings and amenities referred to in his inscription may still await discovery in the unexplored area of the southeast quadrant of the *tall*.

**Table 5.** Entire Citadel Area: Quantities.

| | | |
|---|---|---|
| Surface area of bulge in southeast quadrant, south of assumed original city wall as shown in FIG. 1 | = | 7434 m² |
| Total surface of Areas I-IV = 1856 m²; total volume = 11,872 m³. Dividing 11,872 m³ by 1856 m², we obtain an average depth of fill | = | 6.40 m |
| By assuming an overall average depth of fill (6.40 m) and surface area (7434 m²) = 6.40 x 7434 m² we obtain volume of fill | = | 47,578 m³ |
| Assuming wall follows 100.00 m contour, length of wall, excluding original city wall to north | = | 285 m |
| Assuming battered wall has same average height as fill, face area of wall (285 x 6.40 m) | = | 1824 m² |

## Mesha's Royal Quarter: Its Artificial Fill and Retaining Wall (P. H. Pedrette)

*General*

Mathematical calculations aside, the intention of this paper is to provide hypothetical answers to the questions concerning labour and material resources involved in the construction of the podium on which Mesha's buildings rested.

The podium is assumed to be the bulge in the southeast quadrant of the *tall* projecting southward from the dotted line shown on the contour map (FIG. 1); it has a surface area of 7434 m². From the excavations carried out in 1950-1953, the fill appears to consist of local soil, retained over much, if not all, of its circumference, by a

[3] On our post-Conference visit to Dhībān, we noted that this knoll had been "excavated" and revealed a rectangular stone tower. The masonry was certainly not Moabite, nor Nabataean (no diagonal dressing). Could it be the Roman "t[ow]er" referred to in the inscription found at the site and dated to AD 245/246 (Tushingham 1955)? It appears to be based on a continuation of Wall 12 (FIG. 2)

battered stone wall (Wall III, FIG. 2) with an average thickness of 2.35 m.[4] Unfortunately, details of the construction of the battered Wall P in the "Gateway" area are unavailable.

The face of Wall III consists of stones measuring 40-60 cm high and 30-80 cm long, roughly dressed and coursed, without mortar but with numerous small stones apparently used to level the larger dressed stones. Behind the facing stones, the wall is built of smaller undressed stones, laid without coursing or bonding, resting, in turn, against another battered "wall" (Wall II, FIG. 2) composed of rough stones and *ḥuwwar* chunks.

The wall leans inward on the fill at an angle of approximately 15° from the vertical with corner stones, up to one metre in length laid at right angles to the line of the batter (FIG. 3).[5]

The amount of time taken to perform each particular task can be estimated with relative accuracy. It is assumed that soil for the fill was dug up, loaded into leather panniers, transported by camel, dumped where needed, and then compacted. Similar assumptions have been made for the stone used to construct the battered wall.

One factor, however, involves considerable speculation, namely the distance that the soil and stone were transported. In the construction of the podium, the man (and animal) hours taken to transport material becomes the major variant in arriving at the total manpower employed.

For the purposes of this exercise it is assumed that the soil for the fill was obtained from areas up to 1.25 km around the site, and that the stone may have been quarried from the face of a hill a short distance (1-1.5 km) north of Dhībān (FIG. 4).[6]

Another factor requiring some consideration is the scheduling of the work. For example, if 1000 man-days are needed to perform a task, does one assume ten men working one hundred days or one hundred men working ten days? The total man-days amounts to the same in both cases. I have assumed what I believe to be the most efficient combination considering the scope of the whole project.

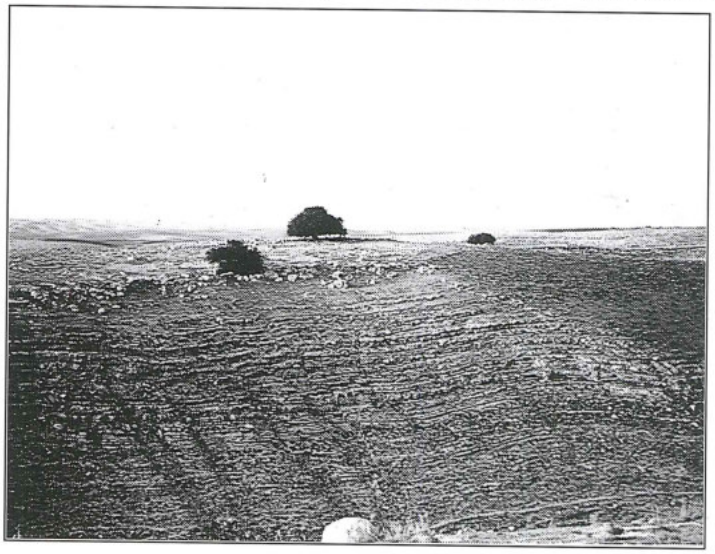
*The Fill*

Taking the transport distance of 1.25 km into account and referring to TABLE 6, we find that it requires 0.71 man-days to obtain, transport, and deposit one cubic metre of fill at the site. As the quantity to be so moved is 47,578 m³ (TABLE 5), the total man-days required is 47,578 m³ multiplied by 0.71 man-days, giving a total of 33,780 man-days to place all the fill.

I believe that this large volume of fill and number of man-days would have required a fairly large work-force



3. View of battered wall from east, showing corner where wall turns sharply to west (*Dhībān I*: PL. 4:1).



4. View of south side of hill a short distance north of Dhībān showing stratigraphy.

[4] Winnett (*Dhībān I*: 14) gives a thickness of 2.25-3.25 m for this wall. Our Plan 2 of *Dhībān II* with the assumed upward extension of the sloping wall to a height of 100.00 m suggests a thickness of slightly over 2 m. We have predicted an average thickness of 2.35 m.

[5] Both the batter and treatment of bonding at the quoin is reminiscent of the structures illustrated in Kletter (1991: 37, FIGS. 7 and 8). Was this a traditional usage?

[6] The stratified layers of stone in such a deposit would have made quarrying relatively simple — only requiring rough shaping.

**Table 6.** Fill: man-day requirements per cubic metre.
Time in minutes for one man, to dig, load into panniers, transport specified distance, deposit, spread, level and compact and return for next load - per one cubic metre.

| Distance (in metres) | 500 | 750 | 1000 | 1250 | 1500 | 2000 | 2500 |
|---|---|---|---|---|---|---|---|
| Excavate (in minutes) | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| Transport (in minutes) | 140 | 160 | 180 | 200 | 220 | 280 | 340 |
| Deposit (in minutes) | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Supervise (in minutes) | 13 | 15 | 17 | 19 | 22 | 27 | 31 |
| Overhead (in minutes) | 30 | 34 | 38 | 42 | 46 | 58 | 66 |
| Total: In minutes | 348 | 374 | 400 | 426 | 453 | 530 | 602 |
| In hours | 5.80 | 6.23 | 6.67 | 7.10 | 7.55 | 8.83 | 10.03 |
| In days | 0.58 | 0.62 | 0.67 | 0.71 | 0.76 | 0.88 | 1.00 |

*Assumptions:*

| | |
|---|---|
| Man-day | A man-day consists of ten hours. |
| Excavate | The worker digs the surface soil with hand tools. Soil when excavated will increase in bulk by 15%. |
| Transport | Transportation is in camel-carried panniers, each camel carrying 1/4 of a cubic metre. |
| Deposit | Soil will be dumped from panniers, spread evenly, and compacted by trampling under foot. |
| Supervise | Average time taken by overseer to locate areas to dig and to supervise transportation and deposition of soil in correct location. |
| Overhead | Amount of time taken to make and repair tools and panniers and to settle disputes, feed workforce and |

— I suggest 400 persons. Dividing the total number of man-days (33,780) by this number of men (400), gives 84 days; this is the length of time the fill project would take to complete. Allowing for work stoppages resulting from possible holy days, illness, and the need to attend to other work projects, we may estimate a round figure of three months to finish this part of the podium project.

*The Battered Wall*

Turning now to the battered wall, from an engineering point of view, the wall and the fill are mutually sustaining and must have been built concurrently. The vertical walls and buttresses apparently supporting the fill inside the battered wall in Area IV (*Dhībān I*: PL. 24:1; *Dhībān II*: Section F-F) are perhaps to be interpreted as stabilizing walls for, in no case, could they have retained the deep 10 m fill in this area. While there could be — and would probably have to be — a building up of the fill to some extent before the revetting wall could be built, I have treated the two operations as concurrent.

On this assumption, I have estimated the time that it would take to obtain the material and build the wall. Separate tables for breaking out, dressing, transporting and laying the stone work are included in TABLE 7.

The length of the wall is 285 m, on the assumption that it follows the 100.00 m contour line. I have assumed its average height to be 6.40 m which is the average height of the fill.

The length of 285 m multiplied by the height of 6.40 m gives the wall a face area of 1824 m$^2$. Referring to TABLE 7 under the column showing a transported distance of 1.5 km, we find that the number of man-days taken to build one square metre (face area) of wall, 2.35 m thick, is 4.14 man-days. The total face area of the wall, 1824 m$^2$, multiplied by 4.14 man-days gives a total of 7551 man-days to construct the wall.

This 7551 man-days needed to build the stone wall, divided by the 84-day construction period established for placing the fill, shows that 90 men would be needed over that period to build the wall.

The total work force required to place the fill (400) and, at the same time, build the battered wall (90 men), over the 84-day period is, therefore, 490 men.

**Summary**

From Pedrette's analysis of the project — in its architectural, management and human components — we can conclude that, in round figures, the podium took roughly 500 men, working continuously on a 10-hour day, three months to complete the construction of the podium.

The method determining the size of the work-force as described above is based on some known and some assumed facts, and on certain established estimating principles and data.

However, he recognizes that this information is not the whole story; the size, source and skill of the potential labour force, the acknowledged popular support for the project (*MI*: 28), the economic strength of the nation and,

time lost due to injuries.

**Table 7.** Wall: man-day requirements per square metre of wall face.

Time in minutes for one man, to break out rock, roughly dress surface of stones, load into panniers, transport by camel specified distance, unload, carry to proper location and lay in wall. Per square metre of wall face, 2.35 m thick.

| **Distance (in metres)** | **750** | **1000** | **1250** | **1500** | **1750** | **2000** | **3000** |
|---|---|---|---|---|---|---|---|
| Break out (in minutes) | 465 | 465 | 465 | 465 | 465 | 465 | 465 |
| Dress stones (in minutes) | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| Load (in minutes) | 145 | 145 | 145 | 145 | 145 | 145 | 145 |
| Transport (in minutes) | 282 | 338 | 388 | 440 | 542 | 595 | 802 |
| Unload (in minutes) | 94 | 94 | 94 | 94 | 94 | 94 | 94 |
| Build wall (in minutes) | 745 | 745 | 745 | 745 | 745 | 745 | 745 |
| Supervise (in minutes) | 110 | 124 | 138 | 155 | 169 | 183 | 282 |
| Overhead (in minutes) | 232 | 258 | 285 | 310 | 337 | 362 | 465 |
| Total: In minutes | 2203 | 2299 | 2390 | 2484 | 2627 | 2719 | 3128 |
| In hours | 36.72 | 38.32 | 39.84 | 41.40 | 43.78 | 45.32 | 52.14 |
| In days | 3.67 | 3.83 | 3.98 | 4.14 | 4.38 | 4.53 | 5.21 |

*Assumptions*

| | |
|---|---|
| Break out | The worker will break out the surface rock with hand tools. |
| Dress surface | Stones will be roughly squared and the exposed face smoothed with a metal chisel. |
| Transport | Smaller stones will be carried by camels in panniers and larger stones pulled by camels on wooden sleds. |
| Build wall | The wall will be built battered with larger dressed stones on the outer face. |
| Supervise | The average time taken by the overseer to locate areas of rock and to supervise dressing of stone, transporting and laying of stones in approximately level courses. |
| Overhead | The amount of time taken to make and repair tools and panniers and to settle disputes, feed workforce and time lost due to injuries. |

probably most important, the political enterprise and assurance of the ruler, were of prime importance to the accomplishment of King Mesha's project. From the evidences of the work still preserved to us and the language of the Mesha Inscription, we can conclude that the ambitious scheme was carried through to completion.

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# Remarques sur la métrologie et le projet architectural de quelques monuments d'époque hellénistique et romaine en Transjordanie

L'étude du décor architectural du Qaṣr al-'Abd de 'Irāq al-Amīr, près d'Amman, du sanctuaire et de la porte Sud de Jarash, ainsi que du temple de Dharīḥ, près de Ṭafīla, m'ont donné l'occasion de faire quelques observations préliminaires sur les unités de mesure utilisées, les projets architecturaux et les difficultés de mise en oeuvre, ainsi que les tracés préparant la taille du décor architectural:

1. La recherche de l'unité de mesure employée pour la construction d'un bâtiment est difficile pour trois raisons: 1) la précision de la mise en oeuvre est fréquemment approximative, même sur des édifices de prestige et de grande envergure, comme le Qaṣr al-'Abd de 'Irāq al-Amīr. 2) L'assise du bâtiment a souvent été ébranlée par un tremblement de terre et les murs se sont affaissés, ce qui fausse les mesures. 3) La ruine du bâtiment limite les possibilités de vérification en élévation. Pour ces raisons, quelques mesures isolées sur une construction donnent en général des résultats peu clairs. Pour trouver la valeur de l'unité de mesure, il faut évidemment prendre aussi précisément que possible les mesures maxima en plan au sol, celles qui ont défini l'emplacement et le tracé du bâtiment, car elles ont beaucoup de chances d'avoir été mesurées exactement et parce qu'elles correspondent normalement, pour une construction non modifiée, à un nombre entier d'unités. A partir de là, une fois définie une unité de mesure hypothétique, il faut essayer de la vérifier sur les divisions du plan et de l'élévation. Pour cette dernière, l'organisation du décor est d'un grand secours car la hauteur des colonnes et de l'ordre complet correspondent normalement aussi à un nombre entier d'unités de mesure, de même que la largeur à la base et la hauteur des baies rectangulaires. Enfin, les parties du décor, tels que les bases de colonnes, les chapiteaux et les entablements sont également construits sur la base de l'unité de mesure:
   - Au Qaṣr de 'Irāq al-Amīr[1], construit probablement vers 175-170 avant J.-C., les difficultés étaient cumulées: le bâtiment présente de grosses irrégularités dans ses mesures, inattendues pour une construction aussi fastueuse, et qui traduisent sans doute la hâte et peut-être la relative inexpérience des maçons devant un projet de cette envergure; ainsi, sur ce plan apparemment symétrique, les pièces latérales des vestibules nord et sud ne sont pas de la même largeur, car il a fallu repousser un peu les murs 7 et 8 pour installer au nord-est et au sud-est les cages d'escalier. D'autre part, il est resté inachevé, si bien que la plupart des blocs ont gardé leur bosse de chantier, qui est forcément irrégulière. Enfin, il a été ruiné par un tremblement de terre au IVème siècle après J.-C.[2], ce qui explique peut-être que les largeurs des petits côtés nord et sud présentent une différence de 13 cm[3] (FIG. 1). Malgré ces désordres, il est facile de voir que la longueur des longs côtés est double de celle des petits côtés, et que les deux façades sont divisées en trois parties égales au nu des demi-colonnes du porche, ce qui nous donnait déjà trois multiples probables de l'unité de mesure. L'élévation devait nous permettre de préciser la valeur de cette unité car la hauteur du niveau 1 est égale aussi au tiers de la largeur de la façade et la hauteur des trois niveaux superposés du décor extérieur sont étagés dans une proportion décroissante de 4, 3, 2[4] (FIGS. 2 et 3). Ces rapports simples permettaient aisément de trouver un sous-multiple commun et d'en déduire l'utilisation au Qaṣr de la coudée royale égyptienne de 52,5cm, utilisée également en Palestine[5]. L'emploi de cette mesure a ensuite été

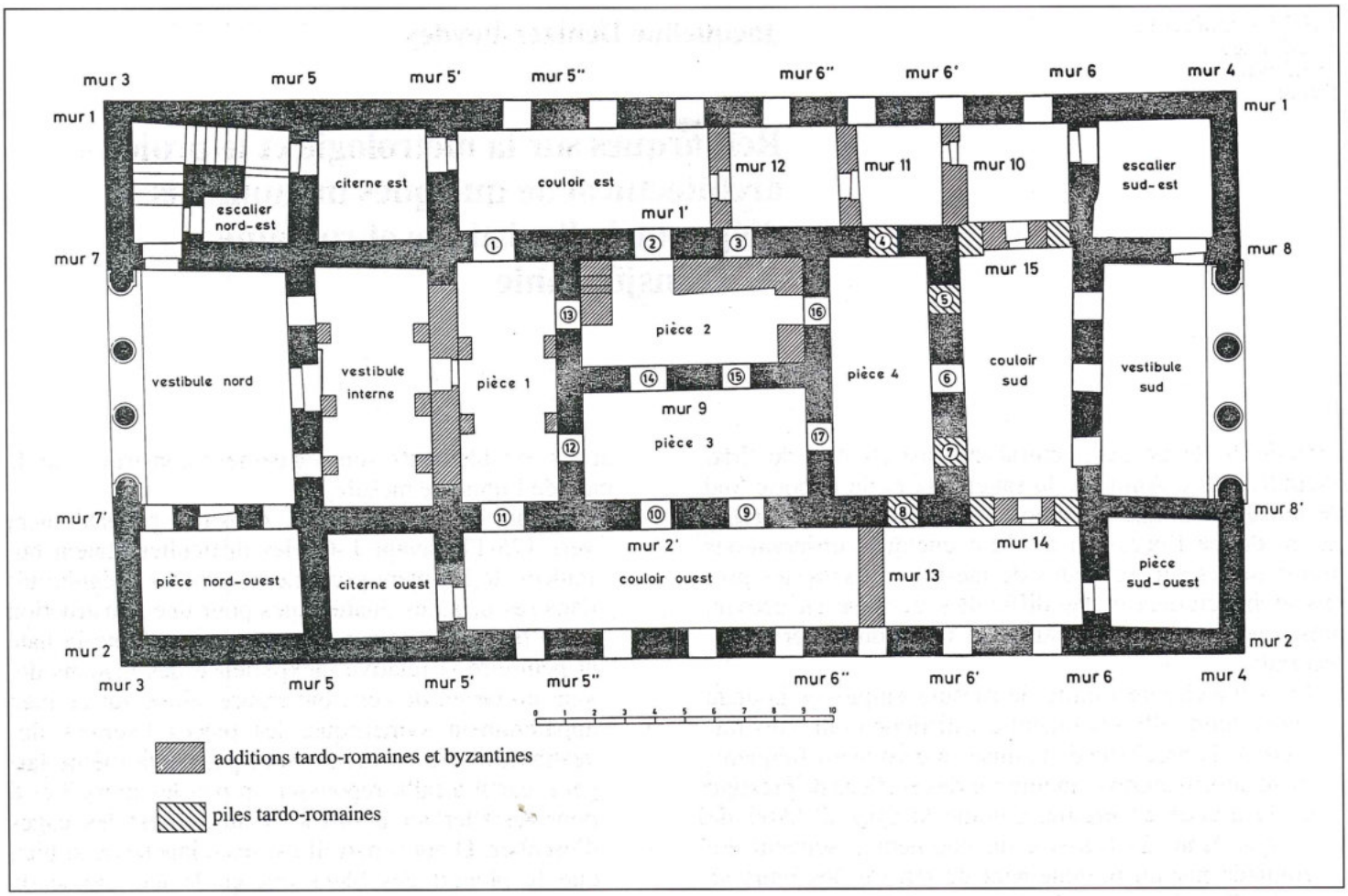
[1] E. Will, F. Larché et coll., *'Iraq al Amir, le château du tobiade Hyrcan, BAH,* CXXXII, Paris, 1991.

[2] E. Will, F. Larché, *'Iraq al Amir*, p. 101-102.

[3] J. Dentzer-Feydy, dans E. Will, F. Larché, *'Iraq al Amir*, p. 135-137 et Pl. 9.

[4] J. Dentzer-Feydy, *Ibid.*, p. 135-138 et PLS. 20, 36.

[5] Voir par exemple R. de Vaux, *Les institutions de l'Ancien Testament,* Paris, 1961, 2ème édition, vol. 1, p. 299-302.




1. Plan schématique du Qaṣr de 'Irāq al-Amīr, d'après E. Will, F. Larché, *'Iraq al Amir*, p.50, FIG. 4.

vérifié par les dimensions et la construction des différentes parties du décor[6]. L'examen de l'état restitué de la façade nord (FIG. 2) permet de remarquer la stéréotomie très particulière de ce bâtiment hellénistique: les blocs ont à chaque assise des dimensions et des formes qui varient en fonction de la place qu'ils occupent, et ils s'emboîtent fréquemment avec des décrochements[7].

- La même unité de mesure égypto-palestinienne a, semble t-il, été utilisée sur le temple nabatéen de Dharīḥ[8] (FIG. 5), situé non loin du sanctuaire de Khirbat Tannūr et probablement construit au Ier siècle après J.-C.: la largeur totale de l'édifice au nu du mur est égale à 16,80m, soit 32 coudées de 0,525m, mais sa longueur totale (22,85m environ), qui devra être précisée[9], ne paraît pas correspondre à un multiple exact de la coudée. En ce qui concerne la façade, en revanche (FIG. 6), dont la hauteur d'élévation est sûre jusqu'au sommet du chapiteau[10], la division en coudées est claire: les pilastres et demi-colonnes de l'ordre extérieur mesurent 20 coudées de haut et le soffite de linteau de la porte est situé à une hauteur de10 coudées.
- A la porte sud de Jarash, qui fut probablement construite comme l'arc de triomphe à l'occasion du passage d'Hadrien en 129-130[11], l'unité de mesure est un pied de +-0,292m, un peu plus court que le pied romain courant de 0,296m. La longueur totale du bâtiment faisait 72 pieds de long, divisés en quatre parties égales de18 pieds correspondant aux axes des baies (FIG. 7). La profondeur totale du bâtiment est également de 18 pieds, et la hauteur totale de la colonne de l'ordre principal est de 36 pieds, soit la moitié de la longueur et le double de la largeur.

6 J. Dentzer-Feydy, dans E. Will, F. Larché, *'Iraq al Amir*, p. 161 sq.

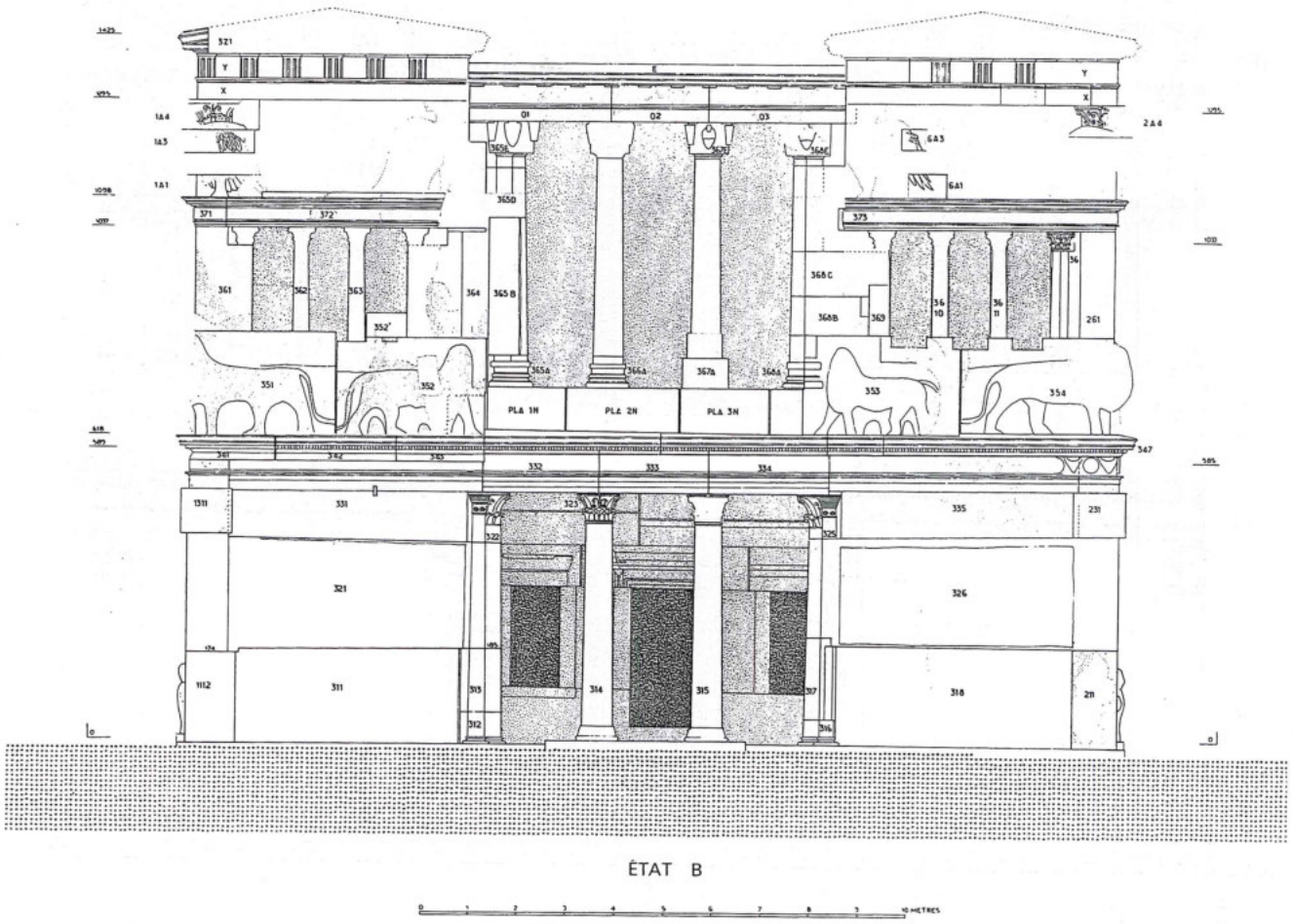
7 E. Will, F. Larché, *Ibid.*, p. 128-129.

8 F. Villeneuve, Z. Moheisen, CRAI, avril-juin 1988, p. 471-477; J. Dentzer-Feydy, *ARAM*, 2, 1 et 2, 1990, p. 229-234; Id., dans *Syria*, supplément (à paraître).

9 Le mur du fond du temple s'est affaissé vers l'extérieur et sa base est encore actuellement dissimulée sous les éboulements.

10 Sont incertaines la place exacte des deux fenêtres et du champ sculpté situé au-dessus de la porte, ainsi que la hauteur de l'entablement dont l'architrave n'a pas été retrouvée.

11 C. H. Kraeling, *Gerasa, City of the Decapolis,* New-Haven, 1937, p. 50.

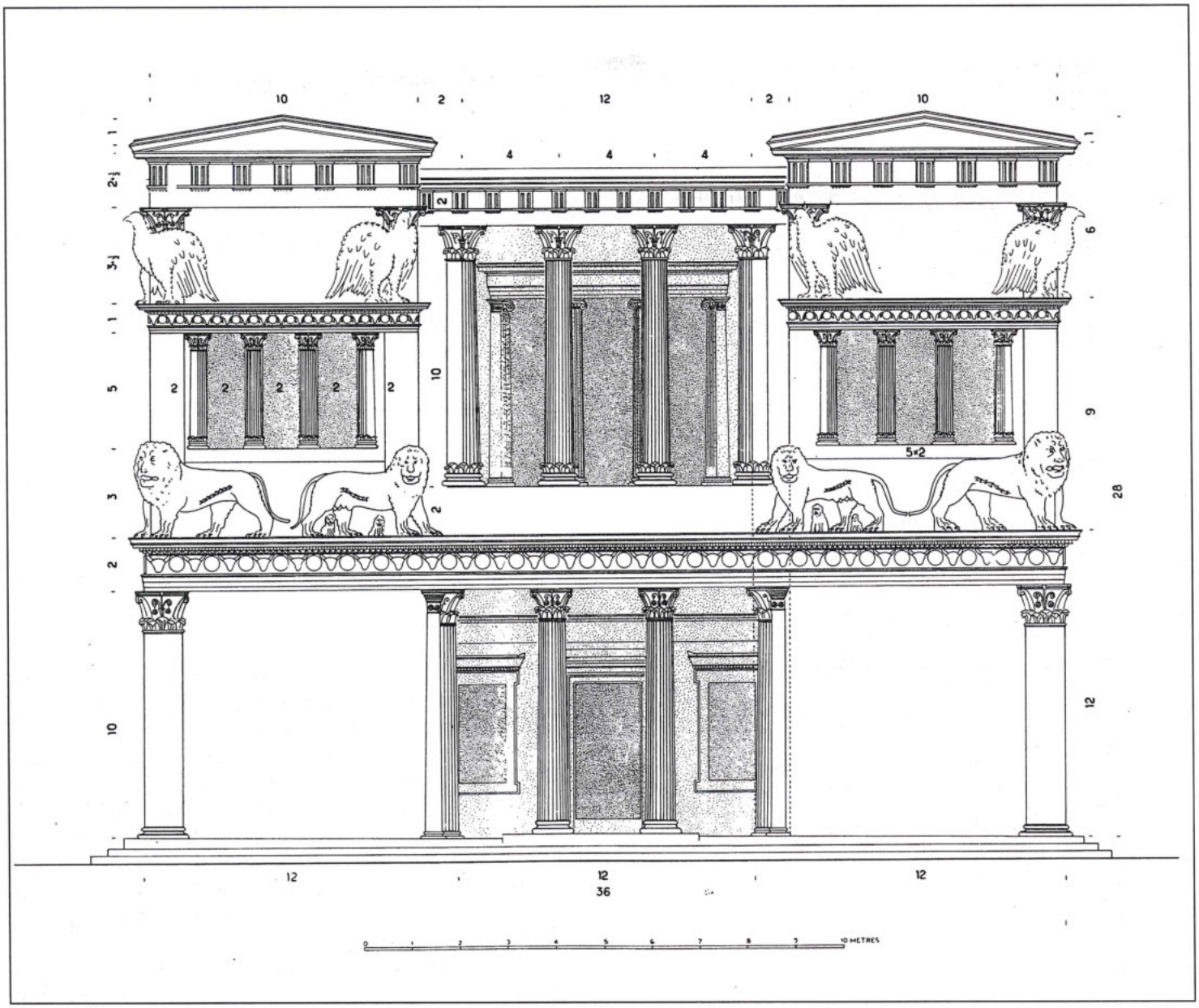



2. Face nord restituée du Qaṣr de ʿIrāq al-Amīr, d'après E. Will, F. Larché, *ʿIraq al Amir*, PL. 20, état B.

Comme au Qaṣr de ʿIrāq al-Amīr, on remarque des erreurs de plusieurs centimètres dans la taille des assises, qui trahissent une grande hâte; elles ont été compensées tant bien que mal et rattrapées par une mise au niveau horizontal à certaines hauteurs de la construction. On remarque également que la préparation des blocs d'assise est tout à fait différente de celle que l'on a vue à ʿIrāq al-Amīr: les assises ont toutes plus ou moins une même hauteur correspondant à deux pieds de haut, ce qui permet d'imaginer une commande et une préparation quasi industrielles pour la taille de ces blocs.

2. Si les mesures principales du plan et les divisions de l'élévation par les ordres et les baies correspondent normalement à des nombres entiers d'unités de mesure, on remarque au contraire que l'espacement des colonnes et des pilastres est traité avec une certaine liberté. Cette liberté est d'autant plus grande que la plupart des ordres sont appliqués, et que leur utilisation est donc plus décorative que fonctionnelle. Dans certains cas, les irrégularités remarquées sont facilement imputables à des difficultés ou à des erreurs de mise en oeuvre, dans d'autres cas, on peut les attribuer à une organisation voulue:

- Au Qaṣr de ʿIrāq al-Amīr, la somme des entraxes du porche nord correspond à 13 coudées alors qu'elle correspond à 12 coudées à la loggia nord, qui surmonte le porche, si bien que les colonnes ne sont pas

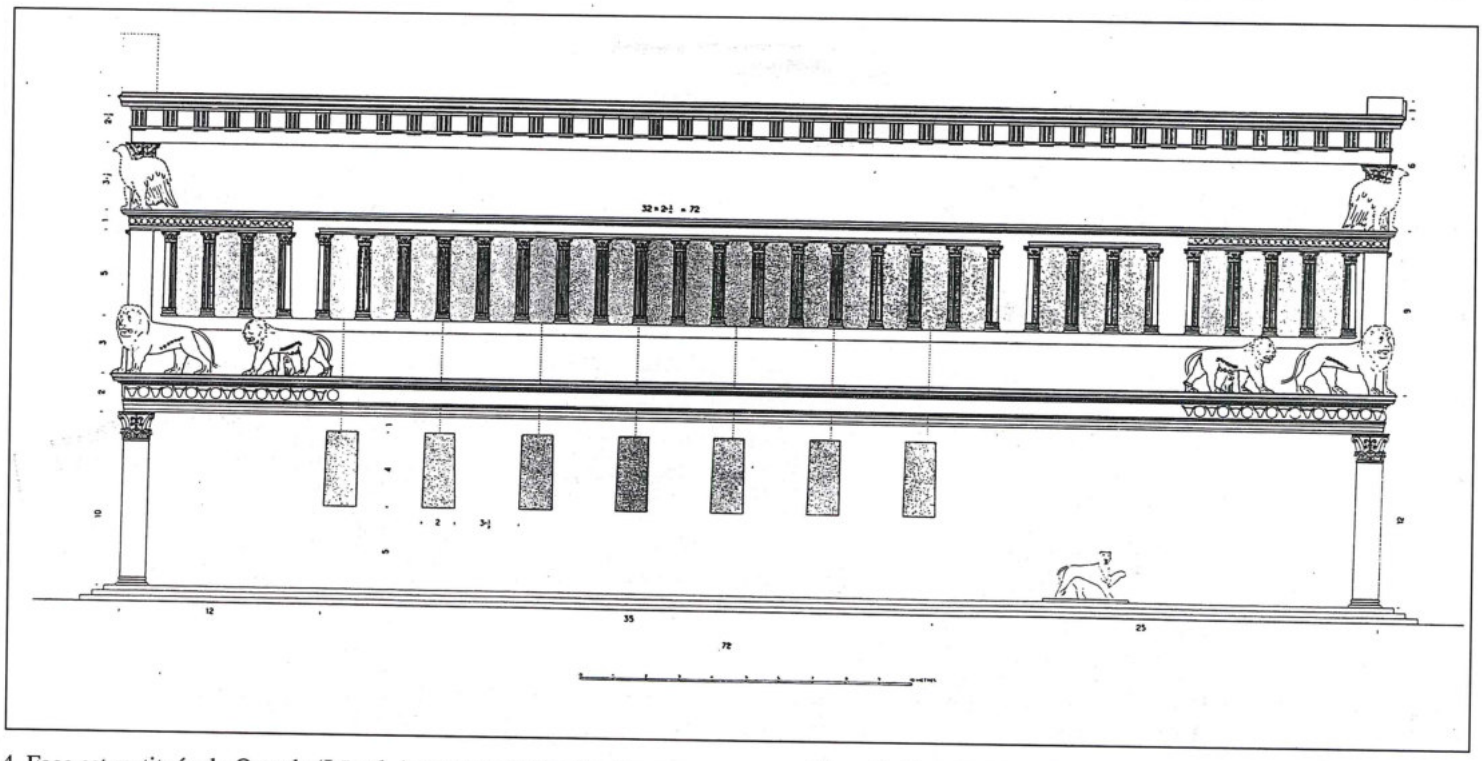



3. Face nord restituée du Qaṣr de 'Irāq al-Amīr, avec indication des mesures en coudées, d'après E. Will, F. Larché, *'Iraq al Amir,* PL. 36.

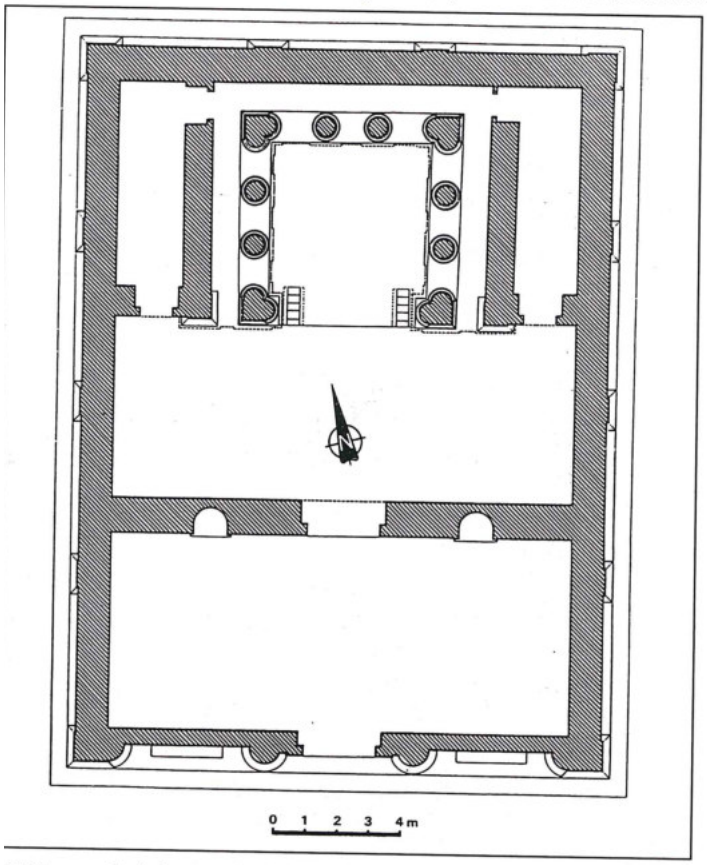
exactement à l'aplomb (FIGS. 2 et 3). Alors que la façade sud du Qaṣr devrait être divisée en trois parties égales, comme la façade nord, des désordres, causés sans doute par l'agrandissement de la cage d'escalier située dans l'angle sud-est du bâtiment, ont provoqué un élargissement en façade du massif sud-est de 0,80m par rapport au massif sud-ouest, soit une erreur de 15%! Cette grosse irrégularité se répercute sur l'entraxe des trumeaux des fenêtres du deuxième niveau. Par ailleurs, sur les longs côtés du Qaṣr (FIG. 4), l'ordonnance restituée des fenêtres du deuxième niveau à partir des blocs conservés permet de constater un étirement de l'entraxe des trumeaux, d'une largeur de 2 coudées 1/4, au lieu de 2 coudées sur la façade nord. Malgré un élargissement de l'entraxe des fenêtres du niveau 1, on n'a manifestement pas réussi à aligner les axes des fenêtres du niveau 2 sur les axes des fenêtres du niveau 1[12].

- Au temple de Dharīḥ (FIG. 5), les axes médians des pilastres de la face arrière sont distants exactement de10 coudées (5,25m), alors que l'on constate un léger étirement des entraxes des pilastres sur les longs côtés (5,40m = 10 coudées et 2 paumes). De même, on remarque que les demi-colonnes ap-

[12] J. Dentzer-Feydy, dans E. Will, F. Larché, *'Iraq al Amir*, p. 139.



4. Face est restituée du Qaṣr de 'Irāq al-Amīr, avec indication des mesures en coudées, d'après E. Will, F. Larché, *'Iraq al Amir,* PL. 39.




5. Plan restitué du temple de Dharīḥ après la campagne de 1987 (dessin F. Larché, R. de la Noue).

pliquées de façade ont été légèrement désaxées vers le centre, sans doute pour mettre en valeur l'abondant décor végétal et figuré qui était sculpté dans les entrecolonnements latéraux.

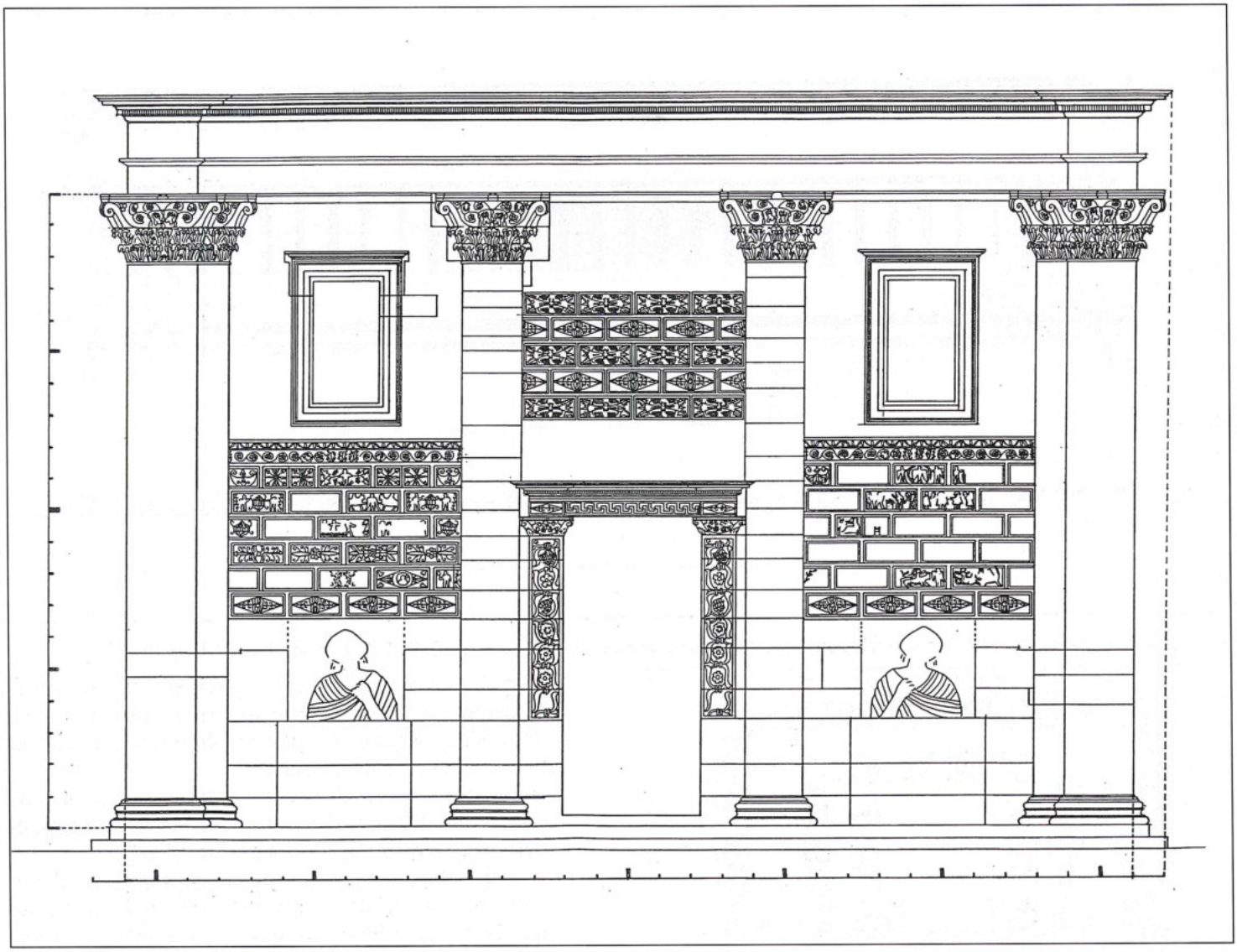
- Bien qu'il s'agisse d'un édifice découvert, le plan du temple de Khirbat Tannūr présente des analogies certaines avec celle du temple de Dharīḥ (FIG. 8)[13]: une enveloppe avec un ordre appliqué de demi-colonnes en façade et des pilastres sur les trois autres faces, un édicule carré, qui est ici centré au lieu d'être au fond de la cella. De même qu'à Dharīḥ, on remarque un léger étirement des entraxes des pilastres sur les faces latérales par rapport à ceux de la face arrière. On remarque également en façade un léger désaxement des demi-colonnes vers les côtés, qui se justifie sans doute ici par la volonté de dégager la porte du temple.

3. L'examen du décor architectural montre que la construction du décor se fait également sur la base métrologique utilisée pour l'ensemble du monument, mais que celle-ci subit aussi des adaptations ainsi que quelques distorsions dues à des erreurs. Nous avons essayé de montrer sur quelles trames ont été tracés les éléments du décor architectural du Qaṣr de 'Irāq al-Amīr[14]. Nous prendrons ici comme exemples des tracés de construction relevés sur des chapiteaux corinthiens:

- Au temple de Dharīḥ, le chapiteau 3.200, qui cou-

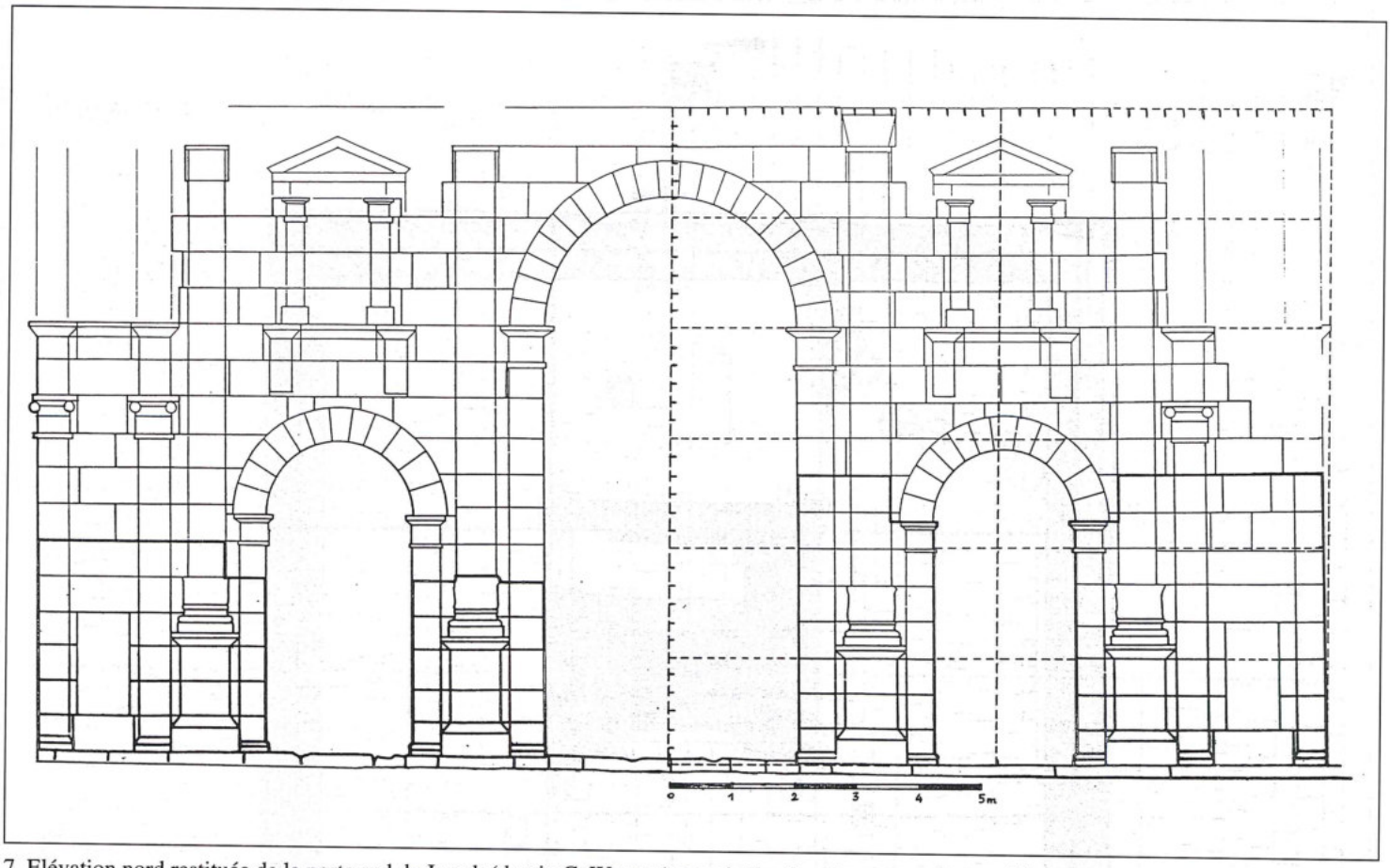
[13] N. Glueck, *Deities and Dolphins,* New-York, 1965, plan A, p. 621.

[14] J. Dentzer-Feydy, dans E. Will, F. Larché, *'Iraq al Amir*, p.162-164, 168-173, 180-185, 197-207.



6. Façade restituée du temple de Dharīḥ (dessin F. Larché) avec indication des mesures en coudées: 16,80m = 32 coudées.

ronnait une des colonnes de l'édicule de l'adyton, a conservé sur l'abaque ses tracés de construction constitués des deux axes de symétrie et de leurs diagonales correspondant aux volutes angulaires, d'un carré dont le côté de 67,5cm est égal au diamètre inférieur du chapiteau, et de fragments d'un autre tracé parallèle à ce carré (FIG. 9). On voit également sur ce relevé un cercle plus ou moins régulier, qui correspond à la saillie maximum de la couronne de feuilles d'acanthe du chapiteau. Sur la restitution du tracé initial de l'abaque (FIG. 10), on a indiqué en pointillé le diamètre inférieur de la colonne inscrit dans le premier carré, puis prolongé les traits parallèles, qui sont tangents à la courbe concave de l'abaque; puis on a tracé les tangentes au cercle formé par les couronnes de feuilles; enfin, connaissant grâce à un fragment de volute la largeur maximum de l'abaque, qui est égale à 1,35m, on a pu inscrire l'ensemble de cet abaque dans un grand carré, dont le côté représente le double du diamètre inférieur du chapiteau. Si l'on divise le côté du carré le plus grand en 20 parties de 6,75cm, on se rend compte que cette construction obéit à une division tout à fait régulière: 10 parties pour le diamètre inférieur et 5 parties de chaque côté correspondant aux saillies de l'abaque, de la couronne de feuilles et des angles de l'abaque. On remarque que 1,35m correspondent à 18 paumes de 7,5cm, mais que pour la construction du chapiteau, cette dimension a été divisée en 20 parties, ce qui signifie que chaque partie correspond à 9/10 d'une paume. Par ailleurs, on remarque que la hauteur du chapiteau (0,72m sans l'astragale) est, comme il est normal, un peu supérieure au diamètre inférieur et que son décor est également construit sur une division en 10: 3 parties pour la première rangée de feuilles, 2 pour la deuxième rangée, 4 pour le ca-




7. Elévation nord restituée de la porte sud de Jarash (dessin C. Wagner) avec indication des mesures en coudées.

lathos et 1 pour l'abaque (FIG. 9). La hauteur de ce chapiteau, astragale compris, est de 0,75m, soit 10 paumes, pour un diamètre inférieur de 0,675m, soit neuf paumes.

- Le même type de tracé a été vu sur un chapiteau accollé aux trois-quarts du sanctuaire de Khirbat Tannūr (FIG. 11)[15], ce qui nous permet de restituer le tracé d'origine (FIG.12).
- Sur plusieurs chapiteaux de demi-colonnes de Pétra, conservés au musée et provenant du téménos du Qaṣr al-Bint, on peut relever des tracés identiques sur l'abaque (FIGS.12 à 19). Malgré des erreurs mineures de mesures et quelques repentirs dans le tracé (chapiteau 12, FIG.17, chapiteau 23, FIG.19), on voit qu'ils ont été construits sur une même base métrologique: un carré intérieur de 8 paumes de côté (= 2 pieds de 30 cm) et un carré extérieur de 10 paumes de côté, tangent à la courbe concave de l'abaque. Sur la restitution proposée ici (FIG. 14), l'abaque du demi-chapiteau s'inscrit dans deux carrés jointifs de 7 paumes (=1 coudée) de côté chacun.
- A Qaṣr-Qārūn/Dionysias en Egypte[16], les abaques des chapiteaux corinthiens portent des tracés gravés tout à fait analogues, et le lit d'attente du bloc inférieur de ces chapiteaux porte le tracé en rayons qui facilitait la mise en place correcte des feuilles.

Un examen plus étendu permettrait de mentionner de nombreux autres exemples dans la région syro-palestinienne ainsi que dans toutes les autres régions du monde gréco-romain. Ce qu'il faut souligner ici, c'est le fait qu'à partir de mesures d'ensemble calculées en unités métrologiques, la construction du décor architectural obéit ensuite, pour chaque élément pris isolément (base, chapiteau, entablement) à un système de division proportionnelle qui s'écarte des divisions de l'unité de mesure. C'est un fait bien connu grâce aux descriptions des ordres que donne Vitruve[17]; il a également été mis en relief par H. Bauer pour les chapiteaux corinthiens hellénistiques[18] et vérifié au Qaṣr de 'Irāq al-Amīr[19]. On est également frappé, sur ces pièces de belle qualité, par les

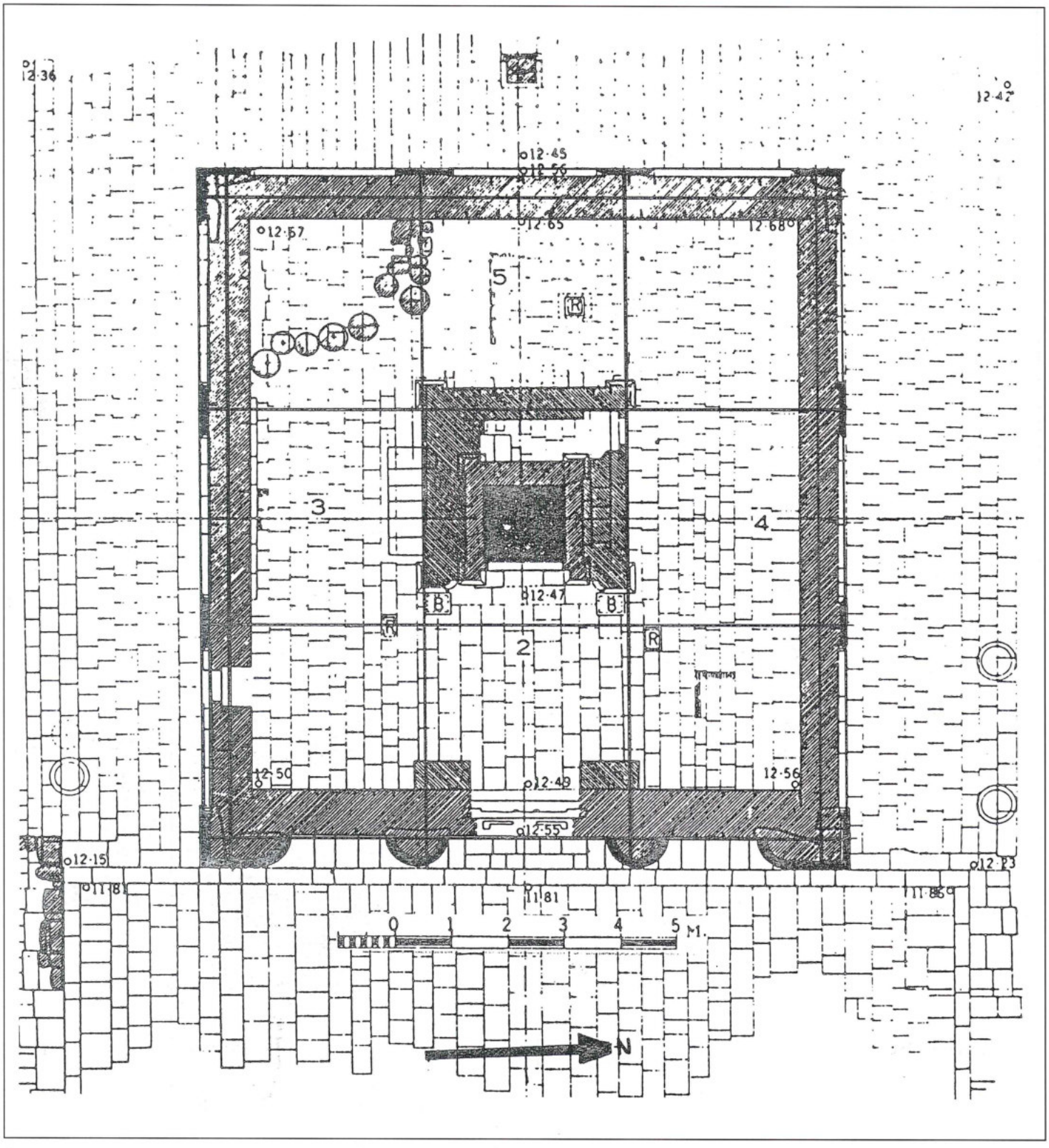
15 N. Glueck, *Deities and Dolphins*, PL. 174, b.

16 J. Schwartz, *Qasr-Qârûn/Dionysias* 1950, Fouilles franco-suisses, Rapports II, Le Caire, 1969, p. 52 et s., FIGS. 38 à 41.

17 Pour la construction des chapiteaux corinthiens, cf. Vitruve, *De architectura*, IV, ch. 1, 11-12.

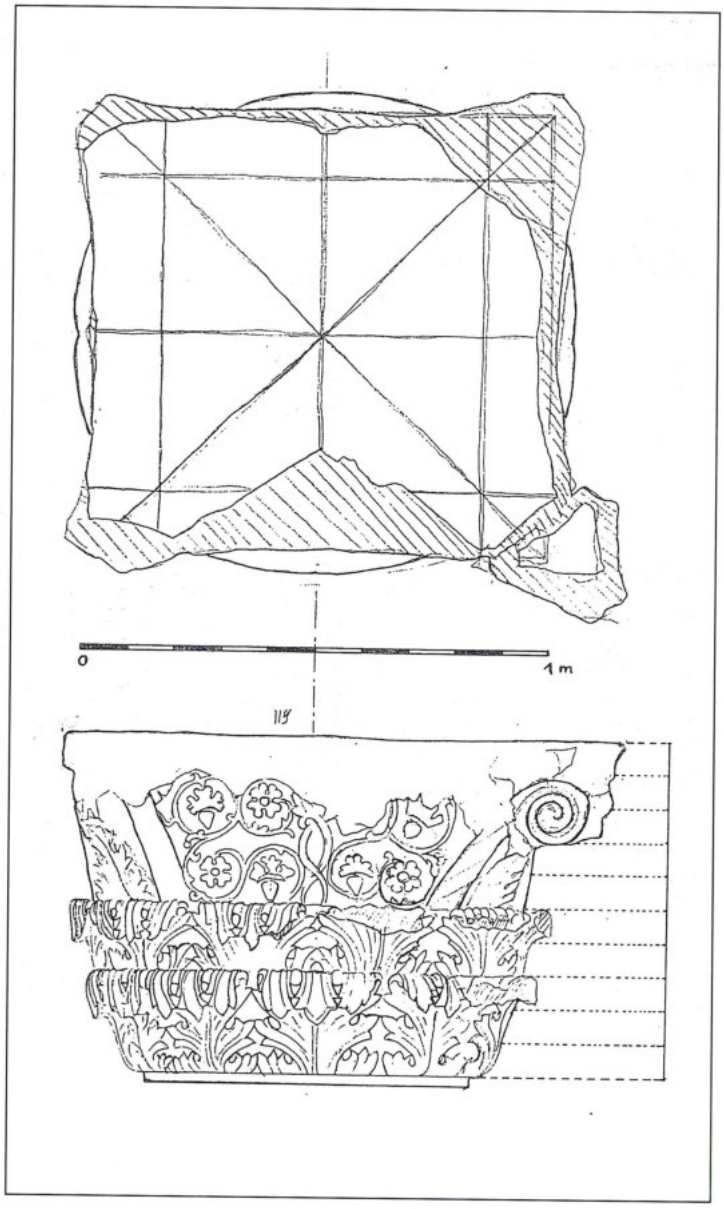
18 H. Bauer, *Korinthische Kapitelle des 4. und 3. Jahrhunderts v. Chr.*, MdaI Ath. Abt. 3. Beiheft, Berlin, 1973, par exemple, sur le chapiteau K1 de la tholos d'Epidaure, Beil.15, sur le chapiteau K1 de l'Asklepieion d'Athènes, Beil.16, sur le chapiteau K1 du Philippeion d'Olympie, Beil.17, sur le chapiteau K1 du temple de Zeus à Némée, Beil.18.

19 J. Dentzer-Feydy, dans E. Will, F. Larché, *'Iraq al-Amir*, p. 168-173.

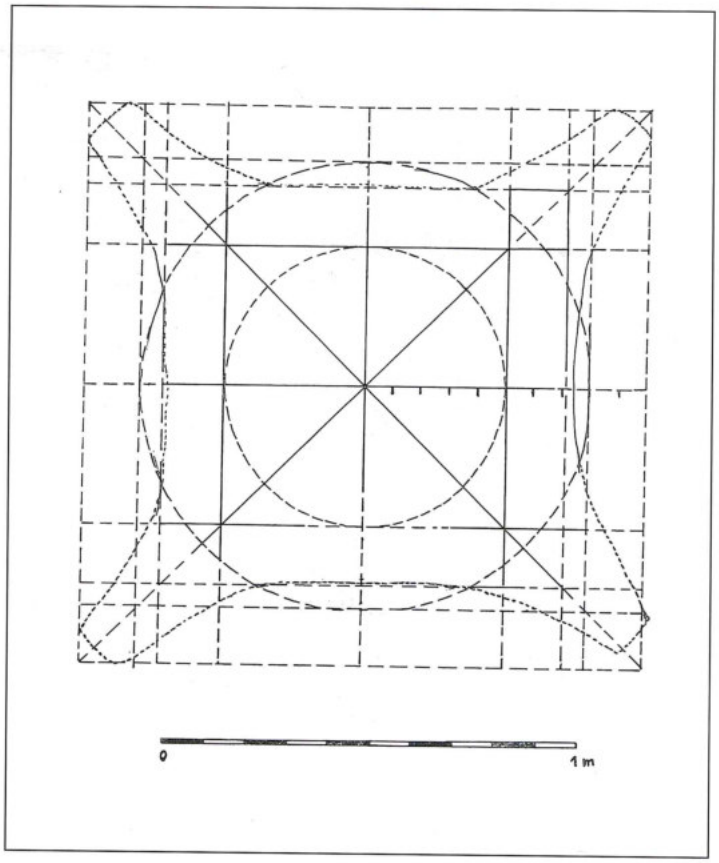



8. Plan du temple de Khirbat Tannnūr, d'après N. Glueck, *Deities and Dolphins*, New-York, 1965, plan A, p. 621.

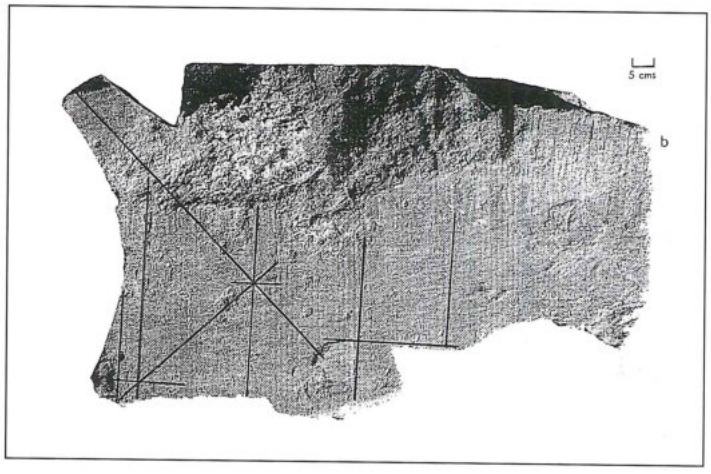
approximations de mesures et les repentirs décelables dans les tracés. Ces petites irrégularités, généralement invisibles sans mesures précises, doivent inciter à une certaine prudence dans la recherche des schémas de décor architectural: le schéma de construction original ainsi que les mesures utilisées ressortent souvent de l'examen de plusieurs pièces, qui permet de définir une moyenne ainsi que des marges d'erreur.



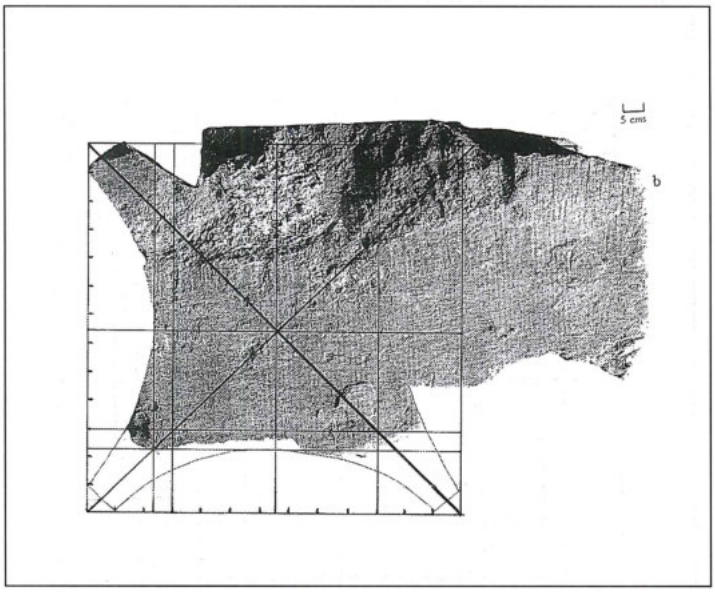

9. Temple de Dharīḥ, chapiteau 3.200 avec tracés de construction sur l'abaque (dessin R. de la Noue).



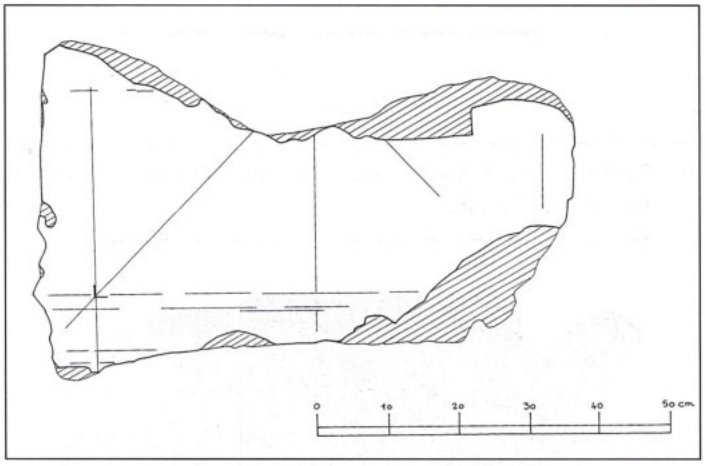

10. Temple de Dharīḥ, chapiteau 3.200, restitution des tracés de construction sur l'abaque.



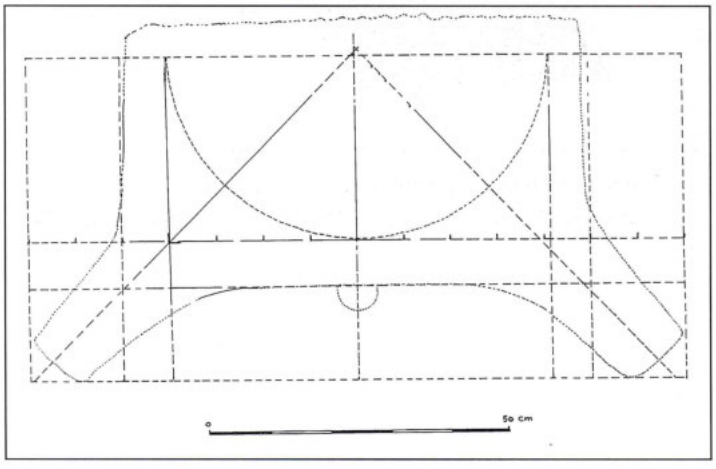

11. Temple de Khirbat Tannūrōtracés de construction sur l'abaque d'un chapiteau, d'après N. Glueck, *Deities and Dolphins,* PL. 174 b.



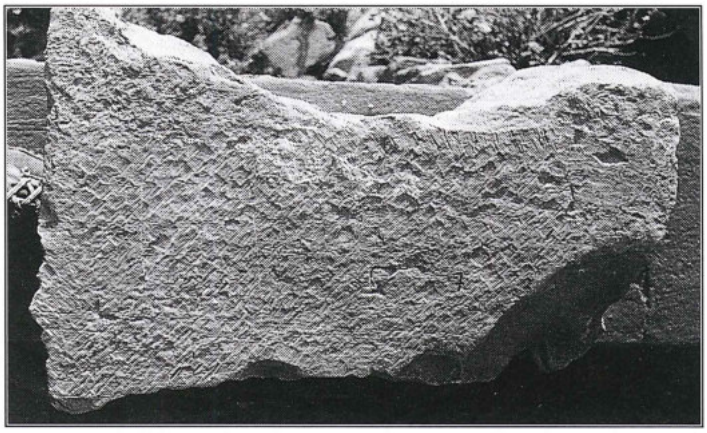

12. Temple de Khirbat Tannūr, restitution des tracés de construction sur l'abaque d'un chapiteau, d'après N. Glueck, *Deities and Dolphins,* PL. 174 b.




13. Tracés de construction sur l'abaque du chapiteau n° 7 au musée de Pétra.



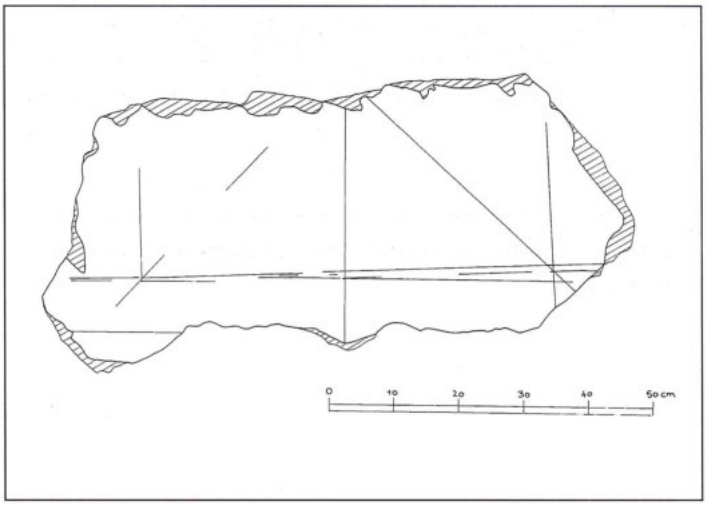

14. Restitution des tracés de construction sur l'abaque du chapiteau n° 7 au musée de Pétra.



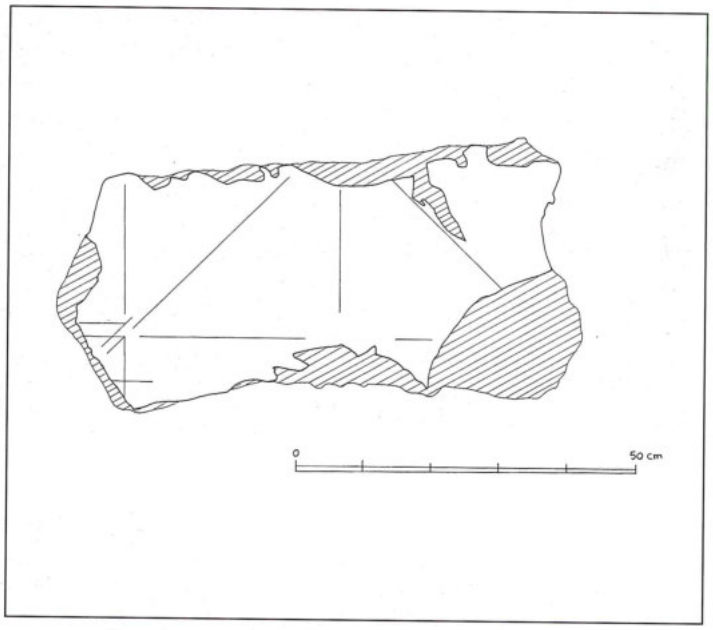
15. Musée de Pétra, chapiteau n° 7 .



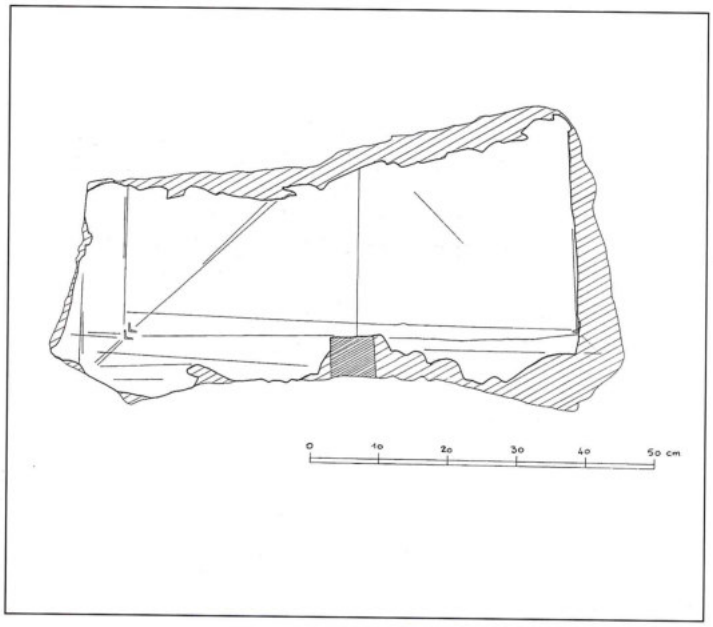
16. Musée de Pétra, chapiteau n° 7.




17. Tracés de construction sur l'abaque du chapiteau n° 12 au musée de Pétra.




18. Tracés de construction sur l'abaque du chapiteau n°18 au musée de Pétra.




19. Tracés de construction sur l'abaque du chapiteau n°23 au musée de Pétra.

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**Giorgio Gullini**

# From Hermogenes to Apollodorus of Damascus: Architects and Urbanists between Hellenism and Late Antiquity

The eastern provinces of the Roman Empire, mainly those of the Syro-Palestinian area, have preserved eminent and important architectural evidence, especially within the second and third centuries AD. This was the period during which the most important towns of the region renovated their looks, both for a great economic growth and for their often integral rebuilding interventions (with imperial funds) after disastrous earthquakes. One of the most evident examples is, undoubtedly, Jarash: from Trajan's period on, it offers a very new palaeography. It does not only modify the development of the plan of the urban quarters, but also the exploitation of the public areas and, consequently their significance in the plan design. The colonnaded streets with tetrapylons at the crossings and the oval piazza are the formal terms of a new town, which, I think, is the product of the Syrian architectural school of the middle Imperial period, during one of the most creative phases of the building culture from middle Hellenism to late Antiquity.

Asiatic Hellenism was deeply rooted in local tradition between the second and third centuries AD, combined with eastern contributions from behind the *limes*. This resulted in a very original architectural culture which entered Rome with one of the most famous members of that school, Apollodorus of Damascus. It offered building features and patterns with a space interpretation very similar to what we intend today for a present town.

For these reasons, I think that in the case of Jarash the usual identification of the colonnaded streets as *cardines* and *decumani* are completely incorrect. The regularity of the plan cannot be related, except for the general geometric form, to the Roman *limitatio*. This is aimed at the best area division for settlements or productive fields; the dimensions and modulation of the colonnaded arteries bring attention to such definite space which is typical of the town, intended as a place for meetings, exchanges and relationships. All these activities are independent from the production of the area occupied by the town and especially of that of the surrounding land. Still today we can use a lucky expression born in the storiography some decades ago: "caravan towns"; it is valid only if we want to underline the new idea of the urban space intended mainly as "relational" space. I mean the space expressed and articulated for the demands and needs of the city and for all the activities of the citizens. It concerns the relationships with other people and, more generally, with the outside world.

As I said, Jarash offers one of the most significant examples and also, at least in the planning if not in the execution, one of the more ancient. The project to which, I think, the inscription of the North Gate refers, can go back to the Trajanic period, although many decades passed before its fulfilment.[1]

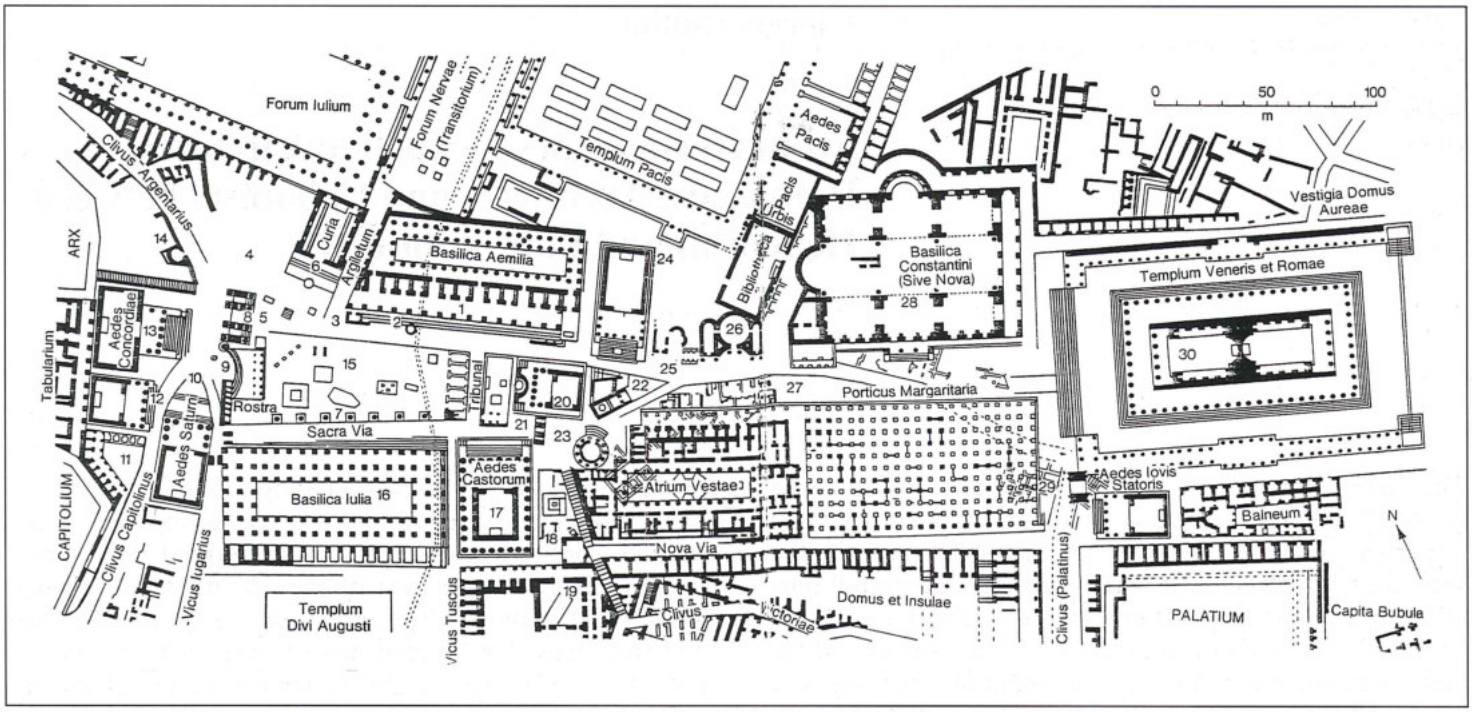
The plan is the manifestation of an architectural culture that, I think, is the same as the great Trajanic project concerning Rome,[2] which by cutting the saddle between Capitolium and Quirinal, gave the definite solution to the political and economical centre of the town (FIG. 1). It did not only solve the problem of the directional structures, the s. c. Markets, and of the new dwelling typologies, the *insulae*, but it also offered a new organisation of the exploitable spaces, both for streets and, particularly, for the relational and economic activities. It represented the tissue of the town as a meeting and living place for the citizens, instead of the forum, or better the forums, crowded with political, civil and ceremonial activities.

Before illustrating the Trajanic project and linking it to the school of Apollodorus, the great architect and urbanist, I would like to explore the origins and the development of the above-mentioned architectural school.

During the Imperial period that school had great importance in transforming the ancient Greek civilization (Classical and Hellenistic) as well as its Republican and first Imperial continuity, towards performances which, even if they do not deny those roots, are coherent with the new world; it is the origin of our present culture.

1 *Mesopotamia* 18-19 (1983-84).

2 G. Gullini, 'L'architettura e l'Urbanistica', in *Princeps Urbium*, Milano 1991, pp. 645-704, FIGS. 549-557, TAV. LXXVII-LXXX.




1. Plan of the *Foro Romano* (after F. Coarelli, *Guida archeologica di Roma,* Roma 1980, pp. 50-51).

I think that these origins should be found in that very interesting period of middle Hellenistic architecture connected by the most recent storiography to Hermogenes and to his school, at least in Asia Minor and in the Aegean area. This school is famous thanks to Vitruvius, who lived in the Augustan period, about two centuries later than Hermogenes, but still declaring himself a Hermogenes pupil. And Vitruvius, in spite of his limitations, is still the most important ancient source and the greatest reference for any research about the history of ancient architecture up to the Augustan period.

Hermogenes' personality and his contribution to the trend of the Hellenistic architecture of Asia Minor were recently studied during a dedicated symposium.[3] After determining his activity between 220 and 150 BC, his contribution was recognized as the most original concerning the study and expression of the dimensional relationships between plan and construction. The building is not intended as an independent block within the infinite space, but as an artifact inserted into the portion of this space that is defined and made appreciable by the suitably foreseen structures enclosing the main monument.

These structures were primarily the first performance in architecture of a new problem not faced up till that period: the relationship between the built artifact and the immediately surrounding space. As far as we are concerned, we can speak of the first essay to express the *objectivation of the space* by the enclosing structures. This meaning starts from the middle Hellenism and becomes increasingly more important later on. The space till then had only a mental category, even if meant through the synthesis of the three dimensions represented by the three segments converging in a vertex, each one being the abstraction of any possible movement on a surface.

The completely changed meaning, which I consider to be the reflection on architecture of the Euclidean geometry, reaches out of Asia Minor, with different expressions in Greece and in the Western Countries. I think it really began in Alexandria. The Alexandrian school, which is very little documented, had a fundamental function in the expression of this new space meaning: the most important evidence, beside the "Palace of Columns" of Ptolemaid Cyraenaica, is in Sicily at the times of Hieron II. The culture of the island in that period was very much influenced by that of Alexandria. This culture entered Rome after the first Punic war (266-241 BC) and it was developed in the city before the impact of the other Hellenistic schools at the end of the second century BC.

The early attention in the western countries, Italy and Sicily, to the large interior spaces of the "relational" type, intended mainly as civil spaces, can be confirmed through the description given by Diodorus of the majestic dining room with 60 *klinai*, built by Agatokles toward the end of the fourth century BC in his Syracuse palace, and of the big Gymnasium hall in Posidonia which may be dated to the time of Alexander the Mo-

[3] W. Hoepfner and E. L. Schwandner (eds.), *Hermogenes und die hochhellenistische Architektur.* Internationale Kolloquium in Berlin vom 28 bis 29 Juli 1988, Mainz a. R. 1990

lossus.

This formula, expressed by the typologies of enclosed areas, and cut out in the tissue of the town, seems to be preferred by the Roman architects who proposed original solutions from the end of the third century BC onward. A significant example is given by the *Macellum*, the first building for a public market designed for food transactions (last decade of the third century BC) and in the extended type of *horrea*, storehouses surrounding an interior courtyard (first half of the second century BC).[4]

The calculated implementation of the axial relationship of orientation and of the points of view revealed by the Hermogenes' design of Magnesia, both in the Artemision and in the Agora, did not inspire the creations of Roman architecture between the third and last quarter of the second century BC, which seems to be more connected to the Alexandrian school. In fact, it brings to full realization in architecture of the perspective illusionism, such as in the upper Sanctuary of the Fortuna Primigenia at Palestrina, 39 kms from Rome.[5]

The series of colonnades on the ramps and on the terraces make a fusion of the space defined by the construction with the landscape space, in a double meaning of representation of fiction and reality. Following the fundamental Greek idea of art intended as reproduction of reality, it brings at around 150 BC, as said in the famous Plinian expression: *cessavit deinde ars* (the art ceased), followed by a more reassuring *ac rursus revixit* (and immediately was revived). This could be said by a later writer (first century AD) who saw the reminiscence to the simple spatial objectivation which followed the illusionism of the third quarter of the second century BC. The meaning of the expression of Plinius, or better of his late Hellenistic source, became very important in the history of architecture thanks to the effects of such a critical attitude.

This is the origin of a space defined by a portico intended to put in the foreground the main building on the short side, opposite the entrance of the architecturally organised enclosure. It is the new meaning of the old Forum in Rome with the *Tabularium*, built as a facade of the Capitolium, overriding the axis of the Via Sacra. The same formula marks the plans of the Forum of Caesar and of the Forum of Augustus, while the porticoes behind the theatre at Pompey, in the Campus Martius, are even closer to the original Hermogenes idea of the objectivation of the enclosed space.

The idea of the monumental square, historically born as a reaction to the perspective illusionism, becomes a planned expression of the commitment as one of the most intelligible media. The cultual dedicaces follow a political aim and become part of the State organisation's language and, above all, of the Emperor's will.

In the eastern provinces, and particularly in the Syro-Palestinian area where the radiation of the Hellenistic culture from Alexandria and later on mainly from Antioch were deeply influenced by cultural contacts from behind the eastern *limes*, the formula stimulates, in terms of grandiose architectural expression, the development of a space as a place for the people who enter and exploit it. Its perimeter, or better the facades enclosing it, help to suggest, through their layout, the possible way of exploiting the defined space.

This is a new formula of the meaning of the space I called, as mentioned above, "relational", in opposition to the "tridimensional" one, which is defined by lines corresponding to the three dimensions; these are expressed by the structures which are thought to be significant to the perceptibility of the space.

The continuity of the Hellenistic culture in the Syro-Palestinian imperial architecture can be proved by the fronts modulated by the colonnaded curtains and intended mainly as structures finalized to a spatial definition. So the space gets its specific "human", especially "urban" dimension, becoming a protagonist of a new meaning and image of the town. That is exactly what we wanted to perceive at Jarash and, in general, in the monumental manifestations of many towns of the Syro-Palestinian area.

These manifestations illustrate a real school of architects to which Apollodorus belongs by right of birth. He was lucky to meet Trajan and, after being the main officer of his engineers army in the Dacian campaign, he become his great planner and architect. It is him who elaborated the project Trajan became able to afford, thanks to the financial resources coming from the gold mines of the newly acquired province. This project represented the final urban frame of the capital of the Empire; in fact it does not concern only the Forum and the Markets, realized by cutting the saddle between Capitolium and Quirinal, but also the organisation of a larger area in the north, at the foothill of the Quirinal. This became a model quarter of the new idea of the town, which I explained above and which is well documented up till now by the area of the Markets.

To this project we also have to add the baths on the Oppio hill with their revolutionary plan and the architectural design linked with a strict technological logic of the new port at the mouth of Tiber, which should definitely assure all the supplies to a town with a population of more than one million.

I think it was useful to illustrate this project for Rome, inquiring for the roots of this meaning in the monuments of the Syro-Palestinian area in the early and middle Imperial periods.

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Gullini 1991, TAV. XIX; LIX,3

[5] Gullini 1991, TAV. VIII-XI; FIGS. 457-466.

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# Public Building Design and Techniques in Roman Imperial Times: Achievements in Gerasa

Two well known dedicatory inscriptions provoke speculations, once again, on the Gerasa city plan. The first inscription gives reason to ascribe the responsibility of a new urban organization to the policy of Trajan: the emperor is clearly indicated as the founder of the city in the double text on the panels of the North Gate (Welles 1938: Inscr. 56-57; dated AD 115; see also Parapetti 1983-84: 62).

On entering the city through the North Gate, the plan introduces the main colonnaded thoroughfare, oriented northeast-southwest, perfectly focused on the Zeus temple. This is crossed by two transversal streets, also colonnaded, and marked at the cross points by two tetrapyla in accordance with the standard of urban planning of the same period and under the same patronage in most cities of the Roman East, above all in Apamea and Antioch.[1]

The other inscription, fifteen years later, on the "Triumphal Arch" (Welles 1938: Inscr. 58, dated AD 130) is dedicated to Hadrian, apparently to commemorate the emperor's visit to Gerasa.

On entering the city from the side of the "Triumphal Arch", the point of view is focused exactly at the Artemis Temple;[2] to the left, the Hippodrome follows in the same direction. This latter orientation, in keeping with the geographic north, can also be recognized elsewhere, mainly in the layout of the Circassian town east of the wadi, seen in the earliest aerial photographs (FIG. 1). The Circassian community, which settled on the site in the second half of the 19th century, obviously took advantage of the still standing structures, then following the pre-existing orthogonal layout.

These two distinct orientations, associated with the two principal shrines of the city, suggest a cultic bipolarity (Zeus-Artemis) which might have underlain the growth and development of Gerasa as a synoikistic phenomenon based on the unification of two distinct settlements connected with the two ancestral sanctuaries (Pierobon 1983-84: 32).

The sanctuary of Zeus is documented to have undergone numerous changes from the earliest *naos* dated back to the turn of the second century BC, to the octastyle temple on the upper terrace in AD 166. As for the present form of the sanctuary of the Artemis complex, it is known to have been built during the period from AD 150 to 160. A previous shrine must have already existed in AD 75 — judging by epigraphic sources — however, so far, nothing earlier than the second century has come to light.

As to when the unification of the two original settlements could have taken place, the actual urban configuration seems not to precede the beginning of the second century AD, under Trajan. Only the existing main thoroughfare layout, yet to be precisely dated, could be traced to earlier times. However, the ionic colonnade flanking it near the North Tetrapylon was realized around the turn of the second century AD (Ball 1986: 386). The Southern Transversal Street, on the other hand, was not traced before AD 170 (Gawlikowsky 1986: 109). Moreover, the stretch of the defensive wall immediately west of the South Gate was never built before the turn of the fourth century AD (Seigne 1986: 55).[3]

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The two cities were razed to the ground in AD 115, by the tremendous earthquake that struck all of northern Syria. According to epigraphic sources, Trajan, being in Antioch during the event, decided on the immediate reconstruction of the city. In Apamea, soon after that date, the new city was planned starting from its northern end, above the complete leveling of the ruins. No stratigraphical evidence earlier than the second century AD (apart from the theatre) has been identified so far by the Belgian expedition working there, making evident the originality of the plan, of which a pre-existing "Hellenistic" layout cannot, then, be affirmed.

Of historical interest, beyond the present theme, is the relation of the enormous importance of the Artemis shrine in Gerasa's town planning and the direct imperial intervention towards that specific cult. In this respect it should be observed that no coins earlier than Hadrian — known so far — refer to Artemis as "Tyche Gerason" (Pierobon 1983-84: 33).

3 This discovery is of such importance that new excavations along the city walls should be planned, especially in connection with the Northwestern Gate, which according to the inscription mentioned above refers to the Artemis cult. If the late dating of the wall is to be confirmed, the hypothesis of the gate being a "propylaeum" of the earlier Artemision, only later inserted into the wall enclosure, can be put forward, while the possibility of a translocation of the monument appears extremely distant.




1. Aerial photograph of Jarash, R.A.F. 1926: 1: Zeus Temple, 2: Artemis Temple, 3: Hippodrome, 4: North Tetrapylon, 5: South Tetrapylon, 6: North Gate, 7: South Gate, 8: Triumphal Arch.

Such a diachronic reconstruction implies that we should consider a revision of the belief that city walls and street systems were already inextricably linked together in the second half of the first century (Kraeling 1938: 41ff). This was mainly based on the association of the alignment of the Northern Transversal Street with the Northwestern Gate, dated to AD 75-76 by the inscription on its flat arch (Welles 1938: Inscr. 50).

The puzzling question of the presence a necropolis within the city walls, not far from the Artemis Temple — against Roman burial law — used till at least the end of the first century, can be explained: Gerasa, having no physical boundary till the fourth century AD, should have been developed as an open city.[4]

Another intriguing question in the town planning of Gerasa is the relationship of the "Triumphal Arch" to the project of the city's extension to the south as a Hadrianic initiative, which was apparently realized only by the construction of the Hippodrome (Ostrasz 1991: 240). The Hadrianic plan was very likely much larger; it foresaw new quarters — mainly east of the wadi — as shown above, with the street network oriented parallel to the visual axis of the Triumphal Arch-Artemis Temple. Consequently, the opening of the Southern Transversal Street, as well as the Via Sacra of the Artemision — both served by bridges — provided the connection to the eastern sector of the city only after that project.

The Triumphal Arch, or more appropriately the *South Gate*, and the North Gate, therefore, should be seen as a means to monumentalize the southern and the northern beginnings of the urban thoroughfare. The so called "South Gate" can be assumed, instead, to have been actually built in connection with the latest remodeling of the Sanctuary of Zeus, as its "propylaeum".

Within the building achievements that followed the Trajanic and the succeeding Hadrianic masterplans, the topographic and altimetric location of the principal cultic poles — the second Olympeion and the second Artemision — in replanning the two old fashioned building complexes by the Antonines, was chosen exactly in keeping with the directions fixed by the North Gate and the *South Gate*/Triumphal Arch. It should also be noted that the springing level of the Antonine Temple of Zeus coincides with the observer's horizon from the North Gate, and that its deviation from orthogonality with the view point suggests the differing layout of the older sanctuary. Similarly, from the South Gate the deviated orientation of the Temple of Artemis points to its "other" main axis on which the Via Sacra is based.

What has been so far discussed has to be ascribed to an urban model, developed without discontinuity and with an extraordinary fortune, both in space and time, up to the latest Roman town planning achievements. The model coincides with the diffusion of the Hellenistic culture and its absorption by Rome. Such a diffusion witnesses the vitality of the Hellenistic model which, within its political and cultural ideology, was able to integrate various cultural milieux linked by the same urban life-style.

Within this life-style, Gerasa, judging from what has been recognized so far — although lacking any knowledge of the dwelling patterns — displays all these features in their most developed form.

The dominating and most common feature is the regular orthogonal layout pattern of the town plan, which is typical of the cities built in plains. In hilly areas, many diverse solutions were adopted, based on the adjustment of the geomorphological discontinuity by regular terracing. In the latter town planning, the planner's effort was dedicated to scenographic solutions; in the former, the aim was to underline the street hierarchy.

In Gerasa both solutions were applied. Most evident is the perfect execution of the "orientative projects", which finalize the design in its legibility. The urban area is defined by the "symbolic" representation of the limit between the city itself and its municipal territory through the emphasis given to the monumental accesses.

The colonnades flanking the main streets became the most characteristic feature in North Africa, Asia Minor, Syria and Arabia, where they were commonly adopted after the beginning of the second century AD. This feature, due to its repetitive use, is a clear testimony to the grandeur and uniformity of the central power. However, the colonnades along the main streets cannot be regarded simply as an urban decorative element, they imply an original concept of the urban space, which assigns to them the role of creating an organic structural autonomy.

In Palmyra, the median section of the central colonnaded street is lined by 300 m long porticoes. Its south colonnade is formed by a row of columns of uniform module and the rhythm is only interrupted by two arches at the double entrance of the horse-shoe street around the theatre. This solution aims at the achievement of an architectural uniformity where the irregularities of the pre-existing architectural patterns could not have been otherwise integrated into the new plan.

In Apamea, the colonnades along the central *plateia* have variable modules corresponding to the different buildings that they face. The same solution is recognized in Gerasa. The brackets projecting from the column shafts of the higher module to carry the architrave of the smaller module of the colonnade, assure the continuity of the articulated design. This solution gives reason to suggest that the colonnades did not support any roofing but

[4] It is amazing how recent publications such as Gross and Torelli 1988; and Segal 1988, although quoting Gerasa town planning as a "must" of Roman-Hellenistic achievements, refer to the old publications while ignoring recent ones such as *Jerash Archaeological Project 1981-1983*, I (Amman 1986).

they formed a screen consisting of free standing columns which carried an entablature reduced only to the architrave. This can also be deduced from the lack of pertinent friezes and cornices, if it were not a mere coincidence.[5]

In other words, the colonnades — having lost their original function as porticoes due to repetitive use — became a kind of "wall" enclosing the street, which got transformed from an open to an "enveloped space", therefore planned as an architectural entity and conceived as autonomous.

Tetrapyla, tetrakionia and quadrifrons arches can very often be seen along colonnaded streets of varying cultural milieux, also to lead to the materialization of orientative projects. The over-sized isolated columns at the two crossing points, which divide the main section of the central *plateia* of Apamea in three parts, are on the contrary a rare adaptation of the theme.

In Palmyra, the main axis of the Diocletianic Camp is exactly oriented with the visual continuation of the central stretch of the colonnaded street; while the propylaeum of the Sanctuary of Bel represents the focus of the other two segments of the street: the one from the Funerary Temple to the Tetrapylon, and the one from the Monumental Arch to the Bel Propylaeum.

The lighthouse at Leptis Magna focuses the point of view along the colonnaded *plateia* in the city's civic centre, remodeled by Septimius Severus, who made use of the contribution of Syrian architects and builders.

In Gerasa in particular, the task of achieving the conceptually complex urbanistic and architectural design described above, is assigned, by contrast, to simple and standardized pattern. Even upon careful observation, one cannot distinguish between the architectural decorative elements of the second and third centuries AD, neither on stylistic nor technical grounds. Furthermore, to the very standardized architectural elements and decorative patterns, a real serial production does not apply to the realization of such extended building enterprises.

In the Sanctuary of Artemis, for instance, the following should be observed: the long row of columns of the *ambulacrum* on the west side of the Main Colonnaded Street rests on pedestals. Here, one observes the absence of the plinth, in the column bases, the place of which is taken by the upper *fascia* of the pedestal itself. Such anomalies are scarcely common in Gerasa; on the contrary, antithetical solutions in the subdivision of the architectural elements in stone block mouldings are common: pedestal blocks to which are added the plinths of the Attic type base while the *scotia* with the two *tori* are cut in another stone. The same is true of the column shafts: the *imoscapus* moulding can be found either in the block of the base or in the lowest drum. Column drums of the same module (even in the same building) are never of the same height.

This neglect in the tectonic-stereotomy relationship appears at first glance to be a sign of irrational and casual organization of the building process. The phenomenon can be explained by the existence of an intermediate building stage between the quarry and the construction site; there, entire architectural elements (columns, portals, etc.) would have been brought singly to completion. In this way a serial assemblage (a row of similar columns, for instance) would have been established with the least employment of the temporary installation at the building site, by mounting the elements in sequence. Such an organization of the building process explains the "lame" architraves of the colonnades that correspond to the Macellum. It must have been practically impossible for the builders to achieve a uniform level at the top of the capitals if the columns were erected one after the other and without the continuous scaffolding. The task of bringing the facade to an acceptable orthogonal configuration was then given to the architrave. It could have been finished on the spot prior to its erection, providing it, when required, for the adaptation to the contact face with the capitals. The device is perfectly coherent to the architectural outlook as a whole: an astonishing combination of general appearance, with minimum care allocated to the planning of details.

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[5] Even though I do not believe it to be systematic in principle, the unusual solution (not suggested yet in the available literature) is proved in Gerasa at least in the stretch of the street overlooking the lower "West Baths". There the colonnade is actually on the brow of the terraced sidewalk, whose side limit could have been simply a balustrade (Parapetti 1983-84: 47). Additionally, the mutilated entablature, reduced at the simple architrave, is an unorthodox solution that reveals an *ante litteram* "purist" architectural approach (Parapetti 1983-84: 66).

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# The Hippodrome of Gerasa: A Case of the Dichotomy of Art and Building Technology

> "Now these [Building] should be so carried out that account is taken of strength [durability], utility, grace [beauty]." (Vitruvius: I, III, 2).

Nothing relevant can be added to Vitruvius' definition of an accomplished work of architecture. Although the two-millennia-old definition is not very revealing because of its obviousness, it still lays down the basic criteria for a critical assessment of every work of architecture, past and present. Thereby, it lends itself well to the discussion of the architecture of the hippodrome of Gerasa.

Vitruvius' definition of his last-listed criterion reads as follows: "... (account will be taken) of beauty when the appearance of the work shall be pleasing and elegant, and the scale of the constituent parts is justly calculated for symmetry". (Vitruvius: I, III, 2).[1] Vaguely defined as it is, the criterion of aesthetics is, in any case, nugatory for the study of circus architecture. By its very nature, this building type did not offer many opportunities for exercise in aesthetics. The main features of the circus were an expanse of flat ground (the *arena*), a series of rooms (the *carceres*) from which the chariots started the race, and thousands of running metres of seating tiers (the *cavea*) for the spectators. There were parts of the building that could be, and in some cases have been, treated more 'elaborately' than the rest of the structure — the façades of the *carceres*, the entrance gates, the tribunals for the magistrates. There was also the barrier in the middle of the arena, often crowded with pieces of decorative art. However, the main body of the circus was architecturally plain, one might say 'puritanical' in its appearance.

It is perhaps not fortuitous that Vitruvius lists durability of the building as the first of his three criteria. On this he writes: "Account will be taken of durability when the foundations are carried down to the solid ground, and when from each material there is a choice of supplies without parsimony [avarice];..." (loc. cit.). The criterion is definite and entirely clear.

Vitruvius' second-listed criterion of an accomplished work of architecture is put into the following words: "...; (account will be taken) of utility when the sites [space] are arranged without mistake and impediment to their use, and fit a convenient disposition [orientation] for the aspect of each kind; ..." (loc. cit.). This criterion, applying to every building, is especially true of circus architecture. The criterion deals with the function of the building and the function of the circus was paramount in the architecture of this particular building type. In no other building type was the function as determinant a factor for the architectural setting as in the circus. This was due to the fact that the function of the circus was much more complex than the function of any other building of the time. The architectural setting had to meet the requirements of a very complex procedure of chariot racing and, at the same time, the requirements of accommodation of huge crowds of spectators. It is therefore the degree of architectural fulfilment of these requirements that must be the main subject of study of circus architecture.

The procedure of the sport of chariot racing has been studied and presented best by J. H. Humphrey in his pioneer work on Roman circuses (1986). It is assumed here that the reader is acquainted with what Humphrey presented on the subject in the relevant pages of his book (1986: mainly 18-24). The complexity of the procedure of chariot racing is very well revealed there.

The requirements of creating proper conditions for the spectators were less complex, yet by no means a simple affair. They involved the provision of seating accommodation for thousands of people and a suitable entrance/exit system. The seating had to conform to the requirements of basic comfort for the spectators and to ensure good visibility of the events taking place in the

[1] Vitruvius' symmetry is not what is presently understood by this term. His definition is: "Symmetry also is the appropriate harmony arising out of the details of the work itself; the correspondence of each given detail among the separate details to the form of the design as a whole." (Vitruvius: I, II, 4).

arena. The capacity of the entrance/exit system had to ensure an easy access to the seating and, what is more important, a speedy exit of the crowd of spectators from the *cavea.*

As in the case of all other buildings, the building of the circus was the work of an architect. It was he who designed the building and, usually, directed or at least closely supervised its construction. He naturally based his design on a general knowledge of contemporary circus architecture but within the limits of that knowledge (and the demands of and means allotted by the sponsor) the final product was of his own making in every relevant respect.

It could not have been otherwise in the case of Gerasa's hippodrome, designed and built in the second half of the second century AD (Ostrasz 1989a: 71; 1989b: 334; 1991: 240f.). At that time there was — as Humphrey puts it — "... a clearly defined building type of the circus, and no provincial architect commissioned to build a monumental circus would think of changing the fundamentals of that design in so far as it concerned the way in which the building catered for the sport of chariot racing." (1986: 55). Humphrey calls it the canonical circus and writing of the architectural setting catering for the sport he uses the term "standardization of arrangements" (1986: 88). This view seems to suggest that an architect designing a circus in the second century had nothing else to do but to copy a ready model of the building, with little or no changes and creativeness. In fact, it was far from that. The view on the standardization of arrangements is acceptable but only insofar as it means merely that to cater for the sport, the building had to have the arena with the barrier and the *carceres.* To this there can be added the layout of the *carceres* and, in most but not all cases, the inclination of the barrier relative to the longitudinal axis of the arena.[2] The fundamentals of design of the architectural setting pertaining to the procedure of the race ended at that.

The standardization, in the strict sense of the word, of the architectural setting for the sport of chariot racing did not and could not exist because the sport itself appears not to have been standardized: we know of no constant of the sport (apart from the case of one and a very particular circus, *infra*), defined either by the distance of the race or by the number of laps in one race. A most cursory review of the circuses which are known from their recorded remains (and/or reconstruction) shows that the distance of one lap of the race (determined by the length of the barrier) was about 300m in the shortest circus on record (Gerasa), as much as about 680m in the longest one (Circus Maximus), and any other distance in between these extreme figures in other circuses. There is evidence for a seven-lap race in the Circus Maximus (for review of the evidence cf. Humphrey 1986: 260-265); thereby the total distance of the race amounted there to about 5000m. However, it is not known whether in other circuses the race consisted also of seven laps, or whether the distance of the race was also about 5000m, or whether neither the seven laps nor the 5000-metre distance was the rule at all.

The implications are obvious. If the 5000-metre distance was the constant, then the race in the shortest circus would have consisted of about sixteen laps. In the ten circuses where the length of the barrier is known, a race would have consisted of 14 or 13, 11, 11, 11, 10, 9/10, 9/10, 9 or 8 laps. On the other hand, if a seven-lap race was the constant, then the distance of the race in the shortest circus would have been about 2100m, and in the ten other circuses it would have been about 2500m or 2650m, 3200m, 3200m, 3250m, 3400m, 3650m, 3700m, 3950m or 4200m.[3] As can be seen, the variety is enormous.

The same can also be demonstrated in terms of the time of one race. In the Circus Maximus a race lasted about 8 minutes.[4] If a seven-lap race was the constant of the sport, then a race would have lasted about 3 minutes in the shortest circus, and about 3.7 or 4, 4.8, 4.8, 4.8, 5, 5.5, 5.5, 5.9, 5.9 or 6.3 minutes in the ten other circuses.

The starting distance (from the *carceres* to the *meta secunda*) fluctuated from circus to circus somewhat less, yet the differences were still considerable. In the nine circuses where this distance is known, it amounted to 110m, 125m, 130m, 132m, 132m, 141m, 158m, 160m and 160m. The chariots would have covered the distance of 110m in about 10 seconds and the distance of 160m in about 15 seconds.

The above differentiations show that the race had to be conducted differently in almost every circus because the architectural setting was different. The architecture itself of the circuses demonstrates that it was not a standardized sport to which the design of the architect had to adhere but that it was the architect who, through his design, ultimately decided how the chariot racing was go-

[2] The inclination of the barrier was customary but it was not an inviolable rule; at least in one case, possibly in two others, the barrier was parallel to the longitudinal axis of the arena.

[3] I am well aware that the data presented here (and which will be presented below) lack the substantiation of evidence for each particular case. However, the space in this paper, already opulently used, does not allow for such a substantiation. The data are abstracted from a monograph being prepared by the present writer and entitled "The Hippodrome of Gerasa. A Provincial Roman Circus", mainly from Chapter 7, entitled "Roman circuses and the hippodrome of Gerasa".

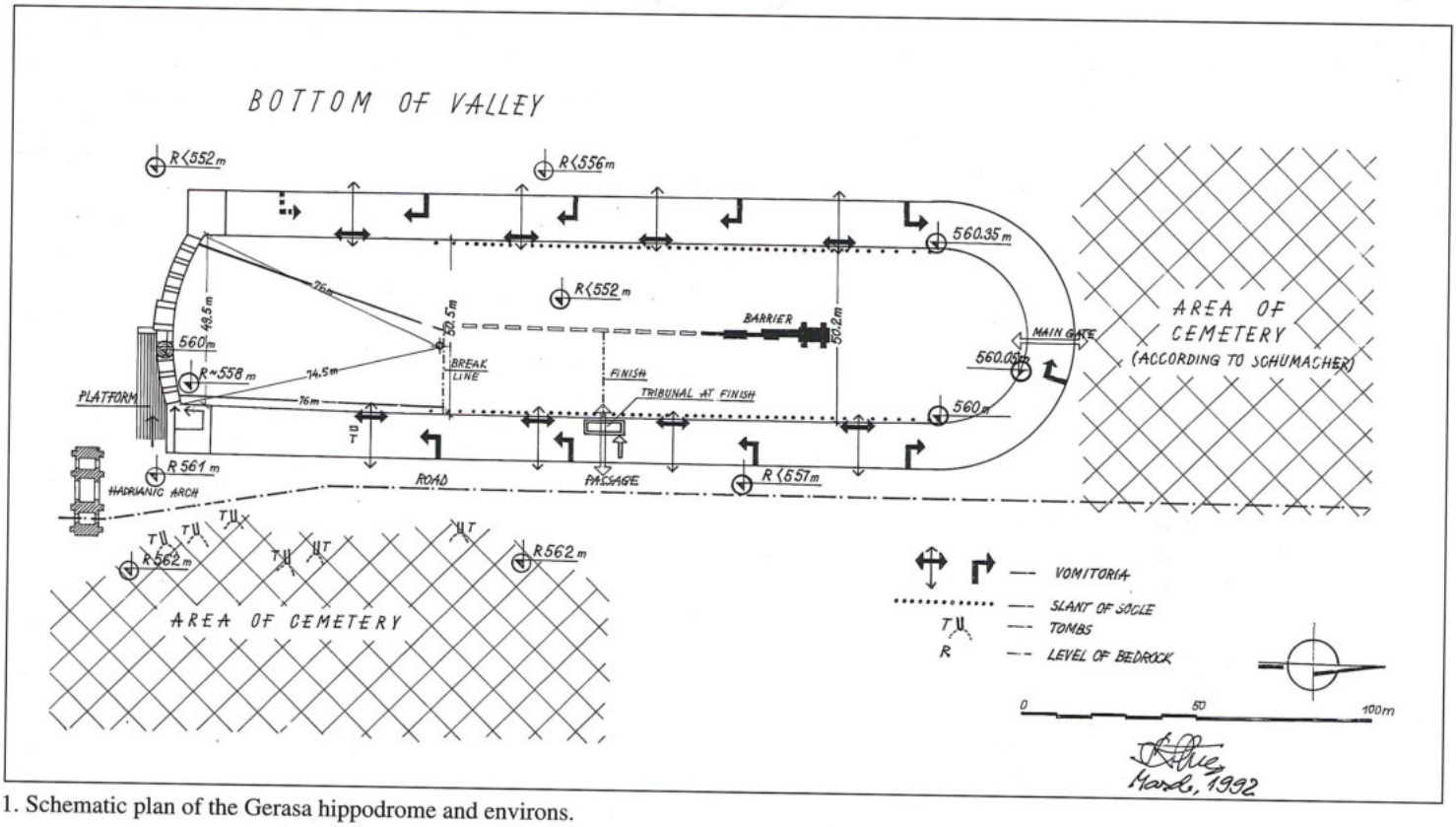
[4] A racehorse of today reaches a speed of about 50km/hour. It is safe to assume that two millennia ago the performance of racehorses was not worse, in any case not much worse. Four horses racing abreast in one team would have been slightly slower but, again, not much slower. The weight of the chariot and of the charioteer could have no significant bearing on the speed of four (or two) horses. The maximal speed could be attained in the straight sections of the race-track. All these things considered, the average speed of the whole race can be assumed to have been about 40km/hour (therefore: 40000m : 60min = 666m/min; 5000m : 666m/min = 7.5min).

ing to be conducted in a particular circus.[5]

The design of the hippodrome of Gerasa is a case in point. The design proves that its author knew well the fundamentals of circus architecture, as they appear to have been in the second century. He designed the *carceres* on a shallow curve of which the cord is inclined in relation to the longitudinal axis of the arena. His design of the stalls of the *carceres* provided for fixing there the gates operated by an opening mechanism. He designed the barrier in the arena[6] and placed what can be seen as the remains of the tribunal at the finish in a point corresponding approximately to the middle (reconstructed) of the barrier, on the side of the right-hand track (FIG. 1). To these fundamentals of design of the circus the architect of the hippodrome adhered faithfully, yet, he created conditions in which chariot racing was substantially different from racing in other circuses, designed by other architects.

The conditions were different owing to the small size of the arena and to the ensuing length of the barrier and the starting distance. In this respect, the architect of the hippodrome faced a formidable challenge in designing the building because the topography of the site chosen for the hippodrome did not lend itself to a longer and wider building.[7]

And yet, in these unfavourable topographical conditions the architect managed to design a serviceable circus. He had at his disposal an area for the arena only 245m long. Along this length he had to fit in the starting distance, the barrier and the space between the *meta prima* and the apex of the semi-circular end of the arena. There is no complete evidence of how he solved this basic problem as only a part of the barrier has survived. It seems that he had no better option than to make the starting distance about 75m, the barrier about 145m and the space for the U-turn at the *meta prima* about 25m long.[8]




1. Schematic plan of the Gerasa hippodrome and environs.

[5] [In] "... a world where charioteers travelled frequently [from circus to circus] ..." (Humphrey 1986: 88) they had to adapt the racing technique to specific conditions offered by each specific architectural setting for the race. This could not fail to have a bearing on the performance of the charioteers, and perhaps horses.

[6] Only a section 35m long (and only the foundations) of the barrier has survived. There is no evidence for its entire length and it is not known whether the barrier was or was not inclined in relation to the longitudinal axis of the arena (Ostrasz 1991: 237-240).

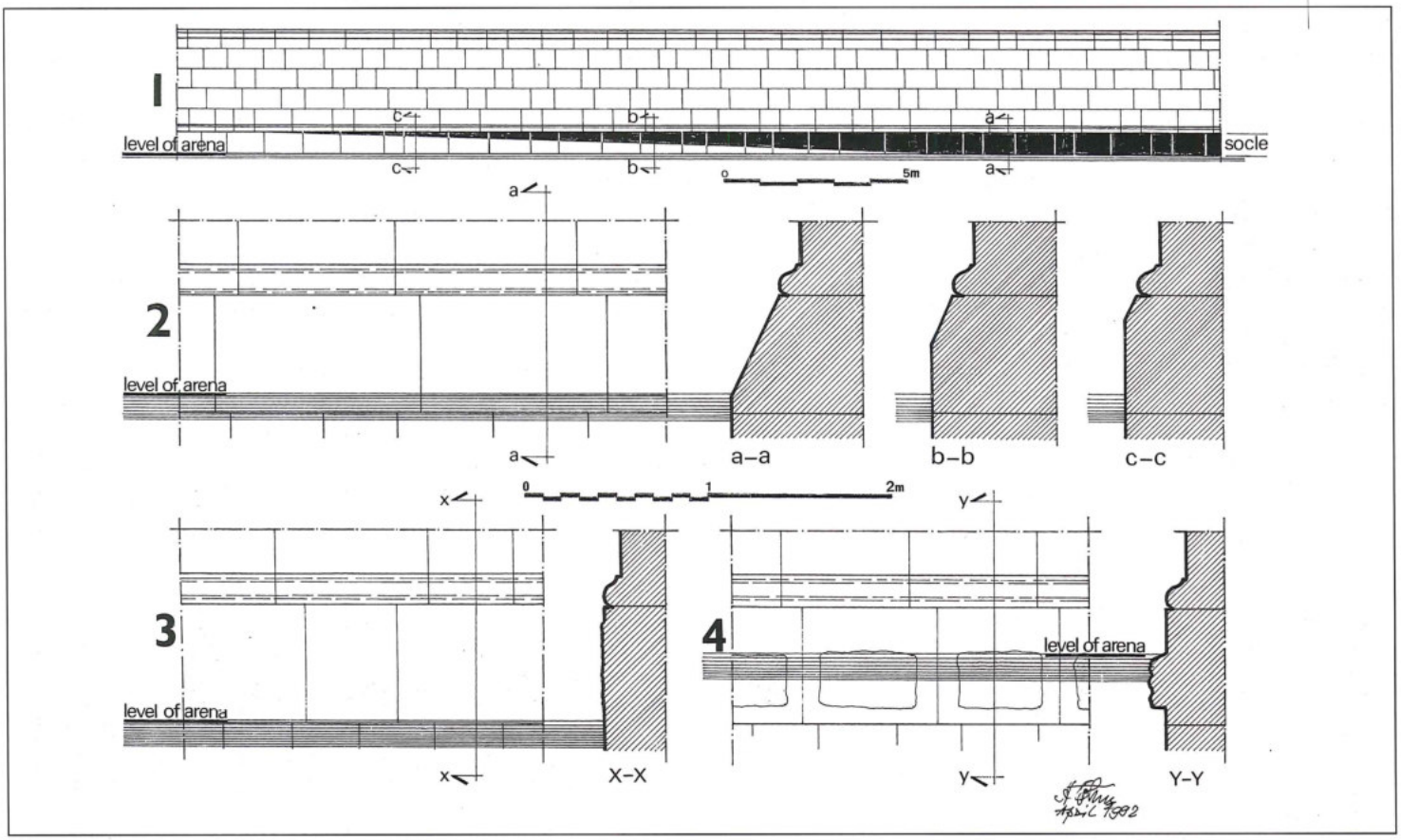
[7] The building could not be extended further to the south because of the position of the Hadrianic Arch, already in place in 129/130 (Detweiler 1938: 73). It could not be extended further to the north, either, because the area north of the present building was occupied by a cemetery (Schumacher 1902: TAFEL 6) which, apparently, could not be encroached upon. The building could not be shifted further to the west, and thus made wider than it actually is, because of the increasing steepness westward of the valley on the slope of which the hippodrome was erected. And it could not be shifted to the east without screening off the north façade of the Hadrianic Arch and without encroaching upon the tombs in the area immediately east of the building (FIG. 1). In every respect, there could hardly be a worse site on which to build a circus.

[8] This might have been the architect's design (and at this point the design is discussed) but the reality was different because, ultimately, not more than five chariots starting from the five eastern stalls competed in a race in the hippodrome (see *infra*).

Owing to the limited width of the arena there was no space for the customary twelve stalls in the *carceres*. The architect therefore designed ten stalls of which each had the minimal width necessary for a *quadriga*. In the remaining space, insufficient for two stalls, he designed a pavilion separating the stalls into two units, each of five stalls. It is not known what solution he adopted to provide enough space for ten *quadrigae* abreast at the break line. The minimum was 27-28m. The width of the arena where this line must have been amounts to 50.5m. Assuming the turning post about 1m wide, the post would have to have been shifted about 3m to the left to obtain the right-hand track at the break line about 28m and the left-hand track about 22m wide. What has remained of the barrier does not contradict the probability of such a solution which would have been consistent with solutions adopted in other circuses.

That the architect took great pains to widen the right-hand track is apparent from his design of the right-hand side of the arena. It bulges outward from the right-hand extreme point at the *carceres* to the point where the semi-circular part of the arena commences. By this solution, known in other circuses, the designer enlarged the width of the arena in the area of the break line to 50.5m from 49.5m at the *carceres*. The left-hand side of the arena he designed to follow the straight line throughout.

There are some refinements in the architectural setting of this hippodrome, relating to the technique of the race, which are not known or have not been noticed in other circuses (but cf. fn. 9). This is the treatment of the socle of the podium wall (the masonry course directly above the surface of the arena). In some sections this masonry course projects from the face of the podium wall proper and it is cut to a slant of which the face recedes from its bottom to its top. The bottom of the slant corresponds to the surface of the arena. The slant was apparently made to protect the wheels of the chariots if they happened to come into contact with the socle.[9] What is significant in this treatment is that the slant exists only in the sections corresponding to the assumed length of the barrier, on both sides of the arena. In contrast, the face of the socle corresponding to the starting distance and to the semi-circular section of the podium wall was left vertical (FIG. 2). This treatment of the socle shows that the archi-




2. Socle of podium wall: 1. socle corresponding to barrier (a-a) and straight stretch north of barrier (b-b, c-c); 2. socle corresponding to barrier (a-a); 3. socle corresponding to starting distance; 4. socle of semi-circular part of podium wall.

[9] A similar treatment of the socle of the podium wall exists in the circus of Tyre. The only photograph that I know shows it to be in the semi-circular section of the wall. I am ignorant if there were or there were not any changes along the other parts of the socle of the wall.

tect did not expect the chariots to come close to the right-hand sides of the tracks between the *carceres* and the *meta secunda* and along the semi-circular side of the arena, but that he expected them to do so in the sections corresponding to the barrier. To cater for this racing technique, the architect designed the relevant parts of the building accordingly.

There is yet another trait of the treatment of the socle which seems to have not existed, or to have not been noticed, in other circuses. This treatment shows all the signs of having been designed to make the track rise as it led around the *meta prima*, along the semi-circular side of the arena.[10] The most probable aim of the treatment of the socle in this part of the arena would have been the creation of most suitable conditions for the chariots to negotiate the U-turn here at the highest speed possible.

The orientation of the hippodrome is ideal; there could not be a better orientation of a circus for the competitors as far as the blinding effect of the sun-rays is concerned. However, as it is the architect's skill in designing the building of the circus that is discussed here, it has to be pointed out that as regards the orientation of the hippodrome it was the topography of the site rather than the architect that was meritorious: once the location of the hippodrome was decided, the architect could not but orient the building north-south. And the position of the *carceres* on the north or south side of the circus (the latter is the case of the hippodrome) was entirely non-essential for the condition of chariot racing as both positions were equally good.[11]

The *cavea* of the hippodrome could accommodate about 15000 spectators. It is worthy of notice that this smallest circus on record occupies the tenth place in the list of twenty-six (larger and much larger) circuses of which the capacity can be estimated with an acceptable approximation. The discussion of the reason for this grandiosity exceeds the scope defined by the title of this paper. This is mentioned here solely because it was a difficult task to design the accommodation for such a number of spectators in the *cavea* restricted by the small size of the building. The architect performed the task expertly. He designed seventeen tiers of seating, comfortable by the contemporary standards (0.7m wide and 0.45m high), and approachable from seventeen *vomitoria*. Eight of these led to the lower and the remaining nine to the upper sectors of the *cavea*.[12] He concentrated most *vomitoria* in the long median parts of the seating, most advantageous for the spectators, thus in the parts where crowding could be expected to be greatest. This arrangement ensured not only an easy access to the seating but also — what is most important in any entrance/exit system catering for large crowds — a relatively speedy exit for all spectators.[13]

Finally, the architect of the hippodrome proved that he also knew how to care for what Vitruvius calls the beauty of the building. As mentioned above, the circus was an 'introverted' building type; only some interior components of the structure lent themselves to a more 'aesthetic' treatment. For such a treatment the most suitable, and a very conspicuous component of the circus, was the façade of the *carceres* on the arena side. Here was the possibility for this treatment and our architect made good use of it. By its very function, the structure had to consist of a series of repetitive open rooms, identical in size and ranged close to each other in one row. The architect designed the façade of the structure according to modular principles. His module was a compositional unit of the 2:3 proportion (width to height). Every segment comprising one stall was designed in this proportion and the same proportion was adopted for the opening of the stall. It seems that the façade of the central pavilion was composed according to the same principle (FIG. 3).[14]

At the same time, the architect showed a commendable restraint in keeping to a minimum what is commonly called the "architectural decoration". He provided the façade with pilasters to emphasize the structural division of the *carceres* into stalls and topped the pilasters with

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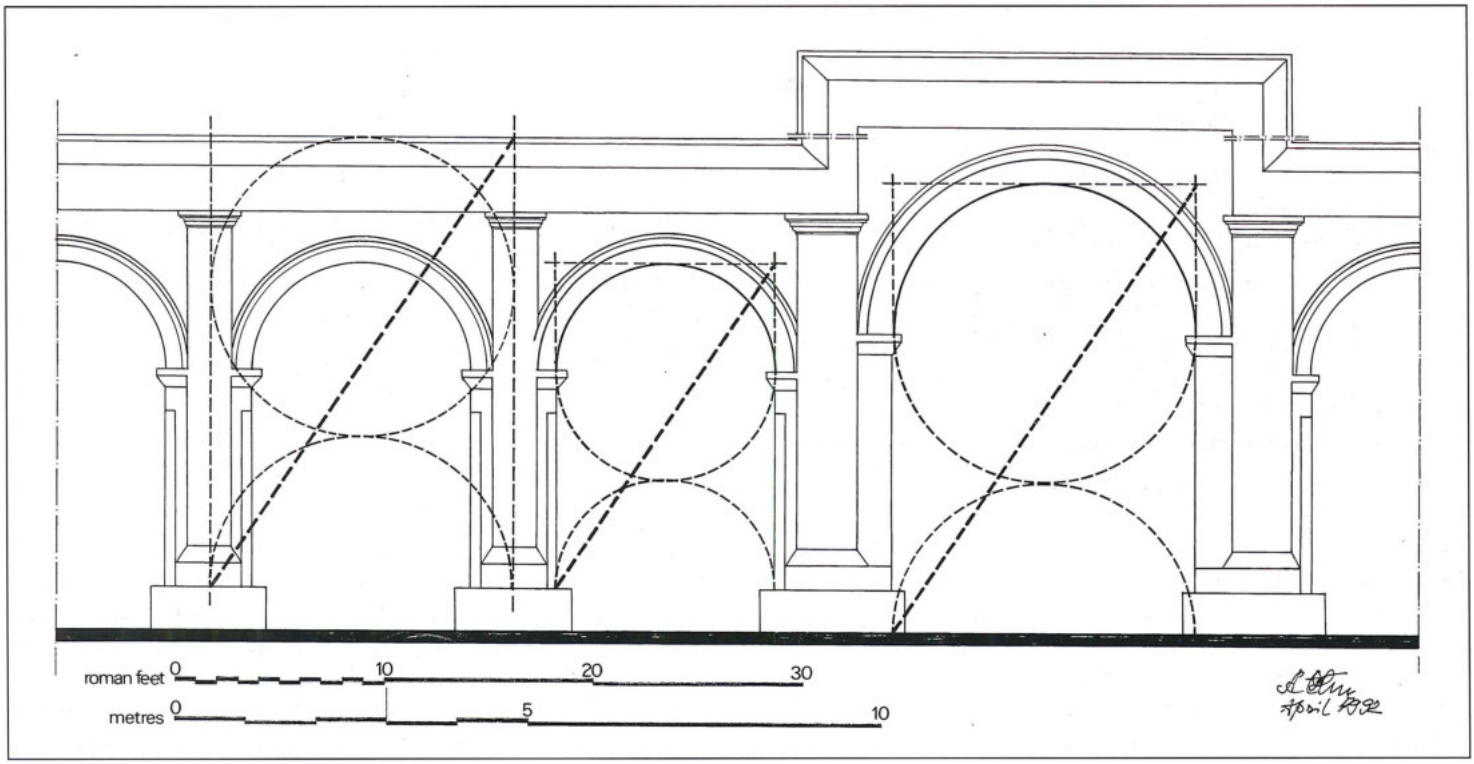
10 The original surface of the arena has survived nowhere but its level is clearly determined by the flooring of the *carceres*. In other parts of the building this surface is marked by the bottom of the slant of the socle of the podium wall. In the sections where the face of the socle is vertical, the surface of the arena is determined by the bottom of the rustication of the stones of which the socle is built. Both the bottom of the slant and of the rustication is practically level throughout the entire length of the right-hand and the left-hand side of the arena. However, the latter is as much as 0.35m higher than the former. The difference results from an upward slope of the top of the socle in the semi-circular section of the podium wall. The slope starts in the last part of the first half (anti-clockwise) of the semi-circle and terminates at the point where the whole semi-circle ends (FIG. 1). The rustication of the stones in this stretch of the socle is very prominent and it occupies only the lower half of the stones; it is obvious that this rustication was meant to be covered by earth making up the surface of the arena (FIG. 2.2). These features show that the surface of the arena along this stretch of the socle sloped upward in the anti-clockwise direction, as the top of the socle.

11 To demonstrate this point properly several calculations and drawings would have to be presented. Let it suffice to mention here only that the position of the sun in the late hours of the morning and in the early hours of the afternoon is high enough (in the latitudes where chariot racing took place) as not to disturb the vision of drivers conducting their vehicles on a level surface. Nowadays drivers of motor-cars know this well. In the early hours of the morning and in the late hours of the afternoon the position of the sun is outside the angle of human vision in the horizontal plane.

12 In most circuses where the relevant evidence is available, one *vomitorium* catered for about 500 spectators. In the hippodrome of Gerasa there was one *vomitorium* per about 800 spectators. Considering the small size of the building and its relatively great capacity, the design can be viewed as successful — more *vomitoria* would have decreased the seemingly planned number of spectators.

13 If the *cavea* of the hippodrome was filled to capacity, all spectators could leave the building in about 25 minutes. To the best of my knowledge, there is no study on the subject for other circuses.

14 There is no full evidence for this feature, possibly because of the way in which the tumble of this part of the *carceres* was excavated and cleared away in 1933 (Ostrasz 1989a: 67, fn. 19).




3. Modular composition of north façade of *carceres*.

simple mouldings. The vaults covering the stalls he showed in the façade in the form of simply carved archivolts. The whole of the façade he crowned with a simple but well proportioned *cyma recta*-cornice. The architect's design of the piers separating the stalls from each other, and especially the design of the imposts of the archivolts, shows ingenuity in achieving a perfect unity of the functional purpose and aesthetic value.

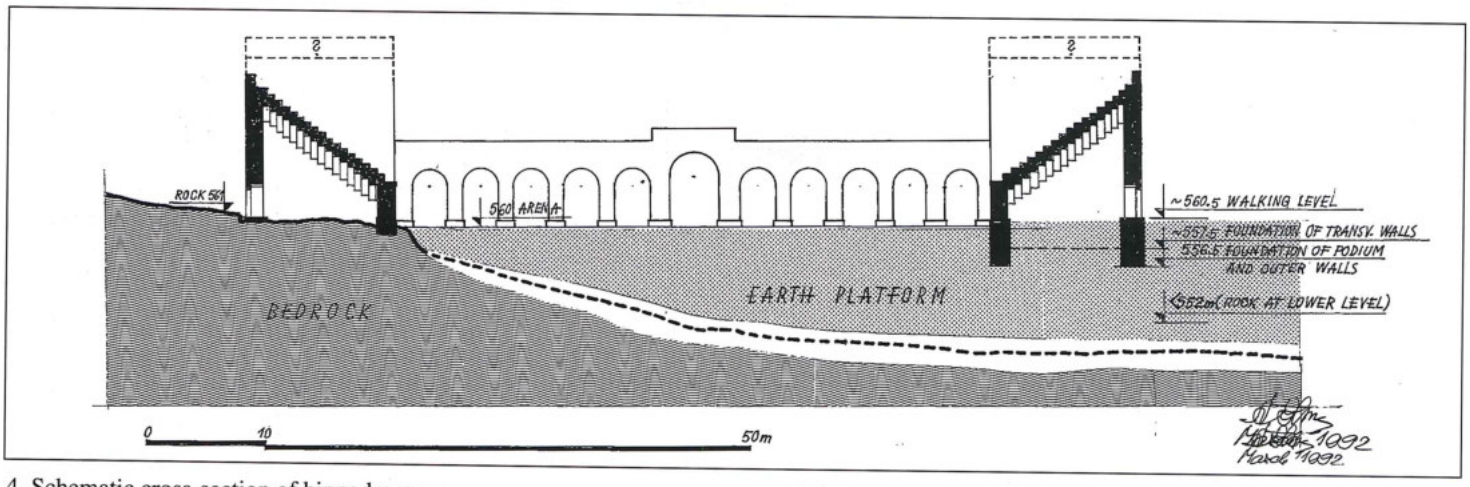
Of course, the architect would not have been a child of his time if he did not use the decorative elements to 'beautify' his architecture, but he used them maturely — to stress the structural and functional nature of the *carceres*. Consistently with his design, the architect designed the exterior of the *carceres* as a plain wall pierced by a series of simple openings, in keeping with the character of the exterior architecture of the whole hippodrome. On the whole, our architect designed a piece of architecture functionally useful and aesthetically graceful.[15]

From the study of the remains of architecture of the hippodrome of Gerasa, its architect emerges as a skilful and, in no few respects, an innovative designer of circus architecture. There comes, however, the constructional technology — an aspect of architecture conditioning the durability of the building — and there the portrait of the architect changes drastically. In respect of building technology, the architect's ability fell far behind his expertise in the other skills: the hippodrome is an example of exceptionally poor building technique.

The manner of founding the building defies all basic rules of construction. Owing to the location of the hippodrome on the western slope of the valley, the foundations of only a very small, south-east part of the building could be set on a solid base (rock in this case). It was there where the architect chose to establish the level of the arena and the walking surface outside the building. From that place, however, the surface of the rock dropped considerably northward and much more so westward. The difference in level was about 7-8m. It follows that the foundations of the west part of the building ought to have been set 7-8m below the designed level of the arena. The architect chose a different way of founding the building. A platform made of earth was formed on the slope of the valley, from its bottom to a level of about 3.5m below the designed level of the arena. On this earth platform the foundations of the building were only set (FIG. 4).[16] The consequence of this solution could not fail to be disastrous because the earth could not

[15] Evidence for the third dimension of the *carceres* in other circuses is extremely limited. There are only two other *carceres* which give an idea of what their entire architecture was (or may have been like): the *carceres* of the circuses in Bovillae and Lepcis Magna. None displays anything close to the sophistication of the *carceres* of the hippodrome of Gerasa (FIG. 5).

[16] The level of the rock under/along the west part of the *cavea* is not known. The actual lowest level of ground in that area is from 5m to 7m below the surface of the arena (Ostrasz 1989a: FIG. 3). The rock must be at a level still lower. Given this situation, it seemed to be a reasonable assumption that the foundations of this part of the building had been set on rock, that is to say about 7-8m below the level of the arena (Ostrasz 1989a: 61). Only the recent excavation revealed a different reality. I recant the former statement.




4. Schematic cross-section of hippodrome.

fail to settle with time and make the foundations sag. And precisely this did happen.[17]

Another constructional sin of the architect was the construction of the foundation walls themselves. Here he demonstrated a surprising ignorance of the statical requirements of the structure. According to the design, the vertical pressure of the whole structure was sustained by the transverse walls. The entire masonry of the *cavea* rested on these walls. The outer and podium walls carried nothing but their own weight. It was obvious that such a statical composition of the structure required the widest foundations for the transverse walls and respectively narrower foundations for the other walls.[18] Instead, the foundations of the transverse walls are narrower than the others (1.2-1.5m; foundations of the podium and outer walls 1.65m and 2.1m, respectively).

The building technique of the foundation walls evidences a similar misconception. The masonry of the whole hippodrome is of poor quality (Ostrasz 1989a: 67) and only a little more so is the masonry of the foundations of the podium and outer walls. However, the foundations of the transverse walls are built much more poorly. It should have been precisely the opposite — if any foundation had to be built poorly at all. In this situation, the transverse walls — the statical spine of the whole structure — were much more vulnerable than the others to the process of settling of the earth on which they had been founded.

The misconceptions in founding the building and the generally poor constructional technology proved to be detrimental to the longevity of the whole structure.[19] The hippodrome was finally destroyed by earthquakes (Ostrasz 1989a: 74f.; 1991: 242f.) but these destructions belong to the late history of the monument. However, as early as in the first quarter of the fourth century at the latest, the building already did not serve its primary purpose and was used as a centre of ceramic production (Ostrasz 1989a: 73). The reason could hardly have been other than dilapidation of the building, which made it unusable for chariot racing (Ostrasz 1989a: 73). Two components of the circus were indispensable for chariot racing: the arena and the *carceres*. Disintegration of one of them would suffice to make the building unusable for the sport.

It was demonstrated elsewhere that only the five eastern stalls of the *carceres* were provided with the necessary outfits which served for opening simultaneously the gates (Ostrasz 1989a: 70; 1991: 239f.). The five western stalls were never provided with these, thus they never served their purpose. The same is indicated by the foundation of a wall abutting against the outside face of the foundation wall of the *carceres*, built in the place corresponding to the eastern pier of the pavilion (FIG. 1). This wall could be nothing else but the retaining wall of a platform at the back of the *carceres*. The position of the wall shows that the platform gave access only to the eastern stalls. There was no access to the western stalls from outside.

17 The top of the westernmost part of the foundation wall of the *carceres* (the floor of the extreme west stall) is 0.28m below the level of the top of its middle part (the pavilion). The downward slope westward of the masonry courses of the exposed south face of the foundation wall is clearly visible and there is no vertical crack in any part of the stonework. Nothing but gradual sagging of the foundation wall could make the masonry courses slope so, and nothing but gradual settling of the ground on which the wall was set could be the cause of it.

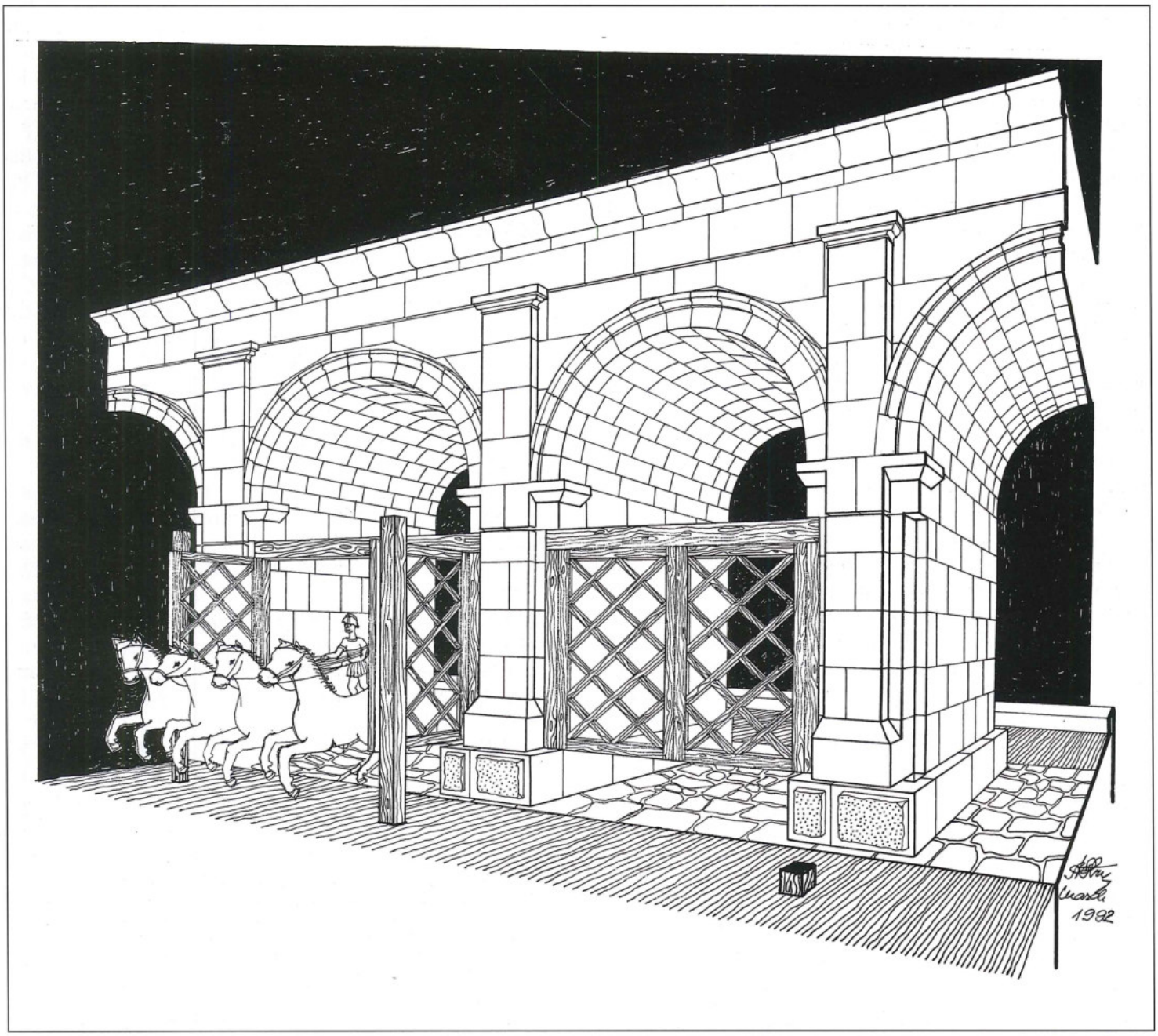
18 One current metre of the foundation of the podium wall carried a load of about 18 tonnes, of the outer wall — about 40 tonnes, and of the transverse wall (the part closest to the outer wall, thus highest and heaviest) — about 47 tonnes. Translating this into modern statical terms, the load of the podium, outer and transverse walls — given the width of their foundations — exerted a pressure on the ground on which they were set equal to 1.1kg/cm$^2$, 1.9kg/cm$^2$ and 3.2kg/cm$^2$, respectively.

19 The hippodrome of Gerasa was not the only structure that was exceptionally poorly built in the lands of the Decapolis. The Monumental Gate in Gadara is another recorded case (Weber and Hoffmann 1990: 300). The sameness of the features of poor constructional technology is striking. What is not striking at all is that the structures so built disintegrated soon after their erection; it would be striking if they did not.

One might argue that the hippodrome was originally designed for only five chariots competing in one race; that the five western stalls were built solely for the sake of symmetrical composition of the *carceres*. The argument is refutable: had such been the case, the outward bulge of the right-hand side of the arena would have been redundant. The bulge had been designed to widen the right-hand track and this proves that this track was designed for more than five chariots abreast at the break line. If the right-hand side of the arena followed the straight line, there still would have been much more space than necessary for five chariots starting from the eastern stalls.

There remains, then, to discuss the question of why the western stalls were not used in spite of the fact that they had been built. What follows is an examination of evidence to this effect.

The appliances for fixing the gates in the stalls and for opening the gates simultaneously included a specific shaping of the piers separating the stalls from each other (the space for wooden jambs and slots in which the jambs were set), and the grooves for a rope (chain?) of the opening mechanism, and the poles in front of the piers (Ostrasz 1989a: 70) (FIG. 5). The two first-



5. Perspective view of part of *carceres*.

mentioned appliances were formed while the part of the structure from the socle of the piers to the level of the springers of the archivolts was being built. In other words, while the western stalls were being built they were meant to be provided with gates. The grooves for the rope were cut in the piers of the eastern stalls only after the completion of construction (this is apparent from the way in which the inner surface of the grooves is cut). The poles in front of the eastern piers were of course fixed there also after the completion of the construction of the *carceres*. As the gates were necessary for the procedure of the race, and the grooves and poles were the necessary outfits for opening the gates, the provision of the eastern stalls with these outfits must have been the closing act of construction — the finish of the *carceres*. The western stalls had been built to receive the gates but they were not provided with the outfits which were necessary to operate the gates. The conclusion is therefore obvious: the builders decided *not* to provide the western stalls with gates *at the very closing stage of construction.* The only explanation for such a decision is that already at this stage it was obvious that the stalls could not serve their planned purpose.

It is inferable what must have happened. The settling of the earth platform made the foundation of the *carceres* sag. The process of settling started, naturally, immediately after the platform had been formed and the settling reached its peak when the construction of the west part of the *carceres* was nearing completion and shortly after the construction was achieved.[20] The parallel subsidence of the foundation made the piers of the stalls lean westward and the inclination of the masonry could not fail to be noticed. The inclination of the preserved parts of the piers (only 1.7m high nowadays) is still conspicuous.

The settling of the earth platform must have been even more detrimental to the outer wall of the building.[21] The process of subsiding of its foundation could not fail to make the wall lean gradually but steadily westward (outward).[22] The southwest part of the outer wall was about 15m high (the height of the foundation included). At this height, the wall must have stood in a very precarious position immediately after the completion of construction. It must have been obvious that it would collapse, and it may have collapsed already in the closing stage of construction. In this situation, no builder would have thought of preparing the western stalls for the start of the race. And so he did not, as our evidence shows. All the above considered, one may entertain the possibility that the very inauguration of chariot racing in the hippodrome of Gerasa took place in the building which was already partly ruined.[23]

In conclusion, we can come back to our two architects: Vitruvius and the architect of Gerasa's hippodrome. The latter showed both prowess and deficiency in many aspects of his profession. This dichotomy was detrimental to the longevity of the building that he designed. By the rules of his profession the hippodrome was, ultimately, 'his baby'. It was he who fathered the hippodrome and it was he who — notwithstanding his other achievements — made it cripple in its infancy and die prematurely. His two hundred-years-older colleague, Vitruvius, would not have thought much of his work.

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[20] The process of settling of the ground on which a structure is founded begins at the moment of building the foundations. The intensity of the process reaches its peak when the construction is completed and it lasts during a short time after the completion of construction. The process slows down gradually after that short period and reaches a zero point of settling soon afterwards, the point of final statical stability in normal conditions.

[21] The subsidence of the extreme west part of the foundation of the *carceres* being 0.28m, the subsidence of the foundation of the southwest part of the outer wall, about 13m further to the west, must have been as great as about 0.4m.

[22] The excavation of the foundation of the southwest section of the outer wall, about 12m long, revealed that the extant part of the foundation (2.5m high) was inclined westward (outward) at an angle of about 9°. There is no evidence for the period in which this inclination occurred. The inclination, enormous as it is, may have resulted from earthquakes which occurred long after the construction of the building, and/or from much later washing out of the earth of the foundation platform. Theoretically, an inclination of the outer wall equal to about 6° had to make the wall collapse — at this angle the gravity centre of the wall would have projected outside the base of the wall. Given the poor building technique of the masonry, the wall should have collapsed at a much smaller angle of inclination.

[23] It would have been the southwest section of the *cavea* that collapsed so early. The earth platform carrying the foundation of this part of the building was higher than anywhere else; therefore, the settling of earth and the resulting sagging of the foundation must have been greatest there. In the wake of the collapse, the southwest part of the arena must also have disintegrated which would have made it unusable for racing. The western stalls stood high in their leaning position during the following centuries and they collapsed only under the impact of an earthquake much later (Ostrasz 1989a: 75). Their long survival in spite of this position is explainable. Owing to the constructional composition of the *carceres* (a series of piers spanned by vaults), they were structurally a uniform whole. The inclination of the structure was lengthwise. At the actual angle of inclination, the centre of gravity of the structure as a whole and of its elements sustaining the vertical pressure (the piers) remained within the base of each part of the structure. Its statical stability was of course disturbed but not to the point of collapse. Finally, at the western extremity of the *carceres* (the lowest level of inclination) there was a solid tower which buttressed the whole structure.

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# The Nabataean House and the Urbanistic System of the Habitation Quarters in Petra

n comparison to sanctuaries, public squares, theatres nd necropoles, private architecture has so far been a nore or less neglected subject in Classical and Near Eastern Archaeology. In the field of private architecture ne cannot expect spectacular finds of statues, reliefs or nscriptions associated with excavations of sacred or secular state architecture, which as showpieces, enhance the ame of archaeological museums. In this respect the city f Athens is a particularly good example. There we find umerous temples, the Greek and the Roman agora, the heatres and most of the necropoles excavated and published – but scarcely a dozen private houses. The same s true for most of the ancient cities in Greece and Asia Minor. Another fact is that, in most cases, scientific interest focuses on residential quarters only when analysing urbanistic concepts. It was not until the 1960's – nder the influence of the Anglo-American research – hat Classical Archaeology began to deal with the problems of private architecture to an increasing degree. In he meantime notable results have been obtained, for intance the excavations of houses on Monte Iato in Sicily, t Kassope and Eretria in Greece, at Pergamon in Asia Minor, at Dura Europos in Syria or in Bactric Ai Khaoum[1] and in 1992 private architecture of antiquity was ne exclusive subject of a congress held in Damascus.[2] On this briefly sketched background it may not come as surprise that in Petra archaeological research has followed this general trend and concentrated on the stuning tomb-facades and temples – despite the fact that ne conditions for archaeological investigation of the priate architecture are particularly good and promising on this site:[3] first the authors of antiquity mentioned how the Nabataeans used to live and dwell; second the development areas of the city are not contaminated by recent building activities.

## The Statements of the Authors of Antiquity

For lack of local, Aramaic written sources about the Nabataeans we have to rely on the statements of Greek and Latin authors, who had their reservations about the unfamiliar nomads. From their point of view the Nabataeans controlled – as a result of their excellent knowledge of caravan routes and of the scarcely existing water reservoirs and springs – the trade in spices and aromata between southern Arabia and the Mediterranean, but they were considered to be uncivilized people. This poor opinion of the Nabataeans is clearly expressed by the statement of Diodorus (XIX, 94.3- 4) that the Nabataeans stuck to the following three prohibitions:

- neither to drink wine nor to plant vines,
- not to cultivate the ground,
- not to live in stone built houses.

For those unacquainted with the Arabic language and habits, the expression "stone built house" needs a short explanation. What may sound to the European like a pleonasm, since from his point of view every house is built of stone – or possibly of mudbricks – is solely understandable in terms of local tradition: the Accadic cuneiform inscriptions name the nomadic tent "house of the desert";[4] even nowadays the Bdūl nomads who live near Petra, call their big black tents "*bayt*" – commonly translated as "house" – and not "*khayma*", a term they use

For Greek houses: J. Travlos, *Bildlexikon zur Topographie des antiken Athen* (1971) 392ff.; M. Kreeb, The House in Ancient Athens, in: *Athens in Prehistory and Antiquity, Exhibition on Architecture and City Planning. 15th century B.C. - 6th century A.D.* (1985) 24ff.; H.-P. Isler, *Antike Kunst* 33, 1990, 57ff.; W. Höpfner and E.-L. Schwandner, *Haus und Stadt im klassischen Griechenland* (1986) 75ff. 205ff.; P. Ducrey and I. Metzger, *Antike Kunst* 22, 1979, 4ff.; K. Reber, *AA* 1988, 653ff.; id., *Antike Kunst* 32, 1989, 1ff.; 33, 1990, 111ff.; for Syrian houses: J. - J. Ch. Balty, in: *Apamée de Syrie. Bilan des recherches archéologiques 1973-1979* (1984) 19ff.; J. R. Gisler and M. Huwiler, *ibid.*, 79ff.; F. Baratte, *ibid.*, 107ff.; A. Schmidt-Colinet, *ibid.*, 141; ff. Ch. Donnay-Rosmans and G. Donnay, *ibid.*, 181ff.: A. Allara, *Syria* 63, 1986, 39ff.; P. Leriche, *ibid.*, 5ff. 61ff.; *id.*, in: *Akten des 1. internat. Kongresses "Arabia antiqua"* Rome 1990 (in print); for Bactria: P. Bernard, *AAAS* 21, 1971, 166ff.; *id.*, *Journal asiatique* 264, 1976, 245ff.

2 "Les maisons dans la Syrie antique du IIIème millénaire aux débuts de l'Islam; Pratiques et Représentations de l'éspace" – colloque international de l'Institut Français d'Archéologie du Proche-Orient à Damas.

3 J. McKenzie, *The Architecture of Petra* (1990), for domestic architecture: 105ff.

4 H. Klengel, *Zwischen Zelt und Palast. Die Begegnung von Nomaden und Sesshaften im alten Vorderasien* (1972) 202ff. with n. 301; cf. also: F. Gabrielli, L'antica società beduina, *Studi Semitici* 2, 1959.

only for the small camping-tents of the American and European tourists. To distinguish a permanent dwelling of a town from the movable tent of the nomads, the material specification "stone" had to be added. Diodorus and his literary source seem to have taken over this term without question.

Whereas the first *tabu* ranks with the commands of abstention which are well known in pre-Islamic times, the two other prohibitions force the Nabataeans to renounce agriculture and permanent dwellings and to keep up their traditional way of life as nomads. The fact that not only the Nabataeans but also the Rechabites,[5] who lived west of Wādī 'Arabah, had the same taboos proves that we are dealing here with a wider cultural phenomenon – that is to say the end of one of the immigration movement of Arab nomadic tribes to Syria and Palestine, that had started in the early first millennium BC.

## Results of the Archaeological Research at Petra

There are three reasons to believe that the people in Petra did not follow the rules mentioned by Diodorus:

- The numerous carved rock-facades of the necropoles show towers, houses and palaces. Since the successful restoration of Qaṣr al-'Abd at 'Irāq al-Amīr[6] we have a fairly precise idea of the appearance of the latter. It would be absurd to believe that the Nabataeans carved sumptuous tomb-facades out of the rock for the hereafter, and lived without the luxury of permanent dwellings and palaces here below.
- An inspection of the city's upper terraces reveals a high density of stone built foundations and walls, which could hardly have belonged to official buildings but must be regarded as remains of private dwellings. Given these facts we can assume a change from tent to house, i.e. from nomadism to settled abode. The difficult question remains as to when and how this change happened.
- An important point to mention in this context are the stamped Rhodian wine amphora handles. They are among the earliest datable finds in Petra and prove that even in the early third century BC the Nabataeans drank wine imported from the West.

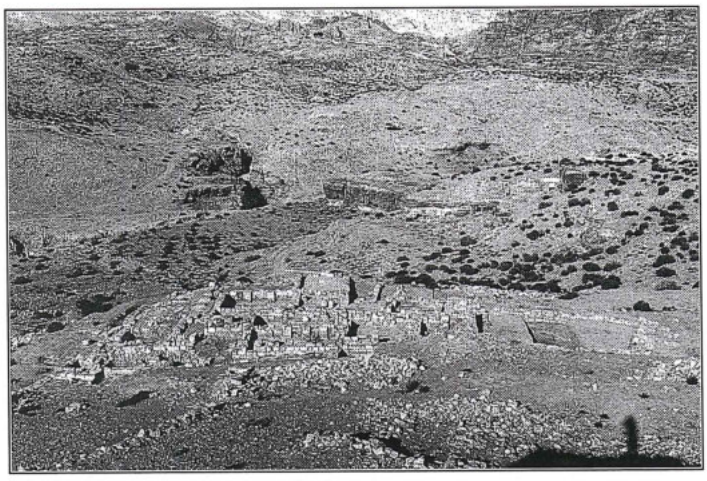
Since the beginning of archaeological fieldwork in Petra back in the 1920s, dwelling-houses were partially excavated time and again – but it was not until Nabil Khairy's excavation in 1981 that a whole house was laid bare. Khairy's comprehensive studies on the architecture and the finds have been published recently.[7]

In his Area B, a row of large and small living rooms opens onto a monumental peristyle measuring 15 x 15 metres, paved with carefully laid flagstones. Under the pavement of the eastern part of the building, a system of channels and cisterns is located. They were hewn out of the bedrock in order to collect the precious rainwater for the long, dry summer months. Two stairways led to an upper storey which is not preserved. On account of the numismatic evidence – coins of Aretas IV with his second wife Shaqilat II (AD 18-40) – the building is dated at the beginning of the first century AD. Although the ground-plan was radically altered later, the overall impression of the original setting recalls the Hellenistic houses of Delos or Pergamon. Accordingly we may suppose that the Nabataeans already had a fairly precise knowledge of Hellenistic architecture at the time between the end of the first century BC and the beginning of the first century AD.

## Excavations of the University of Basel and the Swiss-Liechtenstein Foundation for Archaeological Research Abroad

Since 1988 a team consisting of archaeologists, archaeobotanists and archaeozoologists has been working beneath az-Zanṭūr, the rocky peak of the city's southwestern slope (FIGS. 1-2).[8] From the very beginning the main aim was to lay bare Nabataean dwellings and to study their building methods. For this reason I will concentrate on a description of finds belonging to the Nabataean period. The late Roman buildings which were destroyed by the earthquakes of AD 363 and 419 will be only briefly considered.

Unfortunately we were not excavating undisturbed Nabataean architectural structures. In our excavations we are dealing with a late Roman settlement which is built over a Nabataean house that was erected in the late first



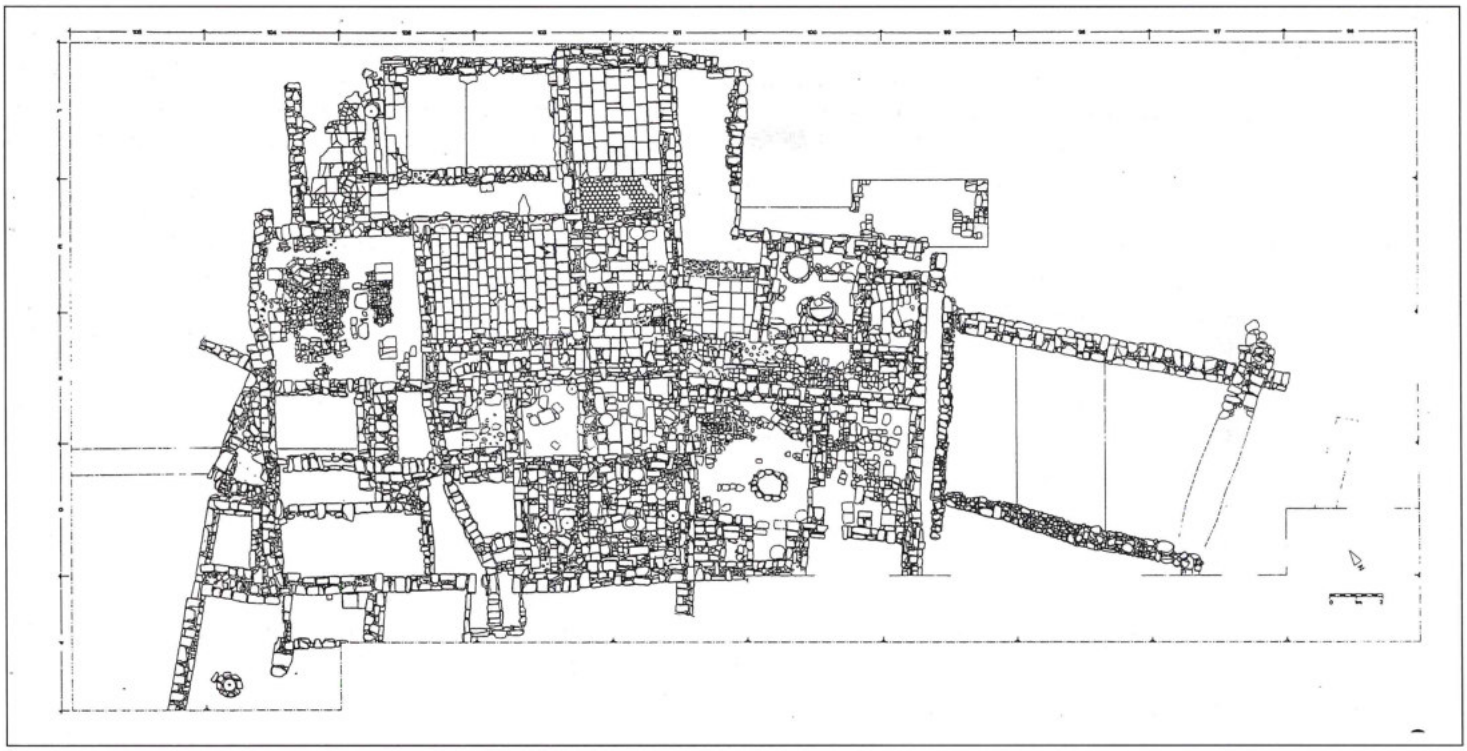
1. Petra. Az-Zanṭūr, general view.

[5] *Jeremiah* 35,6-10.

[6] E. Will and F. Larché, *Iraq al Amir. Le château du tobiade Hyrcan*, Paris, (1991).

[7] N. Khairy, *The 1981 Petra Excavations*, Abhandlungen des Deutschen Palästinavereins 13 (1990).

[8] Preliminary reports: R. A. Stucky *et al.*; *ADAJ* 34, 1990, 249ff.; 35, 1991, 251ff.; 36, 1992, 175ff.; *Antike Kunst* 35, 1992, 129ff.; cf. also the catalogue of the exhibition in Zurich and Basel, *Petra und die Weihrauchstrasse*, 1993.



2. Petra. Az-Zanṭūr, general plan.

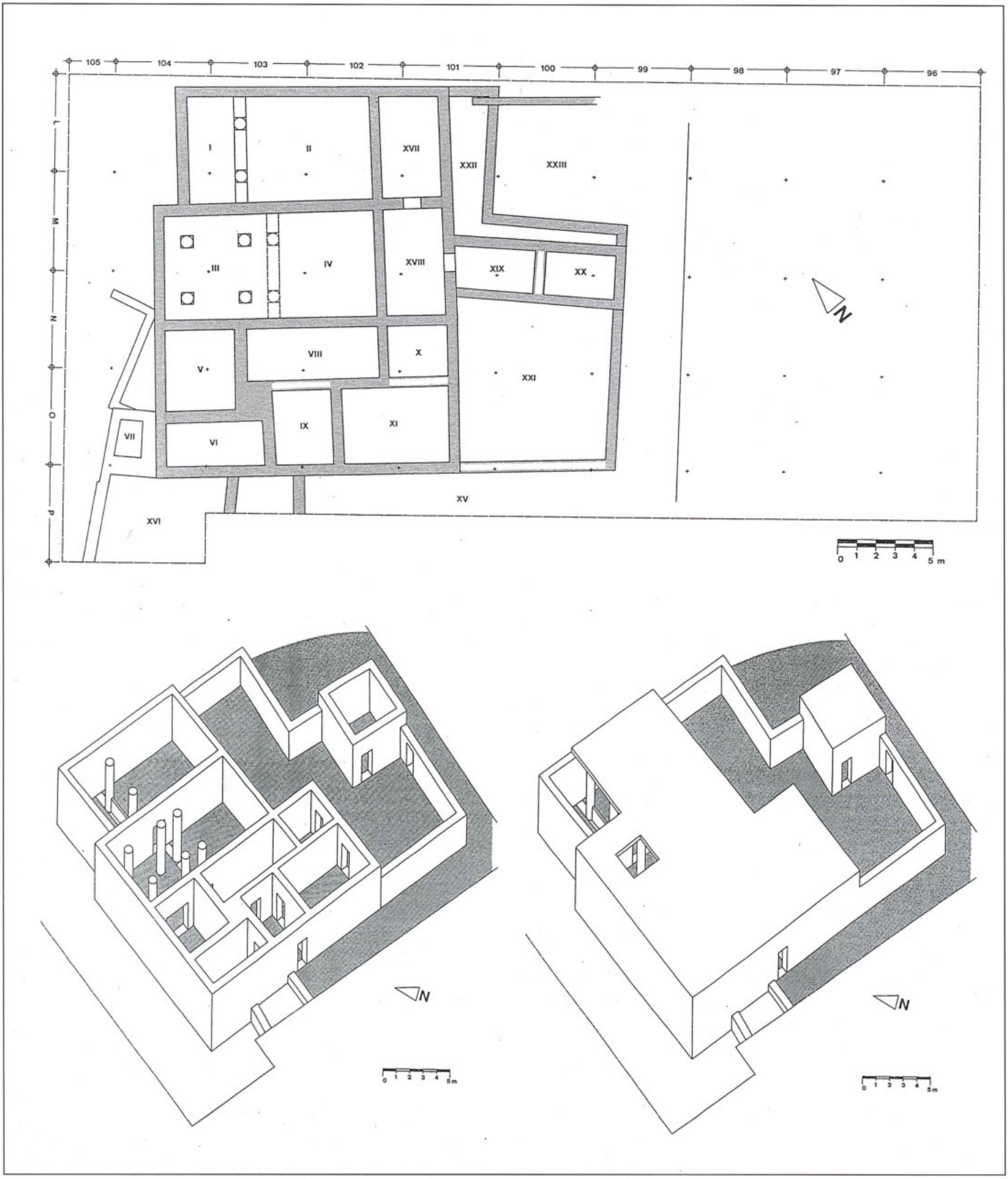
century BC or the early first century AD and destroyed during the early second century (FIG. 3). Around AD 300 the ruin of this building was demolished to its foundations and as much building material as possible was re-used for the construction of the new and smaller dwellings. We have therefore to reconstruct the Nabataean building from its ground-plan and the re-used architectural material. Nevertheless it is possible to state that the building measured about 30 x 30 metres and incorporated, like Khairy's, specific Hellenistic elements: light and air could penetrate from the climatically favourable northern side through peristyle III and through the small open-roofed room I in the inner area of the house. All the rooms were carefully paved with flagstones; the pavement in room XVII is comparable to the pavement in Khairy's Area C: sectors of large rectangular flagstones joined to sectors of small hexagonal "floor-tiles". The upper part of a capital and countless painted stucco-fragments, the remains of wall paintings in room II, prove that the interior decoration did not fall short of the highest Hellenistic standards. The house beneath az-Zanṭūr stands as another witness for the Nabataeans' knowledge of Hellenistic architecture and interiors.

A further important question in discussing Nabataean architecture is whether the Hellenistic influence included the advanced construction and engineering techniques. From the start of our excavation we encountered the phenomenon that the outer walls, erected at the edge of the terrace, were bulging out or lost completely, as was the case in the northeastern corner. The numerous retaining walls and outer foundations which were added later, were attempts to prevent the walls of the endangered rooms from crumbling down. The protrusions of walls and additional auxiliary constructions are especially evident on the northern facade of peristyle III and room I.

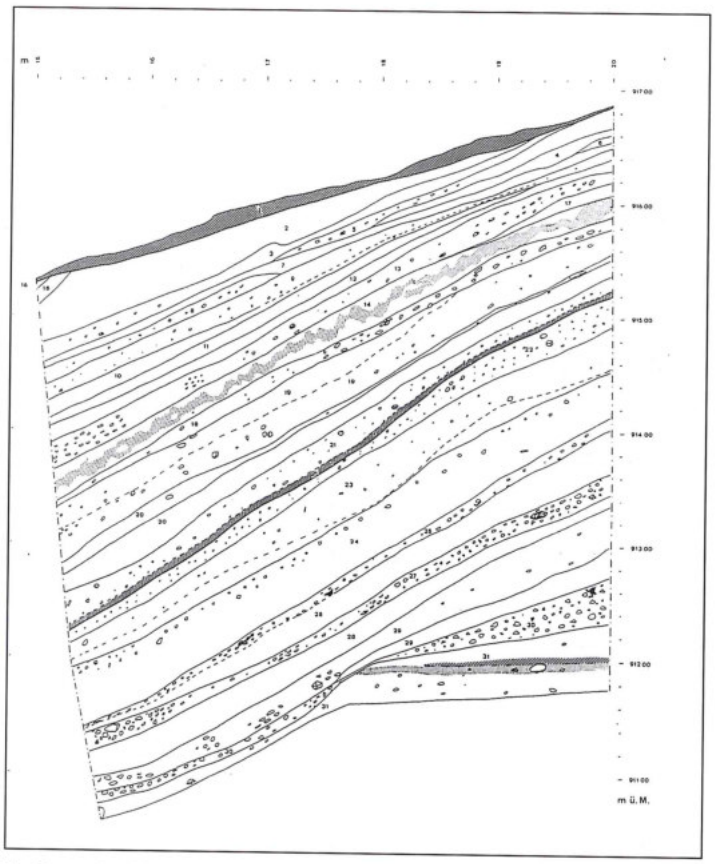
The explanation for the distortion of the outer walls was found in the large stratigraphical trench (FIG. 4) on the eastern side and in two small trenches on the northern and on the southern sides of the terrace. Contrary to our expectations, which were based on the knowledge of Hellenistic dwellings in Greece, Asia Minor and Syria, there was not a single retaining wall to be found. The profiles show only so called "Fliess-Schichten", floating layers – that is to say layers of sand that originated on the one hand from the natural eroding process of the bedrock and on the other from litter deposits. In these layers of the large trench we found a large number of slightly damaged vessels that had been thrown away by the occupants. The most important find was a painted Nabataean bowl.[9]

Obviously the builders did not strengthen the terrace with retaining walls but left the steep slopes as they were. Despite the relatively deep-grounded foundations, the outer walls were too weak to resist the thrust of the building, which was increased by the slight inclination of

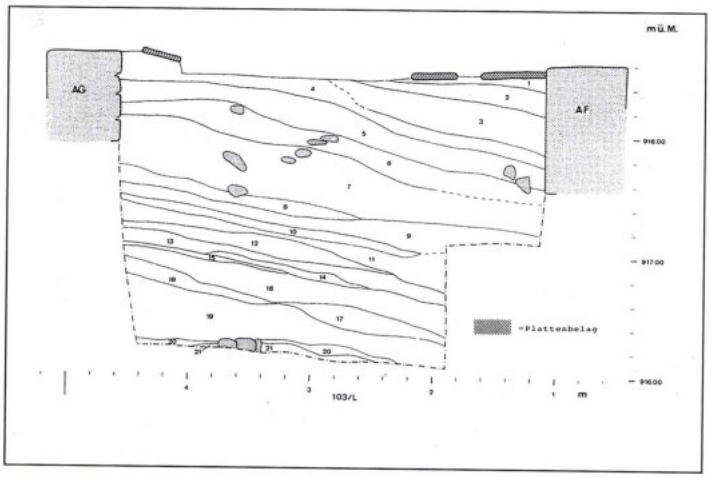
[9] Stucky, *Antike Kunst* 35, 1992, PL. 28,3.




3. Petra. Az-Zanṭūr, Nabataean house of the first century AD. (Ground-plan and reconstructions).



4. Petra. Az-Zanṭūr, stratigraphical trench.




5. Petra. Az-Zanṭūr, sounding in room II.

the house toward the edge of the terrace. To sum up, we may say that the "architect" of the Nabataean house had considerable knowledge of Hellenistic architecture as far as ground-plans and interior decoration were concerned, but not of the construction techniques necessary to deal with the immanent static problems. This fact is perfectly illustrated by the placement of the roofless, that is to say especially unstable room I, at the most exposed point of the terrace.

The architectural evidence laid bare in just four campaigns does not, of course, allow us to draw any definite conclusions relevant to all residential quarters of the city – but I would nevertheless like to propose the following hypothesis: at least some of the Nabataean houses were not built on the rocky outcrop but on the statically unsound sandy grounds of the terraces. The absence of retaining and terraced walls fundamentally modifies the hitherto accepted notion of the residential quarters at Petra as it has been illustrated, for instance, in Iain Browning's guide to Petra.[10] Our results also have an immediate effect for the estimates of the density of the city's sedentary population. In contrast to the usual plan of Hellenistic cities with rectangular street grid and uniform house complexes, built in close sequence, the houses of Petra were not only without a standardised alignment but loosely spread over the slopes on both sides of the wadi. The city showed two "urbanistic systems": the sanctuaries and the official buildings located close to the wadi were built on the rectangular system named after Hippodamos of Milet.[11] The residential areas on the contrary must have resembled a "petrified nomads' camp".[12]

The question as to the reasons for the Nabataean divergence from Hellenistic urbanism may be answered at least in some respects. In room II the late Roman settlers tore out not only the walls but also the pavement in between. For that reason it was possible to make a sounding in this sector (FIG. 5). The aim was to find out when the Nabataean building was erected. We had to dig down some 1.5 m to come upon light greenish layers with an unusually firm texture. They contained not only numerous fragments of pottery and lamps but also quantities of bone splinters – all in all clear indications of intensive dwelling activities. Furthermore these layers had no definable outer limit – neither traces of stone nor mud brick walls were found – but ran out lenticularly to the edge of the terrace. The finds seen together with the density of the firmly compacted material must lead to an identification as habitation layers. This interpretation was confirmed by a sedimentological analysis. Thin and sterile layers separate the four so far detectable approximately horizontal green strata, which have thicknesses from 10-15 cm. All these indications combined with the fact that in the nearby stratigraphical trench these layers are missing lead to the assumption that they represent the trampled deposits of tent floors.

We have to drop the customary idea of a tent with a rigid "skeleton" made of wood or metal with a "skin" of cloth stretched over it. Reliefs of the second half of the

[10] I. Browning, *Petra* (1989) 150 FIG. 75.

[11] Schwandner and Höpfner, 247ff.

[12] Stucky, *Antike Kunst* 35, 1992, 138 FIG. 8.

seventh century BC from Assurbanipal's palace in Nineve[13] depict the king's campaigns into Arabia. A detail shows the corpses of Arabian warriors lying under burning tents. These tents correspond largely to those used by today's Bedouins. They consist of a woolen tent-cloth and wooden tent-poles, which are just placed under the stretched tent-cloth without being driven into the ground. So the nomads' tent looks more like a canopy than like a modern camper's tent.

The limited dimensions of our sounding did not enable us to lay bare the complete extent of the greenish layers; a singular round depression reaching exactly the bottom of one of these layers, could possibly be caused by a tent-pole. We may draw the tentative conclusion that tents of the type described stood on the terrace beneath az-Zanṭūr until the first century BC. At their seasonal return to the city the different families rebuilt their camps on the respective "hereditary" terraces. During their absence a thin layer of soil had covered the traces of the last temporary habitation and can be identified stratigraphically as the sterile strata separating the habitation layers. Supposedly during the late first century BC the first humble stone-built dwelling was erected on the terrace, the measurements of which we do not know yet.

For the fist time in Petra it is possible to conceive the change from nomadism to a settled way of life, a process which before was only documented by the authors of antiquity. It should not be assumed that this development happened abruptly; it is more likely that during a transition period, tents stood beside permanent houses. Depending on the climatic conditions the inhabitants chose the one or the other way of housing – as is usual in Jordan up to this day. For that reason we should not be surprised that the terraces were not specially prepared and stabilised with retaining walls by the Nabataeans but that they left the sites in the given state – if there was no possibility to build on the rocky outcrop, as they usually did.

Our excavation brought to light the dilemma between ready acceptance of Hellenistic innovations and a persistent clinging to local traditions. We are dealing here with a phenomenon that is not only true of the Nabataean way of dwelling and planning of habitation quarters, but of other aspects of Nabataean material culture as well, such as the tomb facades, the sculpture and the pottery.

[13] *Ibid.*, PL. 26,4; R. D. Barnett, *Assyrian Palace Reliefs and their Influence on the Sculptures of Babylonia and Persia* (1960) PL. 114.

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# A Newly Described Nabataean Temple Near Petra: The "Pond Temple"

The surroundings of Petra still yield new discoveries every year. The reasons why some areas in Jordan are only occasionally included in scientific surveys, and others not at all, are obvious. Modern explorers wish to avoid the dangers connected with climbing mountains and camping that former explorers like de Laborde, Musil, Glueck, and others had to face. Scientifically laudable self restraint leads scholars to overlook or exclude observations outside their own specialty. The local inhabitants know many sites not yet known to scholars, but they do not always know what is of interest to whom, and for many reasons they are prone to keep their knowledge for themselves. The research and discoveries described in this article, however, were helped considerably by local bedouins who showed comradeship and reliability in difficult situations.

Since 1984, the region of Slaysil (FIG. 1) has been investigated several times by an Austrian group of the Naturhistorische Gesellschaft Nürnberg under the direction of E. Gunsam. The experienced mountain climbing team was well equipped for hiking and climbing in the precarious terrain. Tracks and pathways not only from Bayḍa but also from the ad-Dayr plateau to Slaysil were explored. When F. Zayadine reported on the area of Slaysil during the Fourth International Conference on the History and Archaeology of Jordan in Lyon in 1989, he mentioned ruins, one and a half hours' walk from Bayḍa and "une colline rocheuse, et-Tahuneh". From there, according to Zayadine, "une piste construit en colimaçon" runs down "les falaises de Jibâl es-Sumra" (1992: 223).

## The Discovery

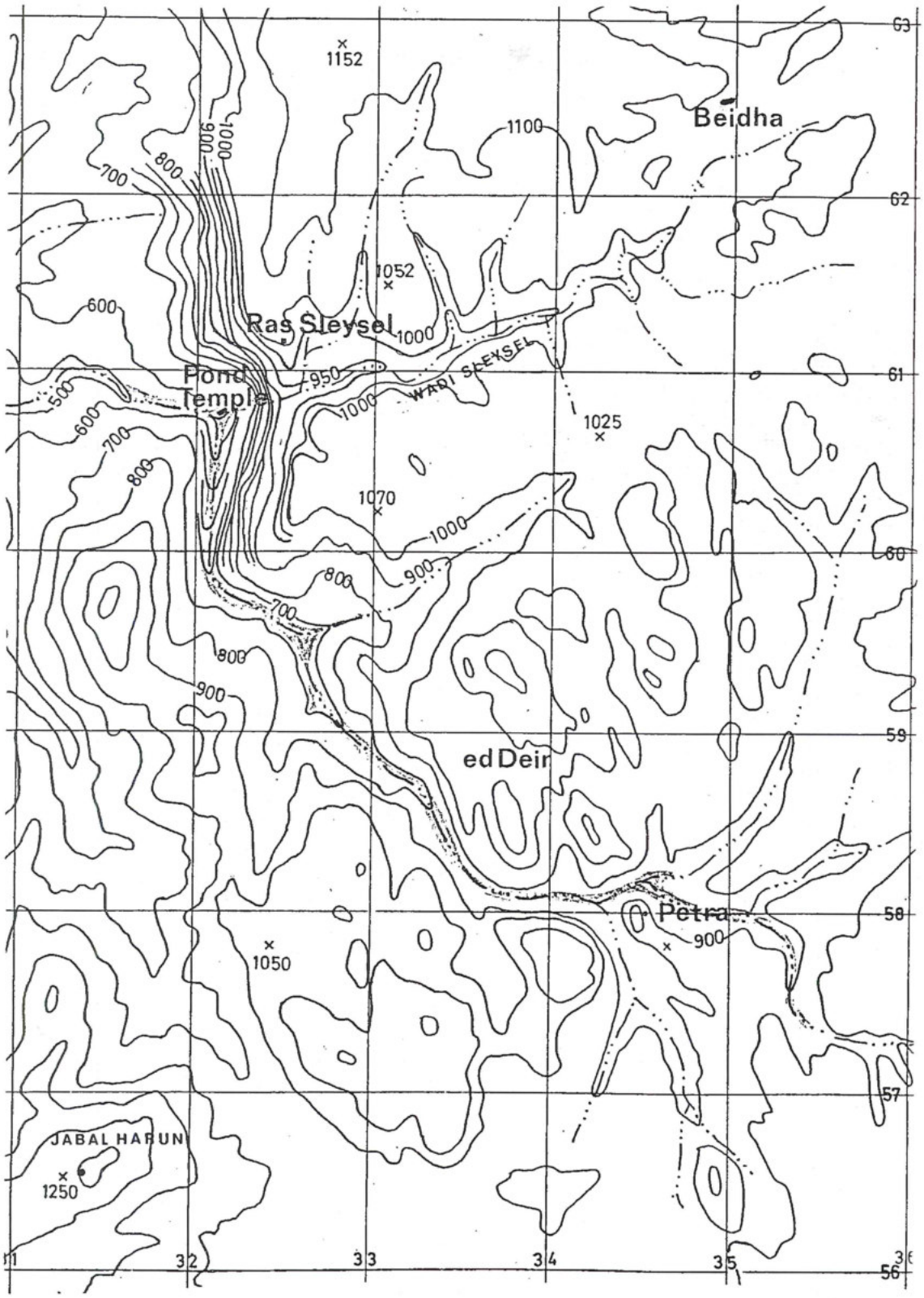
Where Kirkbride had only seen a small platform with a flight of steps leading down to it and beyond to the drop to Wādī 'Arabah (1961: 448-451), the beginning of an ancient road running down from Slaysil had been noted in 1978 (Lindner 1978: 93).[1] The rock face, however, seemed too steep to be climbed. In 1984, the Austrian team of the Naturhistorische Gesellschaft Nürnberg under the direction of E. Gunsam investigated the road more closely. They observed and walked along a well-built road that begins about 65 m north from Rās Slaysil, and then runs down in steep serpentines toward the west (FIG. 2). The road, about 2-3 m wide is paved with massive slabs of durable igneous stone. The substructures of hewn and unhewn stones of the same material are up to 2 m high and built or inserted into the cliff. Perhaps too steep for heavily loaded camels, the road was certainly suited for horses, donkeys, goats, sheep, and, of course, for men on foot.

After 100 m, the road was broken off, and a gap of more than 15 m was absolutely impassable. In 1989, by climbing down toward the southwest across narrow ledges and almost intractable sections of the rock wall, the Austrian team managed to by-pass the gap. Eventually, they reached a scree slope with a 45° incline and a difference of altitude of 300 m (850 to 550 m) which falls in a north-south direction, and is obviously the result of a gigantic rockslide. At the foot of the scree, they entered a ruin field of boulders, tumbled ashlars, and architectural pieces and fragments. The site was explored by Gunsam's team in 1989 and 1990, and by Lindner's team in 1991, who benefited from the exploratory work done in 1989 and 1990. An abnormally strong flash flood in March 1991 that wrought havoc in Wādī Mūsa and Petra also raced through Wādī aṣ-Ṣiyyagh taking rocks, trees, and even scaffolding timber from Petra with it and hit the site together with water coming from Slaysil and from the other surrounding heights. The following description takes into account the changes in the ruins caused by the flood (Lindner 1991: 53).

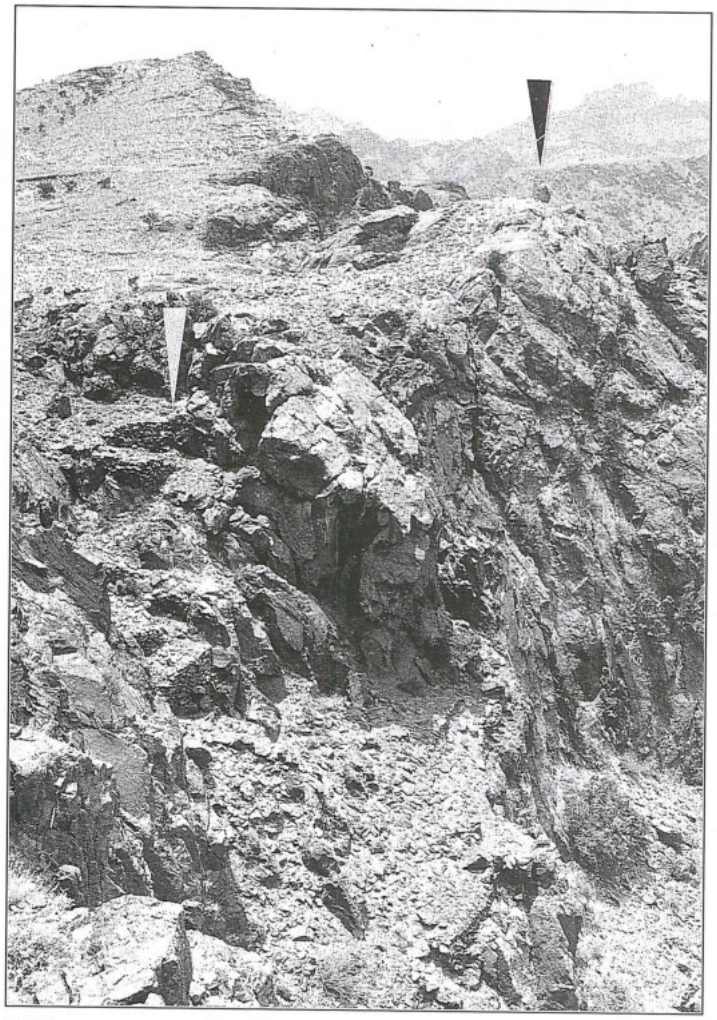
## The Site of Saḥīr al-Baqar (FIG. 3)

The bedouins of Petra gave different names for the place but Saḥīr al-Baqar ("troughs of the cows") seems to be the most common one. The site is bound by a pond to the

[1] The visit to Slaysil was part of an archaeological exploratory project of the Naturhistorische Gesellschaft Nürnberg, which was initiated by M. Lindner in 1970 and continues to this day.




1. Sketch map of the Petra - Slaysil area (E. Gunsam).



2. The sanctuary on Rās Slaysil and the beginning of the road down to the Pond Temple.

east; by a large boulder to the southwest; by the foot of the scree to the north, and by the outlet of the pond to the south. There are two concentrations of finds, one to the southwest and one to the northwest, seemingly connected by a flight of steps. During the last inspection of the site, we could see more ashlars coming out on the slope around. Thus the site is probably more extensive than is described here. An estimated altitude difference of 40 m (580-620 m) indicates the particularity of the terrain as far as it was built on.

*The Pond*

At the foot of the scree, c. 480 m below the sanctuary of Slaysil, a pond of roughly 10 x 6 m is fed from a presumably perennial spring, the water of which falls about 100 m through four or five basins at the rock wall of Jabal Slaysil. More water comes down out of Wādī Slaysil when it rains. Running toward the west, the outlet of the pond reaches Wādī aṣ-Ṣiyyagh, which as seen from Rās Slaysil continues after its sharp bend towards the west. Around the pond and its outlet, as well as in Wādī aṣ-Ṣiyyagh, trees and shrubs grow so thick that it was impossible to decide whether the basin was natural or artificial. Two basins that we were able to reach, however, were washed free of their vegetation during the March disaster, and at the upper one of the two (at c. 590 m), an empty niche may be assumed. As in Wādī aṣ-Ṣiyyagh, live crabs were seen in the pond.[2] Red and blue dragon flies buzzed over the water, and birds were seen around the upper basins.

Mrs. Künne who was with the 1991 team examined the plant life in the temple area. Around the pond at 590m on sandy surface above Precambrian quartz porphyry and porphyrite, she found a hydrophilous, non-halophilous plant community: *Salix acmophylla, Ficus pseudosycomorus, Tamarix* spec., *Nerium oleander, Atriplex halimus, Arundo donax, Phragmites australis, Imperata cylindrica, Typha domingensis, Juncus arabicus, Salsola aegyptiaca, Mesembryanthemum nodiflorum.*

Some halophilous plants appear only marginally: *Salsola aegyptiaca, Mesembryanthemum nodiflorum.*

On the moist rock a plant community, dominated by the fern *Adiantum capillus-veneris,* appears*: Adiantum capillus-veneris, Sonchus maritimus, Samolus valerandi,* and mosses div. spec.

At the sunny temple slope at 580 to 620 m on quartz porphyry and porphyrite, a plant community with a relatively high percentage of nubo-sindian plants is growing:

Trees: *Ficus pseudosycomorus, Juniperus phoenicea, Phoenix dactylifera.*

Shrubs: *Atriplex halimus, Retama raetam, Ochradenus baccatus, Periploca aphylla.*

Halfshrubs and dwarf shrubs: *Anabasis articulata, Anabasis setifera, Hammada salicornia, Zygophyllum dumosum, Agathophora alopecuroides, Salsola aegyptiaca, Reaumuria hirtella, Fagonia* spec., *Farsetia aegyptiaca, Salvia aegyptiaca, Lavandula pubescens, Chiliadenus montanus.*

Perennial: *Cucumis prophetarum.*

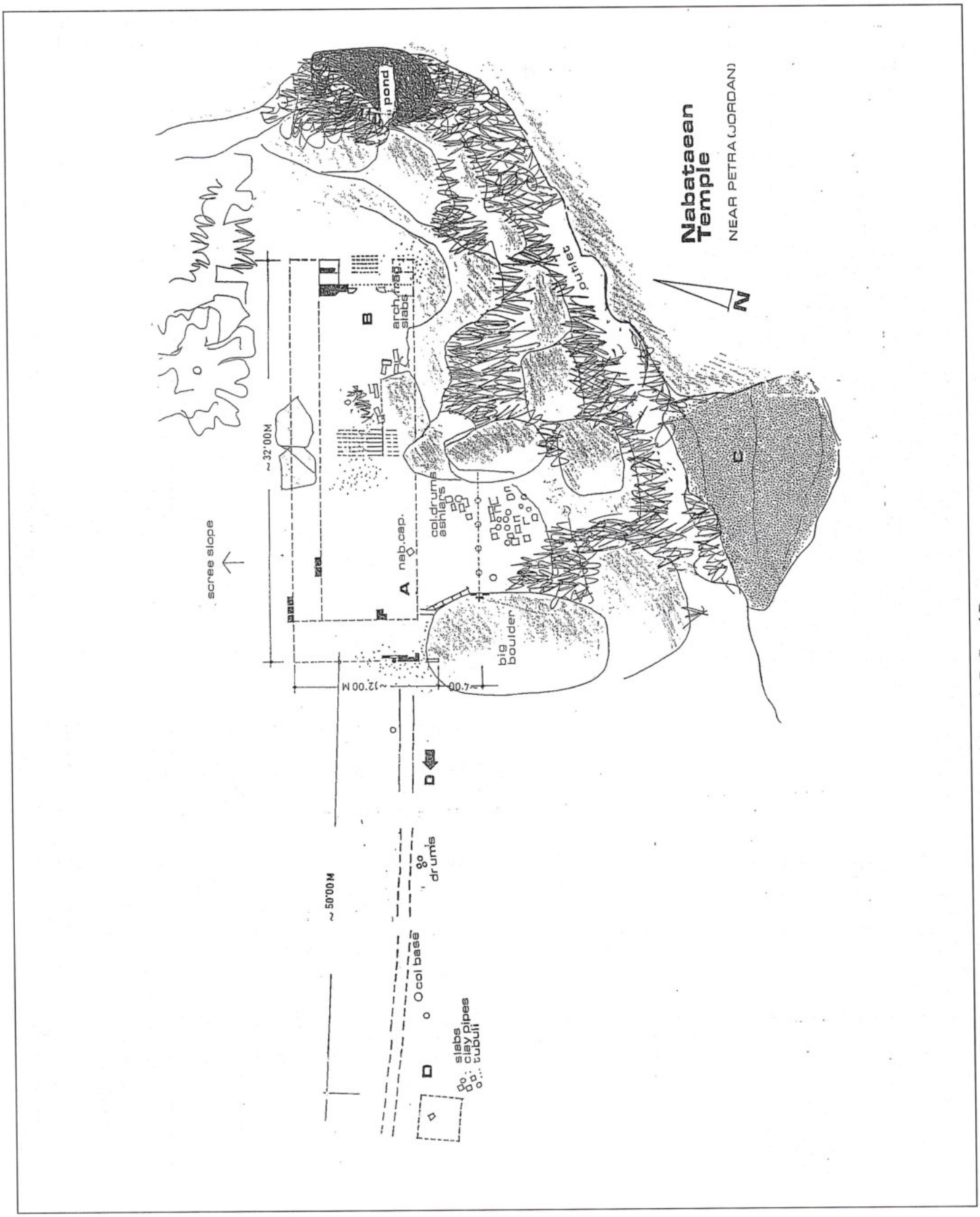
Annuals: *Caylusea hexagyna, Salsola volkensii.*

Because she was there in autumn, the plant list is not complete.

*Area A to the Southwest*

The main feature of Area A is an enormous boulder 14 x 6 m and 6.50 m high. Three cuts 0.60 m long on its east face might have anchored arches but more probably a wall (FIG. 4). Ashlars lying *in situ* around the boulder are the remnants of a structure connecting the boulder with a second smaller one, 9 m to the east, and thus forming a

[2] Similar crabs were noted in another pond-like rivulet coming from 'Ayn az-Zāwī (Lindner 1986: 175).

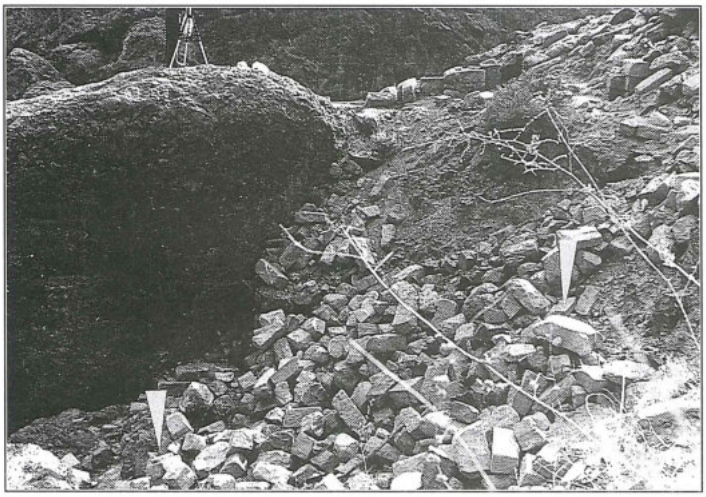



3. Sketch map of the Pond Temple site with tentative boundaries and Areas A, B, C, and D.

supporting wall and/or a stout foundation for another structure built upon it. Around the boulder, but obviously fallen from higher up, one of the two concentrations of finds was noted (FIG. 5). To the north of Area A, a column 1.20 m high with a diameter of 0.44 m and a hole in its face was found set (secondarily?) within a west boundary wall still 4 m long and 1 m high, perhaps the remnants of a gate or a (later?) door opening (FIGS. 6 and 7).



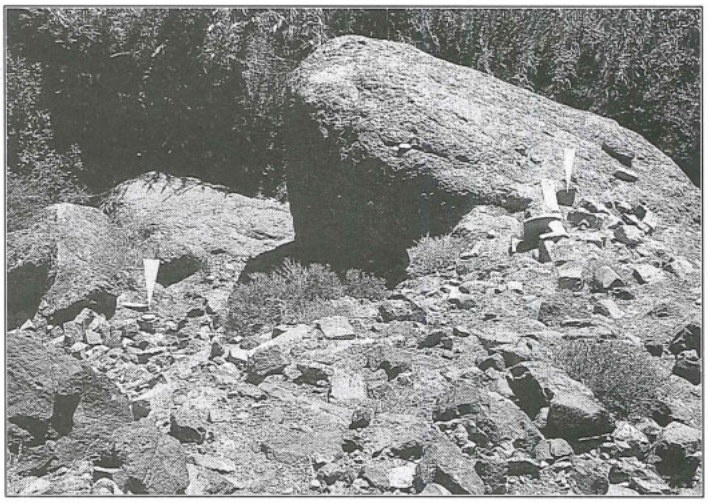
4. Large boulder of Area A with cuts and remnants of an adjoining wall *in situ*.



5. Concentration of finds at the northeast face of the large boulder with the Nabataean capital and metope (arrows).

*Finds of Area A:* Among the two boulders and together with many ashlars, the following architectural pieces were noted:

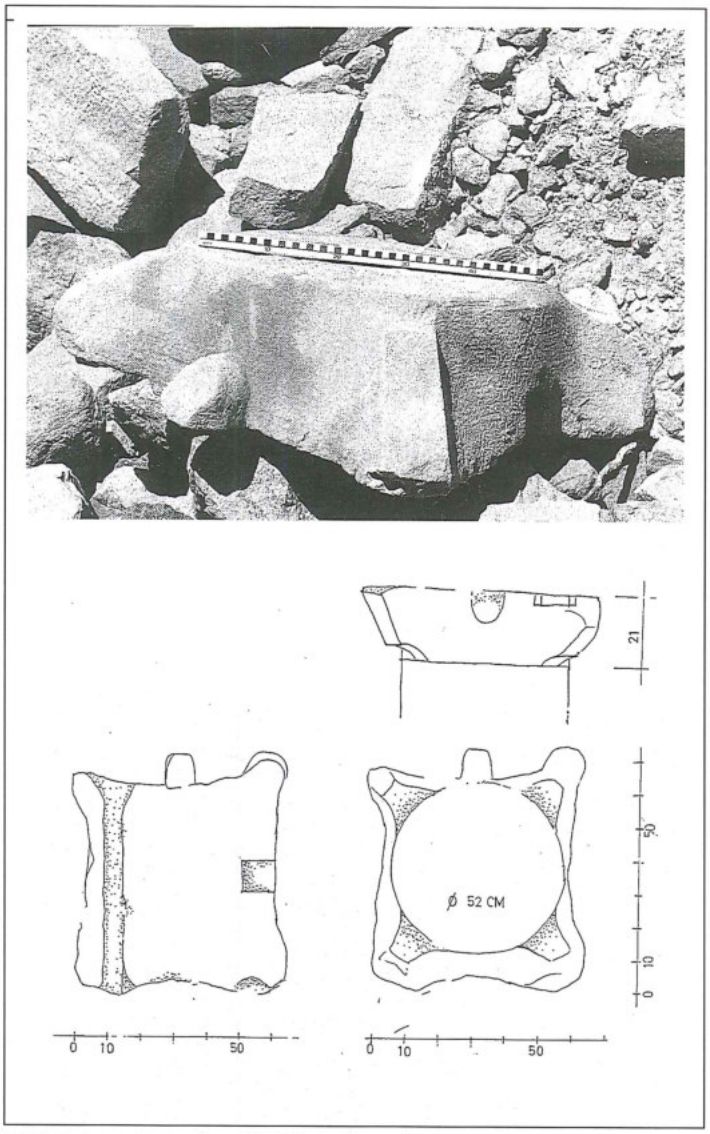
- A Nabataean horned ("Hörner") capital (Type 1 according to McKenzie 1990: 190) of sandstone, 0.64 m square with a lower diameter of 0.52 m comparable with the originally free-standing capitals in the theatre of Petra (Hammond 1965: 45, PL. 34.4) (FIG. 8). A groove, 6 cm wide and 4 cm deep, is cut out of one side.
- Column base, Attic type, 0.55 m lower diameter, 0.44 m upper diameter, 0.30 m high, with a round hole (FIG. 9).
- Ashlar 0.30 m high with disc metope, comparable to a similar one found at Ṣabra in 1990.
- Triglyph, c. 0.30 m high.



6. The supposed gate in the west wall (arrow) with the large boulder behind it. Metope (arrow) to the left.



7. The supposed gate in the west wall with the inserted column and triglyph.




8. Nabataean horned capital from Area A.




9. Column base from Area A.



10. Stonework, remnants of two walls, at the northeast corner of Area B with diagonally trimmed ashlars. A gate or door can be seen in the far end between the two walls.

Six column drums, of 0.35 to 0.40 m and 0.25 to 0.26 m diameter, sandstone.
- Conical column drum, 0.32 x 0.18 x 0.21 m with a hole in its lower surface.
- Ashlar, 0.50 x 0.18 x 0.21 m with brown-red painted stucco.
- Seven ashlars, ranging between 0.33 x 0.30 to 0.60 x 0.25 m, 0.21 to 0.27 m high, four of them diagonally trimmed, one with a smoothed rim of 1.5 cm.
- Paving stone of limestone near the large boulder, carefully ground and polished.

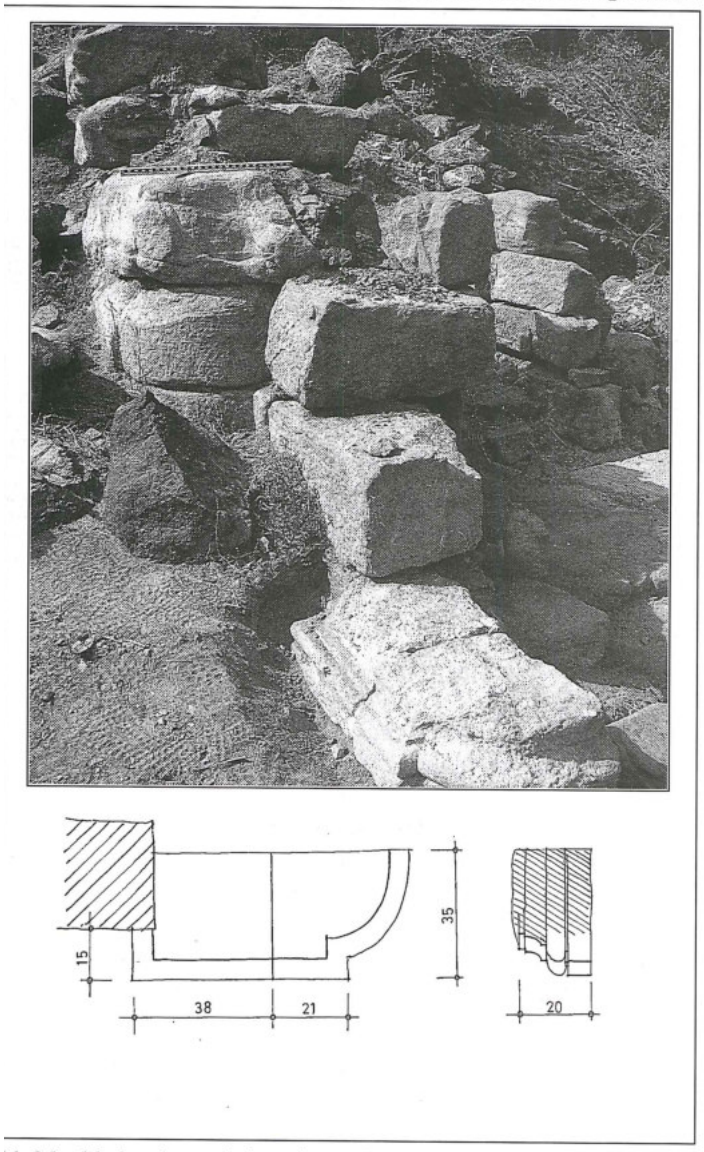
*Area B to the Northeast*

Area B was most affected by the rockslide and again by the flood of 1991. Rocks and boulders are scattered all over. Well-preserved wall sections 2.50 m long, 1.80 m high, and 1 m wide are the remnants of two walls constructed with diagonally trimmed ashlars up to 0.60 x 0.40 x 0.30 m (FIG. 10). At the south end of the stonework, a flight of steps led down to the pond in an east direction. Several fragments of slabs that have slipped off are lying about. A moulded sandstone base broken in two pieces, together 0.75 m long, 0.35 m wide, and 0.20 m high, bounded the west part of the two walls. It might have belonged to a (secondary?) gate or door 0.95 m wide (FIG. 11). The numerous ashlars in this part of Area B indicate a larger extension of the west wall towards the south. The ashlars to the south and east, however, have slipped off, and the second wall paralleling the first one

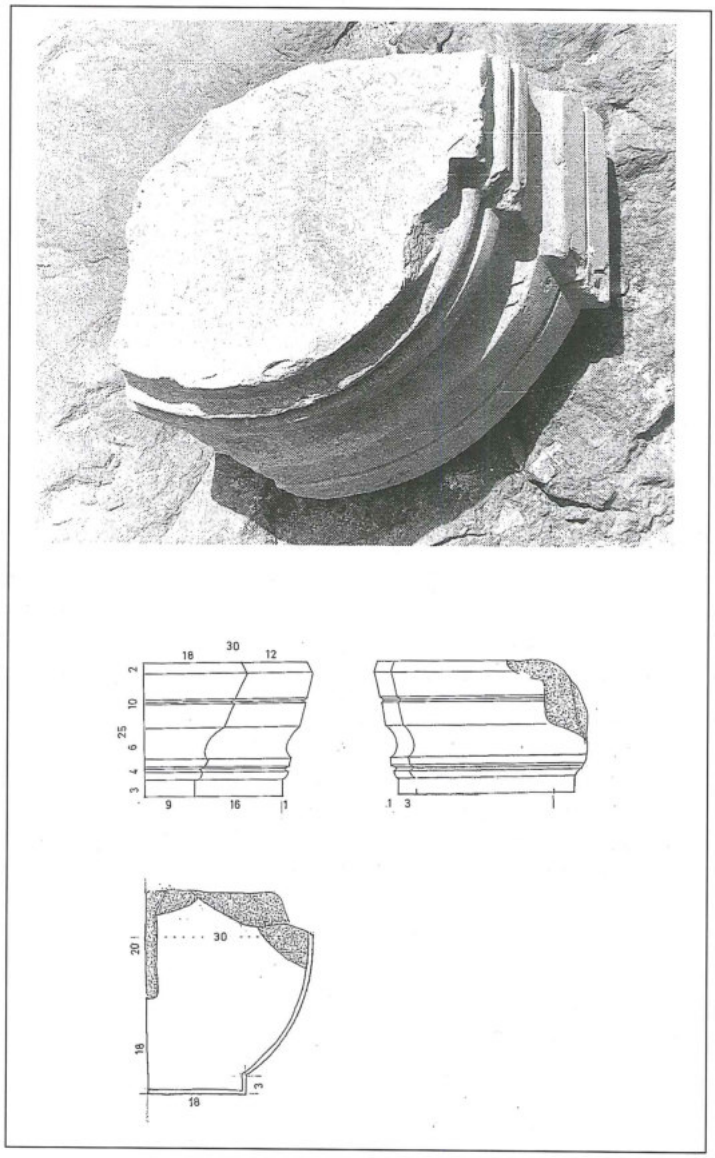
apparently closed the compound. Below the described walls to the west, south, and east, carefully worked architectural pieces and fragments, partly made of a fossil-rich limestone, were found in 1989. The same shell-limestone material is to be found at Petra and Ṣabra, and was described on the north terrace of Umm al-Biyāra (Lindner 1989: 300) but no quarry has been detected so far.

*Finds of Area B:* The following architectural elements were found in Area B:

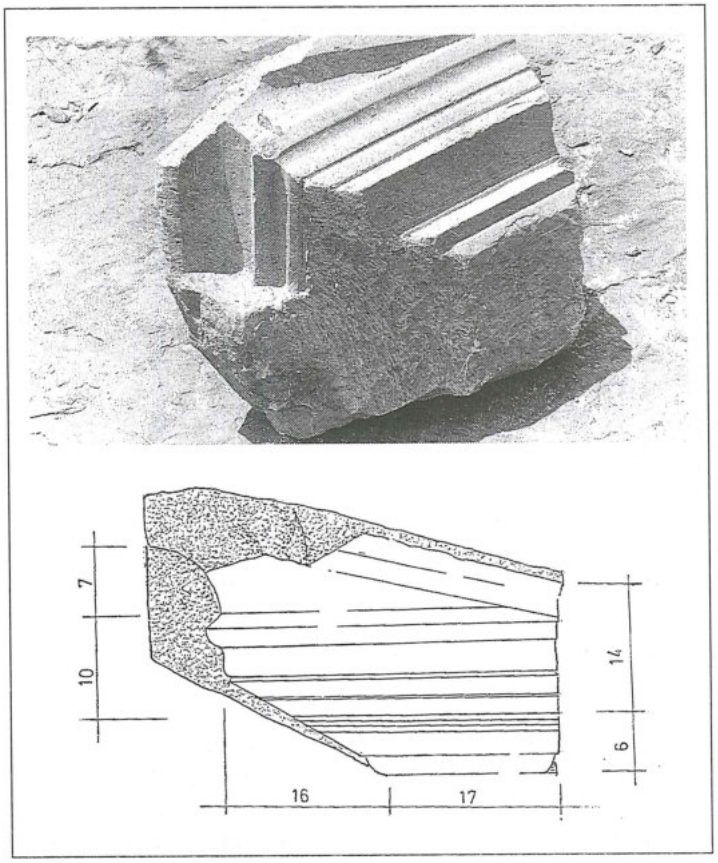
- Echinus of a Nabataean capital, 0.30 x 0.25 x 0.38 m, comparable with the capitals of the upper order of the ad-Dayr temple (according to Schmidt-Colinet 1980: 224-226 and pers. comm.) and with capitals of other Petraean tombs (FIG. 12).
- Lateral fragment of a pediment, made of limestone, 0.44 x 0.42 m (FIG. 13).
- Floral decoration in relief, c. 0.80 x 0.20 m, comparable with finds in Petra and Sabra (Schmidt-Colinet 1980: 190; Lindner 1986: 160) (FIG. 14).
- Pillar capital, 0.30 x 0.25 m, comparable with a similar one found and described on the ad-Dayr plateau opposite the rock-cut temple (Lindner 1984: 170, PL. 25.2).
- Slab of fossil-rich limestone, 0.20 x 0.12 m, 16-22 mm thick, polished on three sides.
- Two fragments of white marble slabs, c. 16-18 mm thick.
- Brown sandstone fragment, 110 x 80 x 50 mm, diagonally trimmed with a smoothed rim.
- Moulded wall or pillar base, probably part of a gate or door (see above).
- Sandstone fragment, 0.55 x 0.40 m, possibly a weathered medallion in relief or a damaged metope (FIG. 15).




11. Moulded and rounded sandstone base at a gate or door in Area B.




12. Echinus, lower part of a Nabataean capital (fossil-rich limestone).




13. Fragment of a pediment from Area B.

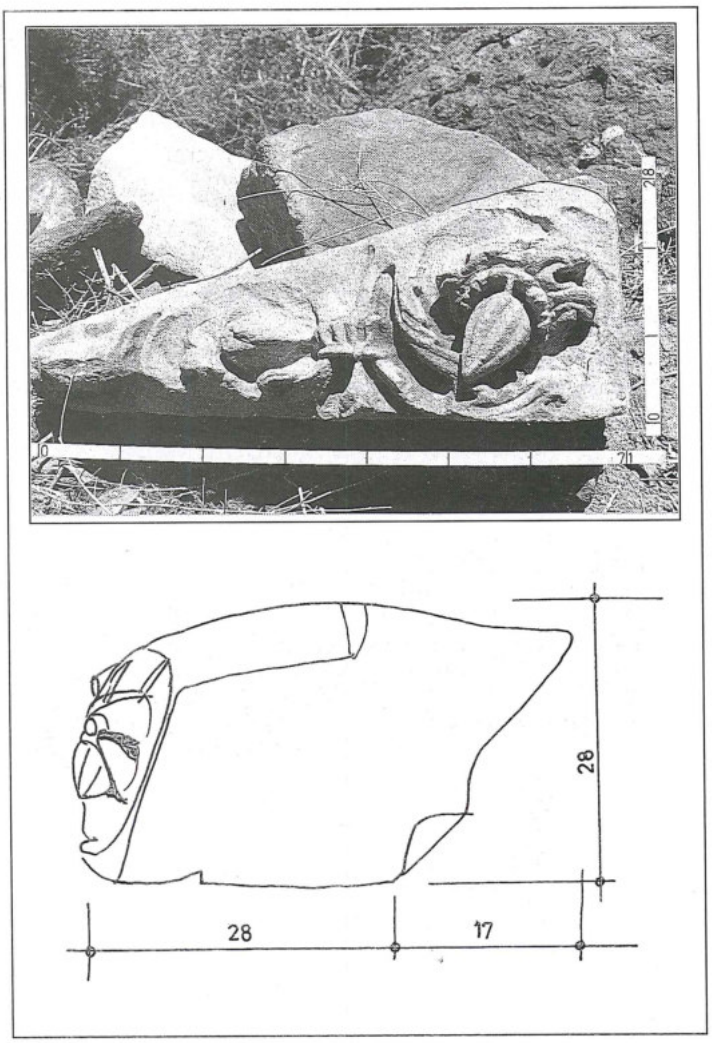
*Area C Above the Pond*

South of the pond outlet, on an inclined rock platform of about 70 x 30 m, roughly 15 m above ground and located near the track to Petra, numerous pottery fragments were collected from the surface.

*Finds of Area C* (FIGS. 16-18): Fragments of painted and unpainted pottery, mostly of plates and bowls, but including a few lamps may be dated to a period from the first century BC to the third-fourth century AD, with a significant preponderance of the first-second century AD. An almost intact oil lamp with two cornucopiae, a symbol of abundance (in FIG. 18), parallels a lamp found at Petra (Horsfield and Horsfield 1941: 197) but the type may also be seen at other (Roman) sites, e.g. at Augusta Treverorum (Trier Museum). A small lamp fragment belongs to the Nabataean "standard type", well-described by Khairy (1986: 66-67). More pottery fragments were collected during Lindner's visit to Saḥīr al-Baqar in 1991, but there was nothing in it to change the dating.

*Area D to the Northwest*

From the remnants of the supposed gate to the northwest of the compound, a pathway, visible in 1990 but no longer in 1991 after having been covered with fallen ashlars from above, was originally 1.20 m wide and constructed

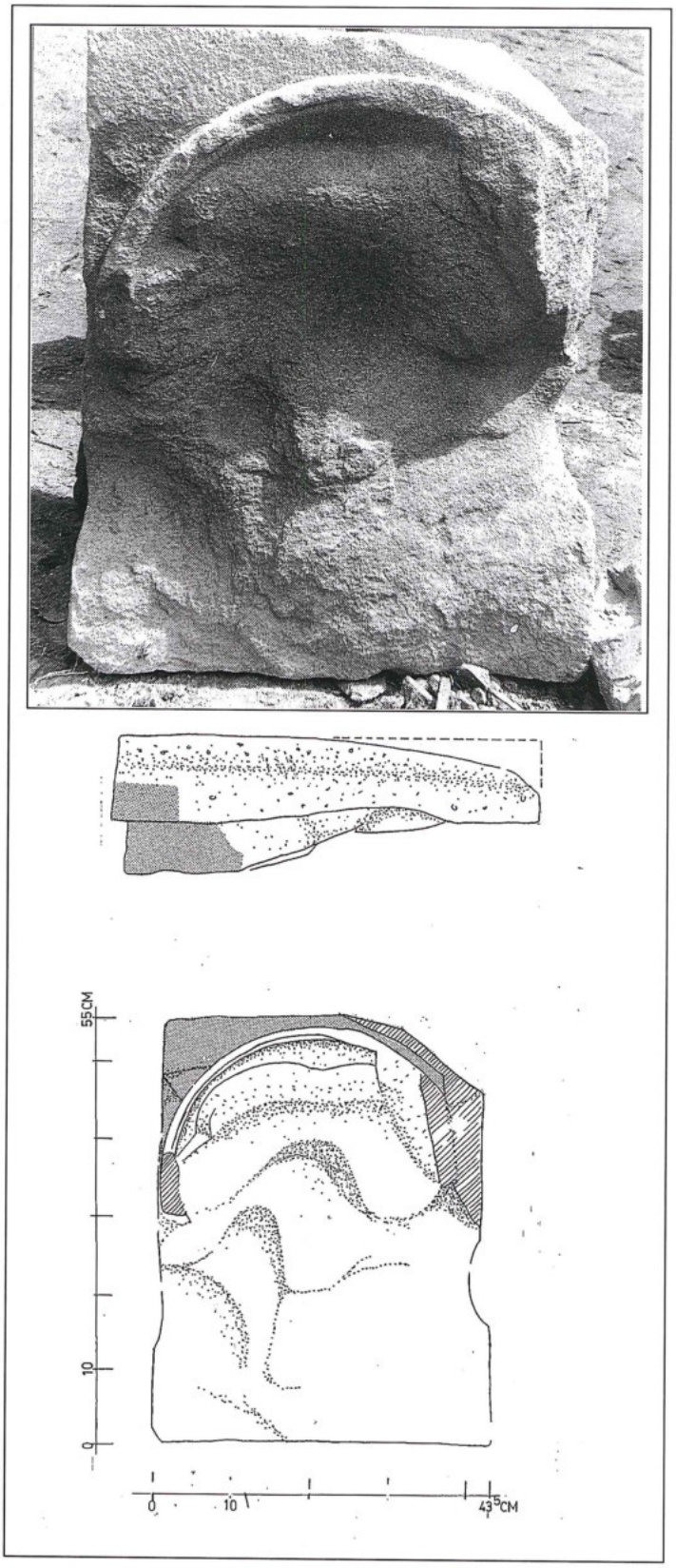



14. Floral decoration in relief from Area B.

of sandstone slabs, measuring 0.40 m square. It paralleled the wadi toward the west and ended after c. 50 m with a house ruin, 3.50 m square. One of the ashlars was diagonally trimmed.

*Finds of Area D:* The following items were found in Area D:

- Trapezoid keystone, 0.50 x 0.28 x 0.16 m.
- Three column drums, 0.31 m diameter, 0.20 m high, another 0.40 m diameter.
- Column base, 0.59 m lower diameter. Drums and base were found between the mentioned house ruin and the compound proper, and were probably not *in situ*.
- In the immediate vicinity of the house ruin, remnants of a Roman-type thermae (FIG. 19):[3]
- Two small fragments of worked white marble, 1.5 cm thick.
- Two sandstone slabs, 0.20 m square, 3 cm thick.
- Fragments of tubuli, 13-17 cm wide, 3 cm thick.
- Two brick slabs, 0.26 m square, 2 cm thick.
- Half of a round clay tile, 0.22 m thick.




15. Sandstone slab from Area B. Relief medallion?

- Many small fragments of clay tiles.
- Many small fragments of clay pipes.

Finds not belonging to a particular area: Two conduit blocks of the usual ashlar size were found in the centre and in the northwest corner of the compound. Others were seen about 50 m higher up where an ancient conduit had been restored by bedouins twenty years ago but neglected later on.

## Conclusions Derived from Location, Architecture, and Finds

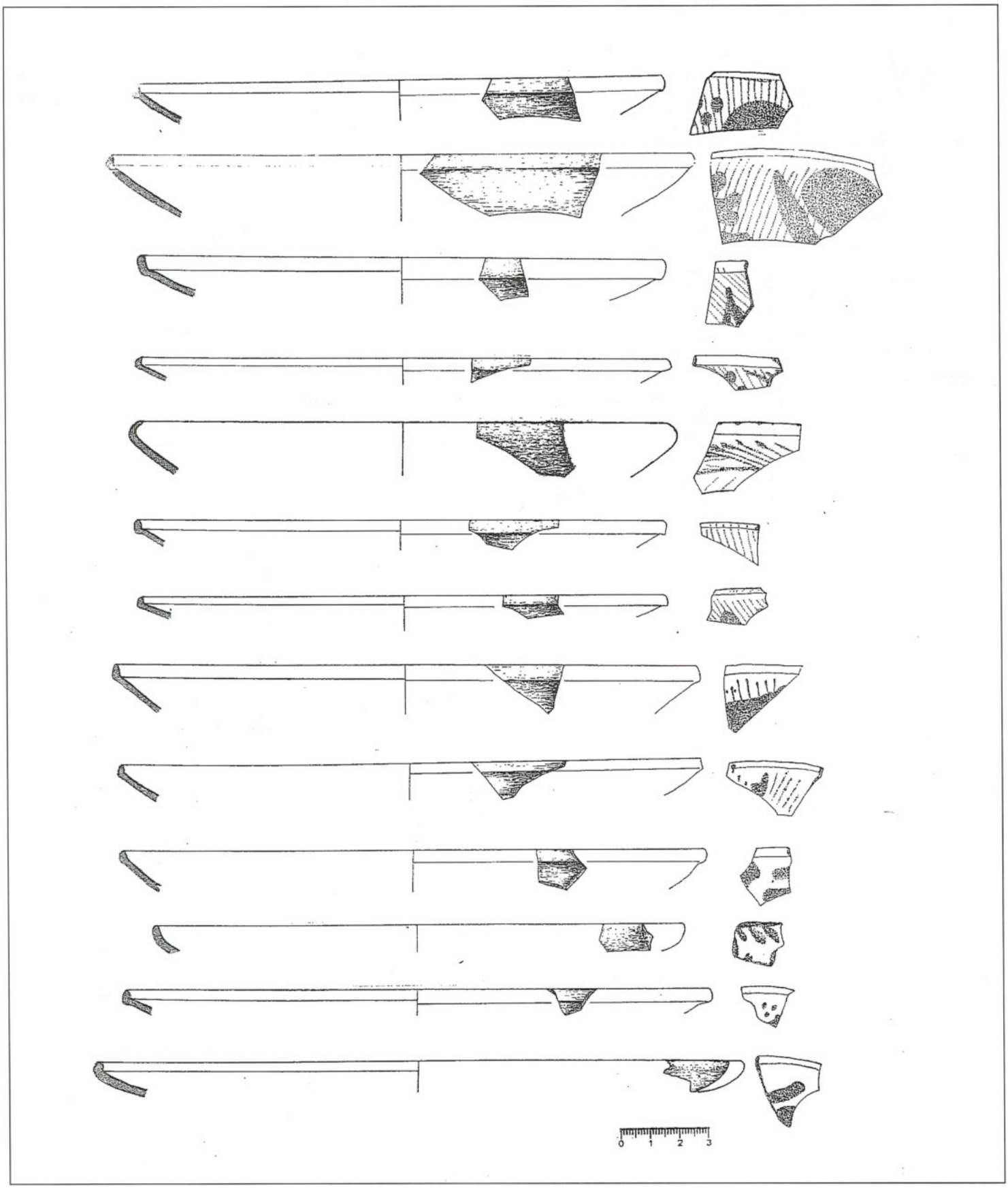
Based on the masonry and architectural pieces that were found, as well as the pottery fragments, which, however, were collected from outside the compound, it is assumed that the ruined compound at the pond 450 m below Rās Slaysil was a Nabataean temple at the crossroads of caravan routes. There were several structures, especially in Areas A and B. Without excavation, however, not enough foundations can be made out to produce a ground plan. The lines in FIG. 3 mark only tentatively the borders of the compound. The rich variety of column and ashlar sizes, of architrave fragments with metope and triglyph together with their delicate mouldings, and the parts of Nabataean capitals demonstrate the former existence of no minor shrine. At Saḥīr al-Baqar there was once an important compound of buildings, peristyles, stairs, and a Roman-type house with hypocausts, all ingeniously adapted to the extremely complicated ground with a risk of natural catastrophes. As a name for the compound the authors suggest "Pond Temple" in English, and "Teichtempel" in German because, in addition to other ponds or basins higher up in the rock wall of Jabal Slaysil, the pond at the foot of the precipice seems to have been both an integral part of the temple and its reason for being.[4]

## Chronology of the Pond Temple

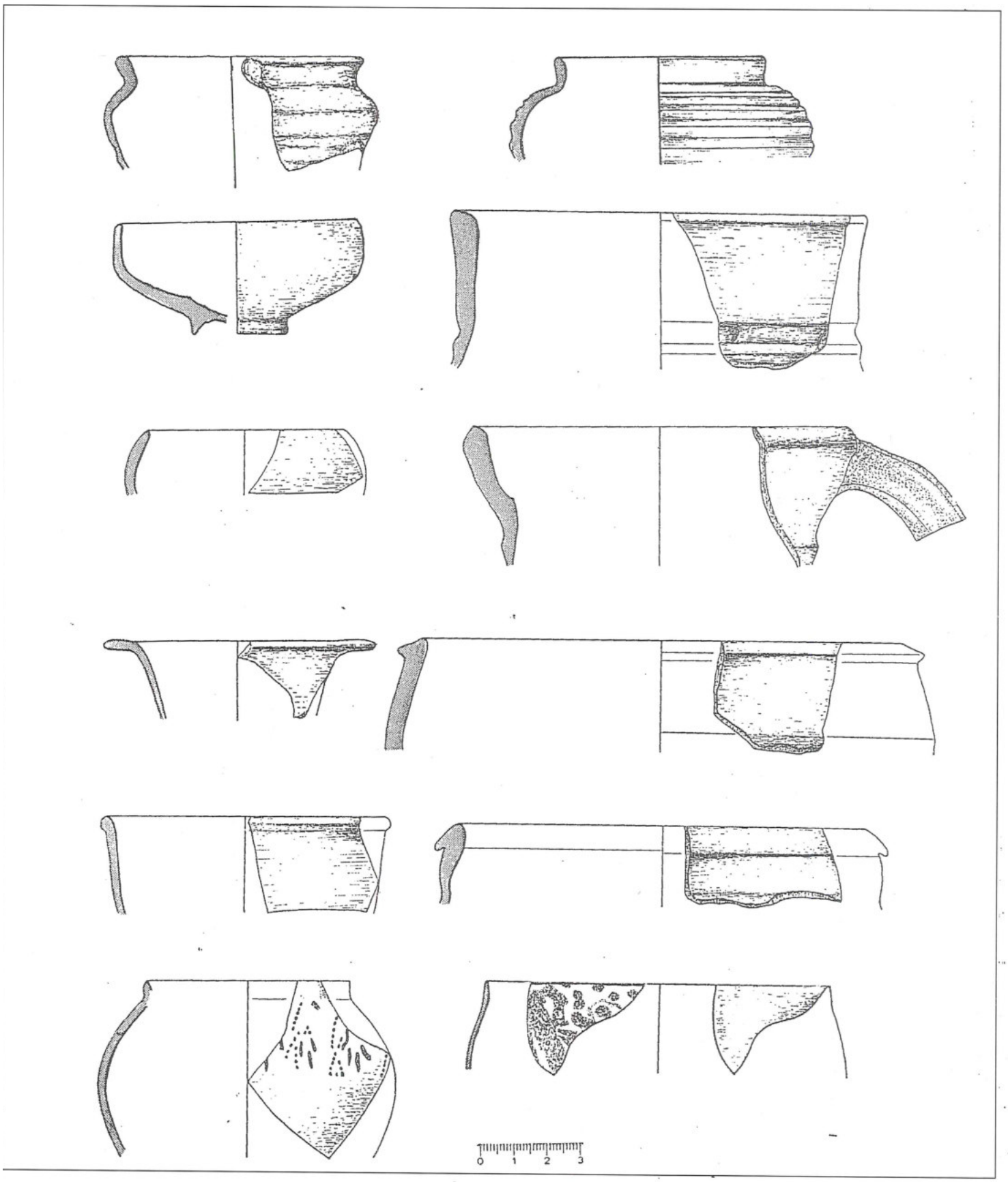
Because no inscription has been found so far, the chronology of the Pond Temple must be based on surface finds. The most spectacular find is the well-preserved upper part of a Nabataean sandstone capital with the typical horns. It is the same type as the upper order of columns at the ad-Dayr Temple not more than a few hours away, which to be sure were carefully sculpted rather than rock-cut (Brünnow and Domaszewski 1904: 186, FIG. 220). Schmidt-Colinet (1983: 307) called it "eigenwilliger Typus des nabatäischen Normalkapitells", for J. McKenzie (1990: 190) it is the "Nabataean capital Type 1". Contrary to the rock-cut version of ad-Dayr, the echinus of Area B (not necessarily belonging to the upper part of the capital from Area A) is made of a fos-

[3] The authors have to thank Mrs. A. Schmidt for detecting the significant pieces and suggesting their function, and Prof. Dr. E. Ruprechtsberger (Linz, Austria) for verifying the supposition.

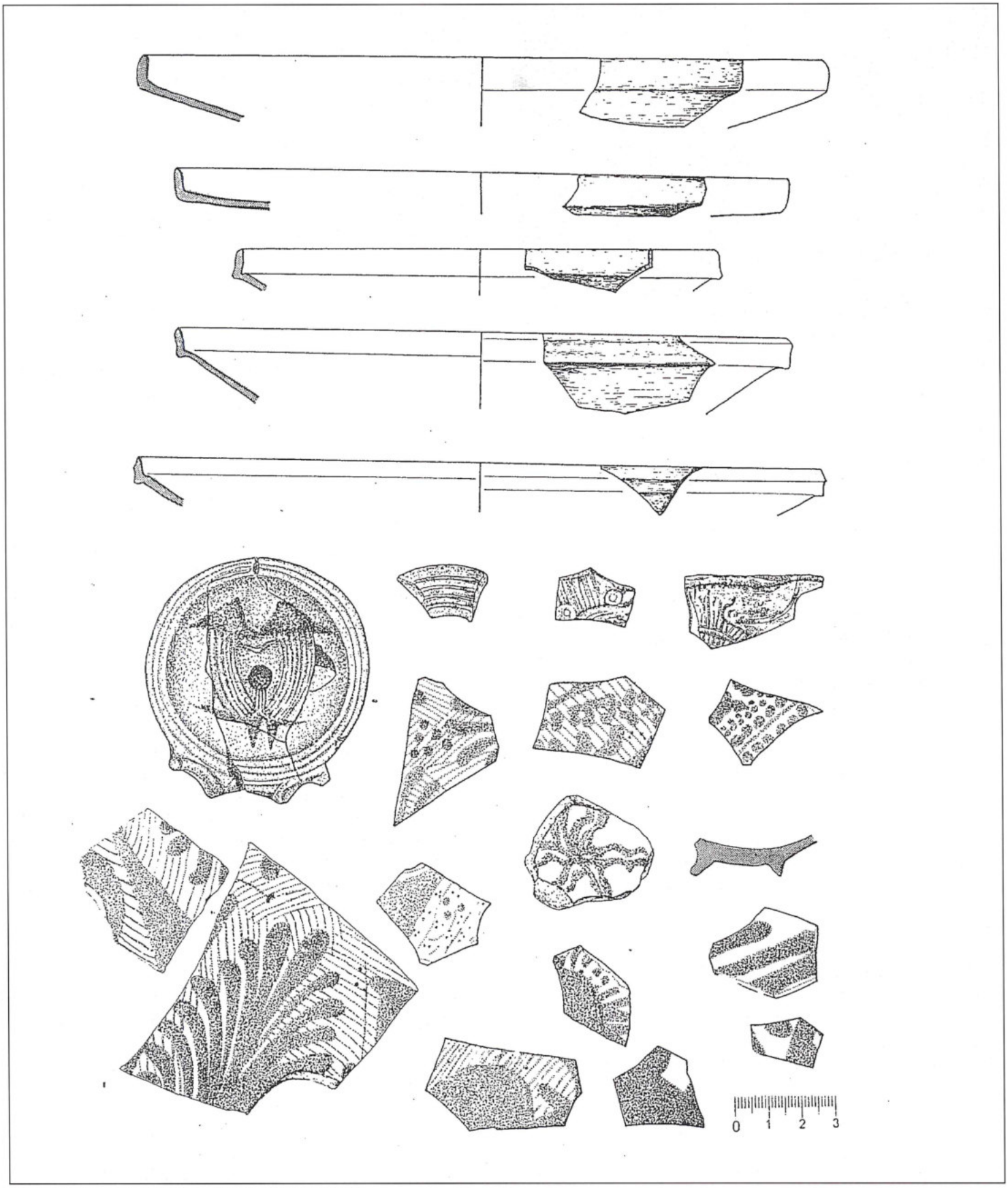
[4] About "sacred pools connected with Nabataean temples" see also Glueck (1965: 391).



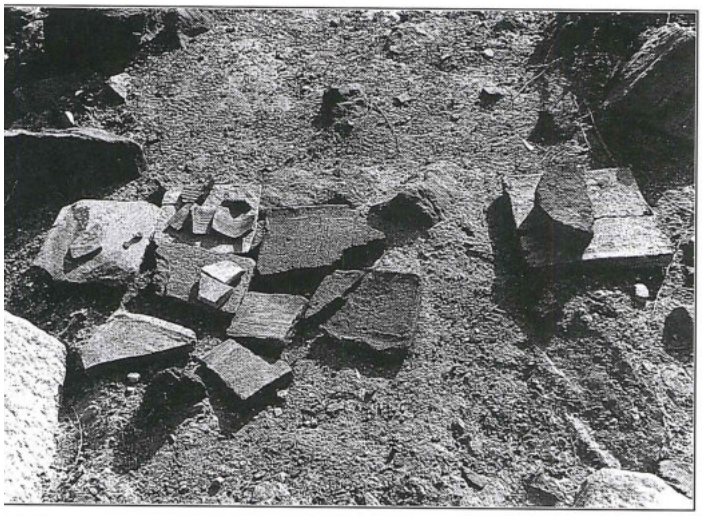

16. Surface pottery from Area C (Pond Temple site).




17. Surface pottery from Area C (Pond Temple site).




18. Surface pottery from Area C (Pond Temple site).



19. Remnants of a Roman-type thermae in Area D.

il-rich limestone, just like a few other architectural elements of the ruin field. Unfortunately, given the formal similarity of the capitals, the same chronological problem arises as with the ad-Dayr Temple itself and with a group of other rock-cut tomb facades with Nabataean capitals — the Bāb as-Sīq Triclinium, Unfinished Tomb, Urn Tomb, Palace Tomb, Turkmāniya Tomb, Sextius Florentinus Tomb, among others.

Comparing these monuments with those tentatively dated by McKenzie (1990: 190), we know at least that the Pond Temple cannot belong to McKenzie's earliest group, which includes Qaṣr al-Bint with a *terminus post quem* in the beginning of the first century AD. The other rock-hewn tomb facades with "normal Nabataean capitals" may be dated from the early first century AD up to AD 129, the date of the Sextius Florentinus Tomb, and to the date of the ad-Dayr Temple, which has been definitely attributed to the era of King Rabel II by Schmidt-Colinet (1980: 22) and by Zayadine (1980: 224). Hammond (1965: 65) attributed the "pure Nabataean" capitals of the Main Theatre of Petra to its original Nabataean order in "Period I (a), possibly between 4 B.C. and A.D. 27". Horned capitals of a Nabataean temple at Oboda (Avdat), destroyed in AD 50, were reused in Late Roman times (Wenning 1987: 165). For Glueck the "pure Nabataean-type capital" of Khirbat at-Tannūr belongs to Period II, which he dates between the end of the first century BC to AD 106 (Glueck 1965: 125, 138, 385, PL. 73, a, b). One of the authors noted (unfinished?) Nabataean horned capitals on the artificial plateau opposite the ad-Dayr Temple (Lindner 1984: 166-168, PL. 21). They obviously belonged to a peristyle in front of a rock-cut sanctuary. Its contemporaneity with the ad-Dayr Temple was suggested. Much earlier, Butler in Sī' described horned capitals that were, it is true, more elaborate than the capital of the Pond Temple, but had a simpler echinus. The South Temple where the horned capital was found reminded Butler of the early work at the site, and therefore seemed to belong to the period between 33 BC and AD 50 (Butler 1916). The Nabataean capitals that Butler noted at Buṣra had a more elaborate echinus, and were dated "probably in the early period of Bostrian history" (Butler 1914: 236-242).

Summarizing the small sample of tentative datings — which may need to be modified — of Nabataean horned capitals, the construction of the Pond Temple by its capital alone cannot be dated more precisely by the authors than in a period from the early first century AD to the early second century AD, unless finer differences between the rock-cut and the free-standing capitals, and between the latter themselves can be analysed. The column base of the Attic type found in Area A is usually part of the normal Nabataean capital, and therefore cannot contribute to the dating. Of course, additional elements such as the floral decoration and the pediment could be compared with those found at Petra, Ṣabra, and adh-Dharīḥ, but these analyses have to be left to more specialized researchers.

The pottery finds are relatively easy to date, but they are only a small sample of what may be hidden in the ruin field, and they were found outside the temple area proper. With a range from the end of the first century BC to the third-fourth century AD (according to Zeitler 1991: 104), and a preponderance from the first-(second?) century AD, they point to a construction date in the first century AD for the Pond Temple.

The architectural remnants of the bathing establishment to the northwest of the temple compound at least allow more chronological analysis. Hypocausts with round and square *suspensura* bricks were used since the first century BC, whereas the *tubulatio* was invented in the first century AD (according to Krause 1965: 3062). However, *tubuli* were used in the thermae that Herod the Great (40-4 BC) built at Masada (Yadin 1966: 74-85). Many influences from the Greek, Alexandrine, Herodian, and Roman world converged at Petra since the middle of the first century BC. Therefore it is not possible to rule out the origin of Roman-type thermae before the annexation by the Romans in AD 106. Whether they were constructed together with the temple or added later on, cannot be answered at present. Concerning the end of the Pond Temple, it is probable that together with the road leading to it from Rās Slaysil it was destroyed by an earthquake in the third or fourth century AD.

**Necessities of Traffic and Topography of the *Numinosum***

One asks, of course, why the Pond Temple was constructed at its hidden spot below Rās Slaysil. A discovery in 1990 provided the answer. In that year, the Austrian team of the Naturhistorische Gesellschaft Nürnberg found and by laborious climbing reached the destroyed

road between the temple and the gap below Rās Slaysil (Lindner and Gunsam, forthcoming). This now definitely proves that the Pond Temple was located at an important road between Petra and Wādī 'Arabah with connections to an-Naqab, the Mediterranean, the Arabian Peninsula, and Syria. Furthermore, a road high above Wādī aṣ-Ṣiyyagh connected Petra and the Pond Temple. Slaysil as a kind of junction could be reached from Bayḍa, from the ad-Dayr plateau, and from Jabal Qārūn with another shrine on its summit (Lindner 1986: 103-107).

The main north-south traffic routes, especially those for camel caravans followed either the Edomite upland or the lowlands of the 'Arabah. Considering their technical level, connections between them must have been equally important. In fact, they were useful as shortcuts and at times when other routes were dangerous to take. There was also purely "local traffic", e.g. sheep and goats being driven to pasture, to water, or to market.

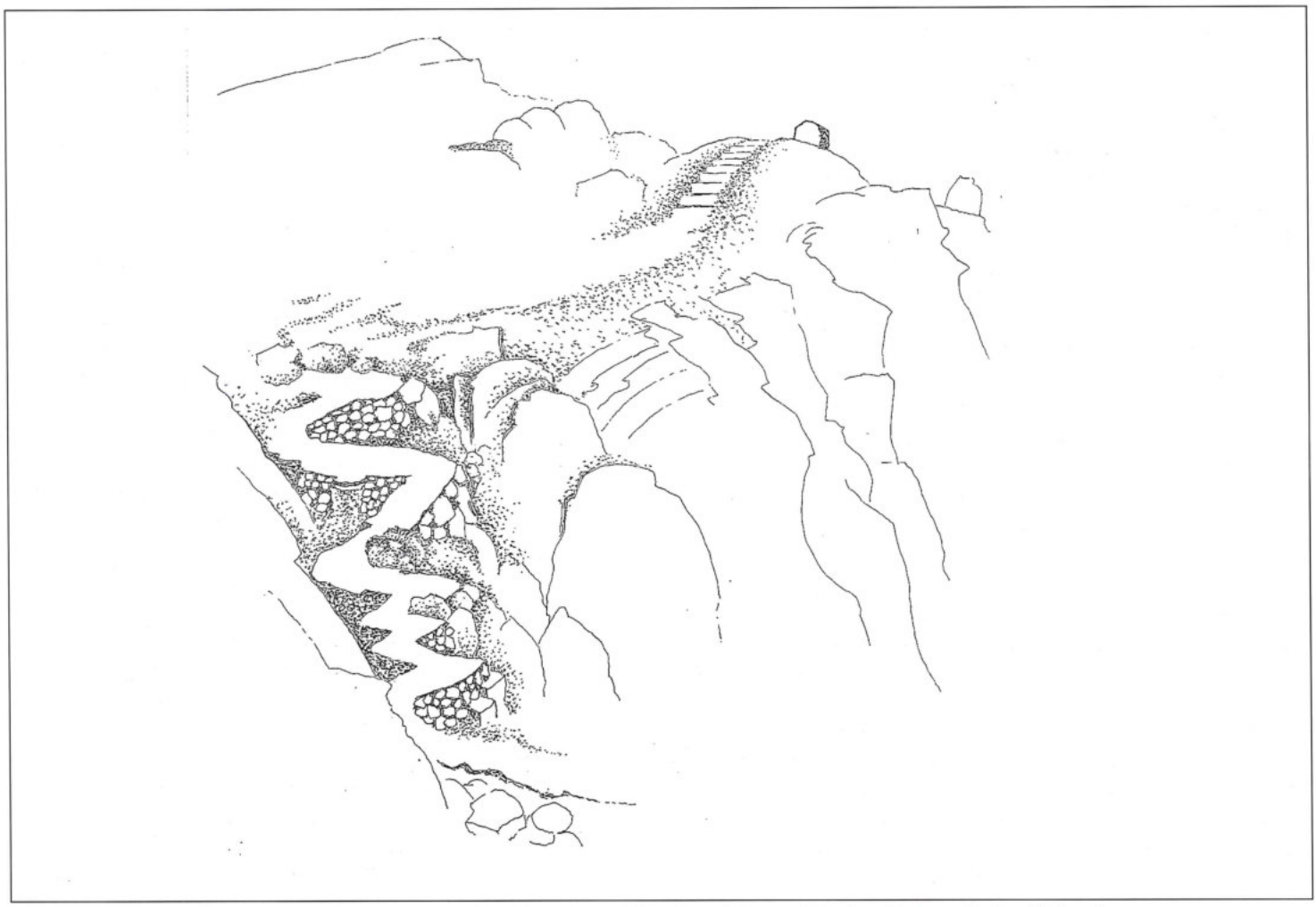
There are other uses to consider. It is to Kirkbride's credit that she observed outcrops of basalt and copper ore in the Slaysil area (1966: 53). In fact, mining and transporting ore might have been one of the reasons for constructing a larger road network. As the stones chosen for special purposes in Petra, Ṣabra, and Saḥīr al-Baqar show, suitable stones were transported over long distances.

The excellent water-supply at Saḥīr al-Baqar was in and of itself an important motive for building the temple, but where water existed, the gods were revered as well. Many examples in Petra show that water that ran either perennially or seasonally confronted the Nabataean with the *Numinosum*, i.e. the divine presence.

Possible connection between the Slaysil sanctuary, a typical "high place", and the Pond Temple and between the different deities revered in the two places can only be a matter for speculation (FIG. 20). The location of the Pond Temple in the deep and near running water points to a goddess of the Atargatis, al-'Uzzá, Isis, Aphrodite type whereas Dushara might have been venerated on the high place of Slaysil.

**Political Aims**

The construction of the Pond Temple, like others in Nabataea, apparently realized a tendency among the kings



20. Artist's interpretation of the connection between the high place of Slaysil and the road leading down to the Pond Temple.

f Petra during the first centuries BC and AD to speed up ıe development toward sedentarization and cultivated rbanization or at least to demonstrate those goals in or-er to compete with other kingdoms and the Roman em-ire.

Following Knauf (1986: 80) and Wenning (1990: 38), the initiative for such projects should be attributed ) the specific Nabataean fraction of Nabataea and its ɔurt. The Nabataean kings were certainly moved by the resistible Hellenism of their time to build temples in the [ellenistic fashion and to have their gods portrayed in uman form. But they also, as Wenning has advocated ıtely, intended by means of a variety of measures to ıow off themselves as a peaceful nation (1990: 438).

At the same time, the construction of the temples be-ays political ambitions of the kings who wanted to row out of the original tribal and elitist structure of their ɔciety into a genuine monarchy. It was the logical way ) document and demonstrate the royal presence together ith the presence of their and their peoples' gods in tem-les and shrines at important spots. It is easy to imagine ıat such projects were initiated and financed by the ɔurt and/or by well-to-do "dignitaries" or groups of ious people who acted as sponsors, who thereby im-ressed the gods, as well as their king and their people.

## losing Remarks

ı the opinion of the authors, the destruction of the Slay-l sanctuary and the recent disturbance during the 1991 ood of the Pond Temple since its discovery, make it im-erative to publish the finds now together with the his-ry of their discovery, notwithstanding the fact that for ɔvious reasons no excavation was possible nor will be the near future. The difficulty of access and the nount of destruction leave many questions unanswered. n the other hand, the finds presented here are sig-ficant and allow us to visualize what the temple com-ɔund might have looked like before its destruction. That is report includes personal experiences is in line with a cent laudable trend leading away from sterile texts to a ore lively documentation of what was and is done in chaeology.

## cknowledgments

the first place, the authors wish to thank the Directors eneral of the Department of Antiquities of Jordan who nce 1973 either personally or through the regional In-ectors in Petra permitted and furthered the archaeolog-al projects of the Naturhistorische Gesellschaft ürnberg (Germany). Thanks are also due to Dr. Fawzi ayadine and to the mentors, helpers, and guides of the ayāthna, Bdūl, and 'Ammārīn, and, of course, to the rticipants in the numerous excursions and explorations hich eventually led to the investigation of Slaysil and the discovery of the Pond Temple. Of special assistance in the scientific treatment of the discovery were A. Schmidt, I. Just, Dr. E. Wieters and F. Morgenstern who together with E. Gunsam formed the "Austrian Group" of the Naturhistorische Gesellschaft Nürnberg. For friendly advice and helpful suggestions Dr. F. Zayadine, Dr. R. Wenning, Dr. Andreas Schmidt-Colinet and Prof. Dr. E. M. Ruprechtsberger have to be thanked. The pottery fragments were drawn by E. Schreyer and G. Spiske. The English text was partly revised by Prof. Pittner, Oberasbach (Germany).

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# Nabataean Architectural Technology

The first detailed commentary on Nabataean architecture was the work of those intrepid explorers, Ernst Brünnow and Alfred von Domaszewski, in their monumental exploration of Petra, published from 1904 onward. Surface survey at Petra was, in turn, followed by the excavators and researchers who variously investigated Nabataean rock-cut installations, defensive architecture, house and cave-dwellings, water control, civic constructions and architectural decoration. Likewise, more widely ranging surveys also contributed to the identification of Nabataean architectural sites. These explorations paralleled, in the southern sector of Nabatene, the early surveys which were done in the wide-spread northern sphere of Nabataean cultural influence.

In general, however, most of these studies were descriptive in nature, not analytical, with but a few exceptions. In spite of often detailed plans, adequate photographs and descriptive texts, little was done to analyze the architectural technology of structures identified as Nabataean.

Still further, some archaeologists labored under two misconceptions of basic Nabataean culture: first, that the "Nabataeans" were relatively recently sedentarized bedouins, without a history of architectural background; and, secondly, that all of their structures, except, perhaps, the rock-cut monuments, were therefore the work of more enlightened foreigners, especially "Romans", in both inception and construction. The work of Parr on the Qaṣr al-Bint (1960; 1967-8), with the discovery of inscriptional data, did much to allay the latter misconception, as did the work of the American Expedition to Petra at the Main Theater and at the Temple of the Winged Lions (Hammond 1965; 1986; 1987; 1989). It is hoped that recent thoughts regarding Nabataean-Edomite symbiosis (Hammond 1991) have also disposed of the former viewpoint, by providing both a time-lapse and a basis for a shared technological background — and have opened the way to the understanding of how "Nabataean" technology, in a variety of crafts and directions, was able to mature and be locally developed.

When architectural technology is addressed, however, the breadth of the subject involved becomes enormous, for "architecture" must consider hydraulic installations, defense works, public buildings, house types, caravanserais, workshops, and — in the case of the Nabataeans — rock-cut structures as well.

Likewise, the term "technology" also presents a vast range of aspects which must be considered: prospecting, quarrying materials, transport and processing, construction techniques, machinery, painting, chemistry, surveying, labor involvement and craft systems, tools, economics, and even the overall philosophy of architecture.

Still further, the question arises as to the originality of any given technological item found in the possession of a people. The question of the actual originality of technology, aside from that found in pristine states, involves the two aspects of origin which must be addressed concerning the presence of any phenomenon found within the attributes of a cultural group: independent invention and diffusion.

The former source for a culture trait — i.e. independent invention, or innovation — can be recognized more readily: namely, the presence of a feature for which there is no parallel outside of the culture involved, or for which there is no readily apparent access for diffusion from another culture possessing the same, or a similar, feature.

In all of Coele-Syria the question of innovation is complicated by the duration of occupancy of the area, from prehistoric through historic times, as well as by the relatively unrestricted access throughout the area because of the lack of significant natural barriers to the movement of peoples.

These importations ultimately became standards, and hence, Nabataean and other local usages should probably be referred to as "derivative", or even, as Patrich (1990: 11), "stimulated", rather than "influenced".

Sorting out examples of local innovation of technology therefore becomes extremely difficult. The trading activities and the wealth of the Nabataeans made it

even more possible both to observe and to import technology encountered in their widespread ranging throughout both the Eastern and the Western worlds. The presence of a mixed population at Petra, as reported by Strabo's informant, Athenodorus (XVI. 4. 21), also suggests a direct avenue for the acquisition of technological information and even for the presence of foreign craftsmen. Still further, by the Nabataean period, technological information was being widely circulated in written form, as well. At the same time, certain architectural features and technological practices occur in the Nabataean area which must be considered Nabataean, *s.s.*

The identification of the second possible mechanism, diffusion, for the presence of a cultural trait is likewise extremely complex, since the practical solving of similar problems encountered by two, or more, cultures, often results in the same solution (convergence), a phenomenon which can be illustrated, world-wide, from Palaeolithic through modern times.

Further, analysis of the degree of direct borrowing of a feature (adoption), or partial borrowing with variation of technique (adaptation), must also be considered in regard to individual cases, as well as the essential nature of the borrowed feature.

When one enters the area of borrowed, or adopted architectural technology employed by the Nabataean architects, the list is quite considerable because of the widespread commercial travel of the people, their fantastically eclectic taste, and the pervasive presence of both "Hellenized" and "Orientalized" architecture around them, as well as because of the extent and varieties of architectural remains. Adapted, or modified, technology is less represented, although identifiable. Unique, or innovative technology is even more obscure, but a few examples may be cited and future excavation, or future technological analysis of excavated remains, may produce a more definitive list. As a consequence, examples of Nabataean architectural technology coming under these headings can only be broadly categorized, with relevant examples as illustration.

**Support Technology**

Under this heading must be considered all of those aspects of technology generally ignored when architecture is considered. Among those aspects are materials procurement, source prospecting, mining, quarrying, raw materials transport, materials processing and chemistry, materials fabrication, site location and preparation, surveying, architectural planning, economics, labor management, artisan types required, and similar factors.

The fact of Nabataean caravan traffic provides the possibility for securing raw materials far beyond the limits of any one site, or of Nabatene as a whole, because of the monarchical centralization of political power and the trade networks of the kingdom.

The precise technologies for processing and fabricating items were long-held methods, shared throughout the Middle East from Neolithic times onward (Oleson 1986: 63-76). Although the extent of Nabataean quarrying, refining and processing, as well as fabricating metals cannot be precisely determined (cf. Forbes, VIII, 1964: 222 ff.), the amount of rock-cutting for tombs, as well as the quarry to be seen on Jabal al-Madhbaḥ, does provide a glimpse of considerable local activity, at least at Petra and probably to be found elsewhere as well. Moreover, the degree of purity of some copper fixtures from the Main Theater is exceptional (Hammond 1965: 70-71), but whether it was done by Nabataean smelters cannot be determined. Certain features recovered at the Temple of the Winged Lions do suggest on-site metal processing, even if the details are vague. The quantity and standardization of iron nails and copper tacks recovered at the Temple of the Winged Lions suggest mass production of such items, although importation of these items cannot be ruled out. But the probability exists that processing and fabrication technology, if utilized by the Nabataeans, was part of the commonly-shared metal technologies of the day, perhaps even directly inherited from the Edomites, and needing little change by local cultures for quite some time to come (Oleson 1986: 76-99).

The production of mortars and plasters likewise show no innovative features, nor do the paints used in decoration. The spectroscopic analysis of paint samples taken from the painted plaster of the Temple of the Winged Lions, recently completed by David Johnson and and Chun Shuk Jung (forthcoming) have indicated that the Nabataeans were using the basic chemistry of paints to be found in Vitruvius (VII).

The transport of raw, or partially processed raw materials from quarry, or source sites, cannot be clearly defined. As a caravan nation, the Nabataeans possessed a variety of beasts of burden, including camels, donkeys, and horses. Transport is once again, however, a shared technology and no Nabataean adaptations, nor innovations, in animals used, yoking, nor cartage devices, are identifiable from recovered remains (Oleson 1986: 200-211).

The technology of finishing of stone, both building and decorative, can be seen more clearly than that of most of the raw materials encountered on sites, because of the presence of saw, chisel, and hammer working marks, as well as cutting and sculpting guide-lines, seen on various recovered examples (Hammond 1965: PL. 36.4). Such indicators also provide information regarding the tool types employed by the artisans involved.

It does not appear in the literature that any attempt has been made by excavators to seek building-stone

modules, nor size standardizations, nor to ascertain weights, prior to that previously done at the Main Theater (Hammond 1965: 38, 45-47, 499-450) and currently being done with the building materials from the Temple of the Winged Lions. The results of the analyses again suggest adaptation of conventional standards, essentially Roman (as Vitruvius, X. ii.1ff.; Drachman 1963: 11, 142ff. and 94-105, on earlier documentation).

What do appear to be innovative, however, are the presence of alphabetic and numeric building "instructions" to be found upon both column drums, especially encountered at the Main Theater (Hammond 1965), upon stacked ashlar at the Temple of the Winged Lions (Hammond 1978), at-Tannūr (Glueck 1965), Wādī Ramm, Mampsis (Negev 1988), and even at Kourion (Soren 1987). By this method, an architect could designate a set number of column drums for each column and its place in the line of columns, as well as the destination of specific ashlar blocks. Hence, on-site supervision, by the architect, could be decentralized to a workman who could read the markings in the correct order.

The use of the alphabetic and numeric indicators noted above may suggest quarry-site mass production of both ashlar and, more probably, column drums, to predetermined sizes. This technique was used by others and is evidenced in the literature (Schmidt-Colinet 1990). Still further mass production is to be seen in the ring-bases used in place of drum-cut Attic bases at Petra (Hammond 1978). These are unique and permitted rapid completion of a column, regardless of variation in bottom-drum sizing. The literature only notes one other example of such a feature (Creswell 1958: 25), which may indicate continued Nabataean artisanship well into the Early Islamic period.

Labor involvement, skilled and unskilled, is also a question hither-to-fore not addressed in the literature because of lack of documentation. That architectural craftsmen did exist, however, is apparent from the results of their work. Likewise, the finding of the workshops at the Temple of the Winged Lions (Hammond 1987) indicates local artisan presence, as does the Nabataean graffito scratched into the side of one of the columns of the cella. The named "architects" of rock-cut tombs at Madā'in Ṣāliḥ (Schmidt-Colinet 1987) suggest family craft development in the society, as well as the fact that the artisans were Nabataean and their craft skills probably hereditary (Negev 1986). It is possible, of course, that along with visiting commercial or diplomatic groups, some of the non-native population were artisans. That importing foreign artisans was necessary for all the architectural skills needed in Nabatene cannot be supported, however.

There is no reason to suggest that the Nabataeans, themselves, had not developed the expertise in all the architectural support crafts and services required. The temporal duration of Nabataean occupation in the area of their kingdom, as well as the prior architectural development of the Edomites, would have been sufficient to develop all of the requisite skills. The availability of "textbooks" dealing with specific details makes that premise even more possible. The probability of itinerant artisans reaching Nabataean territory in the course of three or four centuries obviously cannot be ignored, but the continued need for such personnel cannot be supported. That ceramic technology is a valid measure of general technology within a culture has been suggested some time ago (Hammond 1972). When the ceramic skill of the Nabataeans is evaluated against this premise, the probability of other craft skills can be placed at a reasonably high local level of development.

The relative standardization of rock-cut monuments, of ceramic sizes and forms, the extent of architectural development, the adaptation of certain borrowed technology, rather than its slavish reproduction by culturally-related foreign artisans, as well as innovations and "Semiticisms" ("orientalisms" — as Zayadine 1970, and others) within the general technologies of the people, also speak to the degree of craft organizational and management levels within the society. Precisely how labor was either organized, or managed, cannot be determined, but kinship-based craft relationships are most probable, given evidences in that direction. That Nabataean artisans were at work throughout Nabatene, as evidenced by the tomb inscriptions at Madā'in Ṣāliḥ, as well as the presence of pottery workshops recovered at Oboda and Elusa, along with the probability of Nabataean architects at Mampsis, Masada and Khirbat al-Murāq (Negev 1988), also raises the question as to whether these were local, or part of larger "guilds", centrally located, which served to standardize products. In the case of pottery, this later possibility seems to have some degree of support.

Who the skilled and unskilled laborers were, who did the actual work, aside from the "architects" of certain monuments, can only be inferred, here and there, from graffiti and possibly from stylistic elements. However, when the extent of Nabataean architecture is viewed, the number of required laborers is seemingly rather vast. In addition, the number of able bodied men required to conduct the equally vast caravan trade, even though seasonal, further extends the necessary labor pool. Since the actual demographic makeup of the various Nabataean populations throughout the kingdom cannot currently be determined, this aspect of support technology must likewise remain unresolved. At the same time, the wealth brought into the culture by trade, may well have provided some way in which relatively large, non-commercially related craft guilds, including the military,

could have been supported.

Since the matter of economics is also involved in the general support technology of the architectural endeavors of the Nabataeans, that same factor of rather grand financial position, resulting from trade, enters the picture. Obviously, certain architectural works were public in nature — hydraulic systems, temples, probable *fora*, probable administrative centers and residences, and similar works. Whether general taxation, or other local public financing, provided necessary funding cannot be determined, except once again, by inference from the examples of neighboring states, where both sources were utilized. Royal enterprises were among the most extravagant, as the various public works and generous donations for architectural embellishment made by Herod the Great demonstrate (Josephus, *Antiquities* XVI.v). However, the private sector of Nabatene, as elsewhere in affluent societies, assisted in specific building operations as expressions of public beneficence, as inscriptions attest (Glueck 1965; Negev 1961; 1963; 1988 at Mampsis and at Elusa). The commercial wealth of the Nabataeans certainly placed some citizens in an unusually favorable position in regard to affording expensive and expansive public works and equally impressive personal architectural enterprises, as the façade tombs illustrate. The lack of "tickets" recovered in the Main Theater excavations (cf. public banquet tickets at Palmyra, Starcky and Gawlikowski 1985), as well as the lack of seat, or seat section, numbering may, however, attest to some degree of public benefaction by the wealthy to the poorer classes.

**Construction Technology**

It is perhaps in the area of architectural types that the Nabataeans appear to have borrowed the technology of others. Yet, at the same time, in that same area, the Nabataean penchant for adapting, and even for innovating, becomes equally apparent in the tremendous number and diversity of their enterprises (Hammond 1965). Architectural plans of all sorts became part of Nabatene's landscape: pipelines, reservoirs, aqueducts, dams, temples, high places, villas, the colonnaded *cardia*, street-side shops, funerary types (including rock-cut cists, the façade tomb types, the ledge-with-*arcosolia*, the "*ṣahrīj*" monuments, *triclinia*, and even an attempt at a *columbarium*), baths, odeons, theaters, workshops, and probably further types still unrecovered.

When, for example, temple plans are considered, the Nabataeans appear to have adopted a variety of available plans, which scholars have attempted to classify geographically and otherwise (Hachili 1975; Negev 1976). It would appear, however, that plan-choice was a matter of adaptation, selecting the plan to adopt to the particular needs of the local cult involved. But the inclusion of workshop areas adjacent to a temple, not reported except for the Temple of the Winged Lions, may be innovative, at least for the commonly found Semitic area temples.

Site-location choices cannot be characterized as to origin, since the location of various buildings, or tombs, or of hydraulic installations, had, of course, to vary from culture to culture and area to area, according to the topographic situation of the settlement. To some extent, however, a case may be made for some degree of site-choice adoption, with appropriate adaptation at least in theory, from Vitruvian models, or mimicry from general contemporary urban models which appeared in the area. Semitic ancestry may be apparent in the retention of altars, within remodelled versions, at at-Tannūr (Glueck 1965), as a carry-over of ideas of the preservation of sacred space, once so designated.

In the case of the façade tombs at Petra and at Madā'in Ṣāliḥ, parallels for the general type can be found elsewhere, but the Nabataeans adapted the façade schemae to suit some unknown expression of taste and apparently also modified those schemae through time, as the attempts to classify them have suggested (Brünnow and von Domaszewski 1904; Zayadine 1970; Patrich 1990: 114-123 — where the term "selectivity" is a synonym for "adaptation" *et alia*). Even within the elements of façades, adaptation of orders as in the Khazna (Hammond 1965; Dalman 1911) and the inclusion of foreign elements (e.g. the Egyptian cornice) are common. More extensive adaptations also took place, however, for example at the Main Theater, the normal height of the *vomitoria* was reduced, no colonnade was included, no awning appears to have been accommodated, stairway modifications were made, no acoustical devices were built-in, and podium and impost variations suited local height, among other variations (Hammond 1965).

Adaptations of other adopted architectural elements and methodologies were also made to suit local needs, or local taste. The Nabataean "lugged" capital has traditionally been seen as a Nabataean innovation, although recent commentary on its origin raises some questions (Soren 1985; but Patrich 1990). Likewise, the "Nabataenized-Corinthian" capital, variations in the proportions of the Attic base, the plugging of affixed elements into walls with either plaster, lead, or wooden plugs (Hammond 1965; 1975), and similar practices, all represent adaptation of borrowed technologies.

Where it was suitable to local requirements, many technologies were taken over without change and apparently the requisite elements to employ them were locally produced. Thus, ceramic water pipes were adopted for bringing water into Petra from a distance, even though Roman conventional wisdom suggested open canals because of maintenance and pressure control problems (cf. the two sets of pipes below the later open canal system

same time, open rock-cut runnels and drains were widely used elsewhere in the city (covered drains are merely variations of the "open-canal" type) and throughout all of the Nabataean area, indicating choice in adopting technology as it was fitting.

Nabataean dams, encountered throughout the area, are generally of the types found elsewhere, also, but the damming of wadis for future use of winter-rain water, is at least an adaptation of the conventional damming of running streams and serves well for dry-farming use. The development of the "*tulaylā tal'inab*" (Glueck 1965: PL. 213a-c) as a dry-farming feature, appears, however, to have been a significant Nabataean innovation in hydraulic engineering. The great barrage dam, at the entrance to as-Sīq at Petra, is an interesting adoptive item, in that it appears also to have served as a defensive barrier, and must thus be considered adaptation. Its use, in conjunction with the rock-cut diversion tunnel adjacent to it, is rather innovative in principle, even if obviously adopted technologies are involved in the constructions.

The Roman method of wall plastering, complete with the common Augustan Age reduction to only two, or three, coats, instead of Vitruvius' suggested multiple coats, appears as another straight-forward adoption of technology (Forbes 1955; Vitruvius VII. iii.5-6; Negev 1988). The Nabataeans appear to have innovated in this area, however, in their practice of keying the base coats to rough ashlar by the use of iron nails and then keying the final coat by the use of small copper tacks (Hammond 1965; 1975).

A generally recognized innovation of the Nabataeans, however, appears to have been their ubiquitous use of diagonal dressing of ashlar and the walls of rock-cut installations for keying plaster. The use of herringbone incisions in the rough under-coats, another plaster keying device (Negev 1988) was probably adopted from elsewhere.

Extensive uses of plaster (stucco) appear at most Nabataean sites, including residential sites (Zayadine 1987; Negev 1988; Villeneuve 1986; 1988) and was obviously borrowed from neighboring cultures.

The application of paint, including fresco painting, was adapted from conventional practice, at least in some examples, since that encountered in the Temple of the Winged Lions appears to have been simply brush-work without the more complex methods suggested by Vitruvius (VII.iii; 7; ix, 3; x, 4).

Attachment of architectural elements, such as veneers and *crustae*, are another problem in architectural technology and became one for the Nabataeans, as well. But the securing of veneer to ashlar, via copper fixtures, may possibly represent an innovative Nabataean approach to solving an adopted-feature problem (Hammond 1965).

The Main Theater, which during the Roman period might well have been adopted as a totally built structure, was partially rock-cut, because of the need to adapt the adopted concept of the theater as the frontispiece to a sophisticated city (Hammond 1965).

The inset-outset cornering of the rear walls of the Temple of the Winged Lions, also evidenced at the Palace Tomb, appears to be an innovative Nabataean construction feature, whether decorative or functionally conceived. However, that this was simply buttressing, which later appeared in Nabataean structures, does not seem architecturally (i.e. structurally) indicated, nor necessary in either case.

Construction, using both of the building methods noted by Vitruvius (II.viii, 5-7), indicates adoption of conventional, known, techniques (Parr 1960; Hammond 1975; Glueck 1965), with adaptation of methods only visible in block measurements, as noted earlier. The extent of construction practice to be attributed to prior Edomite building cannot be determined.

The general construction methods for road building site preparation, foundations, subfloorings and floorings, stairways, walls, doorways, and other architectural elements, do not seem differently handled from those seen throughout the Roman period world, and were probably all totally borrowed techniques (Parr 1960; Hammond 1975; Negev 1988; Glueck 1965).

The earthquake protection beams, seen in the west wall of Qaṣr al-Bint and in the arches of the "*liwān*" area of the Temple of the Winged Lions appear to have numerous parallel applications throughout Nabatene (cf. Negev 1988), and proved to be relatively effective. Pending report of similar construction technology used by others, this device would appear to be a Nabataean innovation.

Construction machinery appears to have been that generally used during the period (Vitruvius X. ii.1ff. and Landels 1978) and was most dramatically illustrated in the davits cut into the bedrock floor of the Main Theater, as well as by the more generally encountered "levis" holes to be seen on the tops and sides of column drums (Hammond 1965).

Extensive evidence exists, in the surfaces of recovered materials, for Nabataean adoption of the conventional small tools employed by other craftsmen throughout the world: scribing tools, saws, hammers, brushes, chisels, straight-edges, and similar items. No new tools seem indicated, either from excavated examples, nor from observation, with the possible exception of a toothed hammer, the presence of which is accepted by Negev (1988) and others, for achieving the characteristic Nabataean diagonal dressing, both on ashlar blocks and on interior walls of rock-cut installations.

The extensive use of the round arch, without a keystone, is virtually a characteristic of Nabataean building

(Hammond 1965; Negev 1988 and *passim*; and the impressive arch over the entrance to Qaṣr al-Bint, among many other examples), but represents another borrowed technological feature. Certain aspects of springing (e.g. from impost capitals as Negev 1988) may be a Nabataean innovation, however.

The borrowed barrel vault, was apparently first used with caution — and built of stone, not cement (concrete), although cement was used above the stone-built example at the Main Theater (Hammond 1965). Stone built examples continued to be rather widely used throughout Nabatene for a variety of purposes. Corbelling also occurs, but again is not an innovation of the Nabataeans.

Security even entered the area of architectural technology, with typical Roman door locks and keys being adopted with virtually no modification, in addition to earlier reliance upon internal door bars. This aspect of life probably entered Nabataean life when the tent gave way to permanent houses and a different view, as well as protocol, of privacy developed — along with the need for protection of an increasing volume of personal property.

**Decorative Technology**

The question of Nabataean decorative art, in terms of influences, sources, and relationships has been ably considered by others in the field of art history. However, a few observations may be made concerning some aspects of Nabataean decorative art, in the general vein of the present discussion.

One small, but interesting, adopted decorative technique was recovered at the Temple of the Winged Lions, which does not seem to have been reported elsewhere — namely the addition of small painted cast plaster flowers to stone-sculpted capitals. Perhaps these were votive donations of pilgrims, or had some other, now lost, religious meaning. In any case, their application appears innovative.

Somewhat similar, was the use of small, individually sculpted and painted plaster human faces, apparently affixed to walls within the Temple of the Winged Lions. Although these may simply be adaptation of another borrowed decorative feature, the "ancestral" bust of the Romans, or of honorific sculpture, in general, they may possibly represent recognition of donors to the temple. In any case, they represent further Nabataean adaptation and, at the same time, innovation, by miniaturization (Hammond and Mellott, *Nabataean Faces from the Temple of the Winged Lions,* forthcoming).

The interior decoration of the temples at Wādī Ramm, Khirbat adh-Dharīḥ and Petra is, in itself, somewhat unusual, given the austerity of both Greek and Roman temples of the period. That interior decoration of Greek temples was done, is known, but was early and apparently never widely accepted (Wheeler 1964). However, it may be that Nabataean interior decoration must be assigned to the orientalized background of the people, if not innovative. The interior orders (e.g. *aediculae*) of other regional temples, as well as even non-decorated Roman examples, at least suggested appropriate loci for such decoration. The use of conventional egg-and-dart, dentils, modillions, and other sculpted, moulded and painted (generally exterior) decorative elements were certainly borrowed from classically oriented neighbors, as was the use of marble elements, especially under the impetus of the Augustan Age proliferation of the use of that material.

The philosophy of Nabataean architectural technology is thus related to those anthropological aspects noted at the beginning of this study. The Nabataeans, as any rising cultural group, followed the rule of the adoption of new cultural traits from others only if they promoted the needs, well-being, or social aspirations of the people. In the jargon of the system theorists, such action reflects the "maximizing of the minimal amount of culture dislocation", or as Glueck commented, the Nabataeans "steadily assimilated in new environments whatever might promote their well-being" (1965: 5).

Likewise, some adopted features were modified, or sub-traits ignored as extraneous, and some fewer architectural problems required innovation to solve them locally. That the majority of Nabataean architectural technology was borrowed, as a whole, or in part, rather than being innovated, is logical, given the time period in which they lived, surrounded by the already developed technologies of their neighbors, which did not require reinventing. Still further, it is less necessary for a wealthy culture to innovate, than one without great resources, which must struggle to attain a level equal to their neighbors, and it is even less necessary for a culture whose commercial activities brought them into contact with most of the civilized world of the day.

Nabataean innovation did occur, where necessary, and many more examples of it may probably be advanced, but innovation may also be seen in the nature and level of technologies acquired from others, in the adaptations they made to them and in the execution of the choices they made. A discernible flavor, uniquely Nabataean, pervades their architecture — and the support technologies associated with it — as it does in the remarkable phenomenon of a previously semi-nomadic culture achieving predominance as a major international commercial kingdom and as a major socio-political force in the entire Middle East of their day.

Practicality appears to have ruled Nabataean architectural technology, as it appears also to have done in other facets of their history — trade, politics, and religion.

Obviously, it has neither been intended, nor been possible, to address all aspects of Nabataean architectural technology in this paper, but it is hoped it will provide a basis for more extensive research and for more assiduous attention to the technological aspects of all of Nabataean life.

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# Monuments nabatéens de Bostra: Matériaux et techniques de construction et de revêtement

Les fouilles menées depuis 1981 par l'ERA n° 20 en collaboration avec la Direction Générale des Antiquités de la République Arabe Syrienne avaient comme premier objectif de mieux connaître la Bostra nabatéenne[1]. Peu à peu sont apparus différents éléments qui se rattachent à un grand ensemble monumental cohérent situé à l'est de la ville et lié à une restructuration majeure de l'urbanisme (FIG. 1). En font partie d'une part l'Arc nabatéen, connu depuis longtemps déjà, mais sur lequel des sondages ont pu être effectués (chantier A), d'autre part des éléments d'un vaste ensemble monumental découvert plus à l'est sous une très grande église de plan centré, qui réunit les caractères d'une "cathédrale" (chantier B). Ces éléments peuvent s'interpréter comme un mur d'enclos (FIG. 2) précédé d'un portique et d'une cour rectangulaire ou carrée dont une des dimensions dépasse 25 m[2].

## Chronologie

Les états nabatéens des chantiers A et B de Bostra sont bien caractérisés par de la céramique "nabatéenne", peinte ou non, correspondant aux types connus à Petra[3]. Sur le chantier (B) de la cathédrale le remplissage de la tranchée de fondation du mur M 21[4], a fourni 41,5 % de céramique nabatéenne en proportion du nombre total de tessons[5]. Le contexte céramique et quelques monnaies suggèrent une date dans la deuxième moitié du Ier siècle après J.-C. Pour l'Arc nabatéen les références ont fournies par la céramique dont des formes F 35, F 36, F 37A et F 48 de la production dite "Eastern Sigillata" appartenant à deux phases datées entre 40 et 70 et entre 60 et 100 de notre ère[6]. Elles étaient associées à des exemples de céramique peinte nabatéenne qui se rattachent aux deux classes Nab I et Nab II redéfinies récemment[7]. Les tessons de la première catégorie seraient alors à interpréter comme résiduels. Si on s'appuie sur ces bases on peut donc proposer pour cette construction une date située au plus tôt vers 60 de notre ère.

Sous la "cathédrale" on retrouve les deux mêmes types de céramique nabatéenne peinte et non peinte, et de l'*Eastern Sigillata*. Il faut souligner que, dans cette catégorie, on n'a pas trouvé de formes caractéristiques du IIe s. S'ajoute un répertoire de formes locales en pâte rouge (plats et pots à cuire, bols et jattes) ainsi qu'un gros *dolium* non tourné assemblé par plaques et des amphores en pâte blanche comparables à celles trouvées par F. Villeneuve à Khirbat adh-Dharīḥ. D'autres repères chronologiques, qu'il restera à préciser, sont fournis à Bostra par des monnaies. Une monnaie nabatéenne d'Arétas IV et Shaqilat[8], datée entre 18 et 40 et sans doute plus proche de cette dernière date (elle présente des caractères voisins de certaines monnaies de Malichos II et peut-être une surfrappe de ce dernier). Une monnaie

[1] Nous voudrions rendre hommage ici à cette collaboration à laquelle nous avons été amicalement invités par le regretté Sleiman Mouqdad en 1981 et remercier pour leur appui chaleureux le Dr. Ali Abou Assaf et le Dr. Adnan Bounni à Damas et M. Riyad al-Muqdad à Buṣra. Publications antérieures: J.-M. Dentzer, 'Les sondages de l'Arc Nabatéen et l'urbanisme de Bosra', *CRAI* (1986), p. 62-87; J.-M. Dentzer *et al.*, 'Sondages près de l'Arc Nabatéen de Bosra', *Berytus* 32 (1984), p. 163-174; R. Al-Mugdad et J.-M. Dentzer, 'Les fouilles franco-syriennes à Bosra (1981-1987)', *AAAS* 37-38 (1987-88), p. 224-241; J.-M. Dentzer, 'Neue Ausgrabungen in Sî' (Qanawat) und Bosra (1985-1987): Zwei einheimische Heiligtümer in der vorkaiserzeitlichen Periode', *Akten des XIII. Internationalen Kongresses für Klassische Archäologie*, Berlin, 1988, p. 364-370, Berlin, 1990; J.-M. Dentzer et P.-M. Blanc, 'Nouvelles recherches franco-syriennes dans le quartier est de Bosra', *CRAI*, février1993 (à paraître).
Sur la "nouvelle cathédrale": J.-M. Dentzer, 'Fouilles franco-syriennes à l'Est de l'Arc Nabatéen (1985-1987): Une nouvelle cathédrale à Bosra?', *XXXV Corso di Cultura sull'Arte Ravennate e Bizantina* (Rav. 19/26 marzo 1988), p. 13-34; J.-M. Dentzer et F. Villeneuve, 'Siedlungen und ihre Kirchen in Südsyrien', *Von den Aposteln bis zu den Kalifen (1.-8. Jht.), Austellung Linz, 1993* p. 82-10 1.

[2] Le mur nord-sud M.7 a été suivi sur 23 m; le mur est-ouest M.21 sur 4,50 m et sa fondation sur plus de 5 m. Cette dimension est déduite de l'emprise d'une mosaïque installée postérieurement dans l'espace de la cour.

[3] J.-M. Dentzer, 'Céramiques et environnement naturel: la céramique nabatéenne de Bosra', *Studies in the History and Archaeology of Jordan*, II, Amman, 1985, p. 149-154.

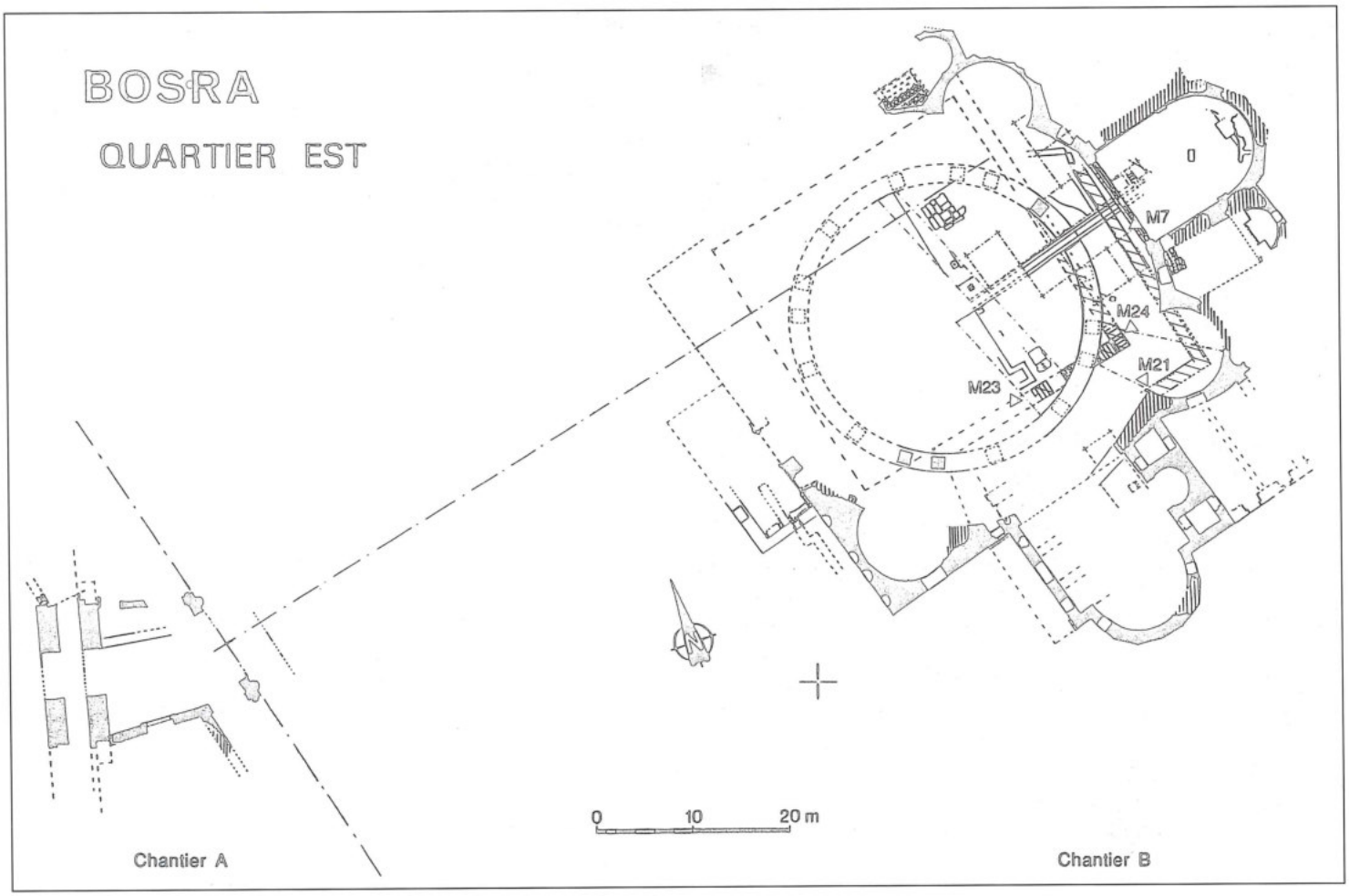
[4] BB 1748.

[5] Cette part est ramenée à 11,8% des individus (Nombre Minimum d'Individus) (étude en cours par F. Ravoire).

[6] J. W. Hayes, 'Sigillate orientali', dans *Enciclopedia dell'Arte classica ed orientale, Atlante* II, Rome, 1985, p. 30 et 36.

[7] Par J. Gunneweg, I. Perlman et F. Assaro, 'The Origin, Classification and Chronology of Nabataean Painted Fine Ware', *Jahrbuch des römisch-germanischen Zentralmuseum Mainz* 35 (1988), p. 315-345.

[8] Monnaie Bosra B m379, secteur 10, Unité Stratigraphique BB 1748.




1. Quartier est de Bostra: Arc nabatéen, mur d'enclos (M7-M21) et portique (M23-M24) sous la "Nouvelle Cathédrale".

(m327)[9], trouvée dans le radier terminal de construction du mur M21, as romain ou monnaie de cité du Ier s., fournira peut-être, après des traitements complémentaires, un *terminus post quem* plus précis[10].

**Techniques et matériaux**

L'Arc nabatéen et la cour à portiques découverte sous la cathédrale, proches dans le temps et liés par ailleurs par leur système d'orientation, peuvent être attribués à un programme de construction nabatéen. Les fouilles effectuées à Sî', permettent de comparer les techniques de construction à celles qui ont été mises en œuvre, dans un contexte culturel légèrement différent, dans le Jabal al-'Arab[11].

Le matériau de base commun à toutes les époques et à tous les sites de la région est le basalte, généralement extrait non loin du site, voire sur le site lui-même puisque la roche-mère est présente partout, à des profondeurs variables. De véritables carrières n'ont pas encore été identifiées à Bostra. Les coulées de laves ont tendance à se fissurer suivant des lignes régulières (prismes), qui se détachent et fournissent sans traitement supplémentaire des blocs de formes presque régulières avec deux faces parallèles qui peuvent être mises en œuvre sans retouches. Le basalte était utilisé sous cette forme dans les constructions les plus anciennes (à partir de l'âge du bronze) et dans les périodes plus récentes pour les murettes agricoles et les travaux de soutènement. Il peut être traité d'une façon plus ou moins élaborée selon la fonction du bloc et l'apparence cherchée dans le monument. Les fouilles récentes ont montré, en particulier, des traitements différents dans l'élévation monumentale.

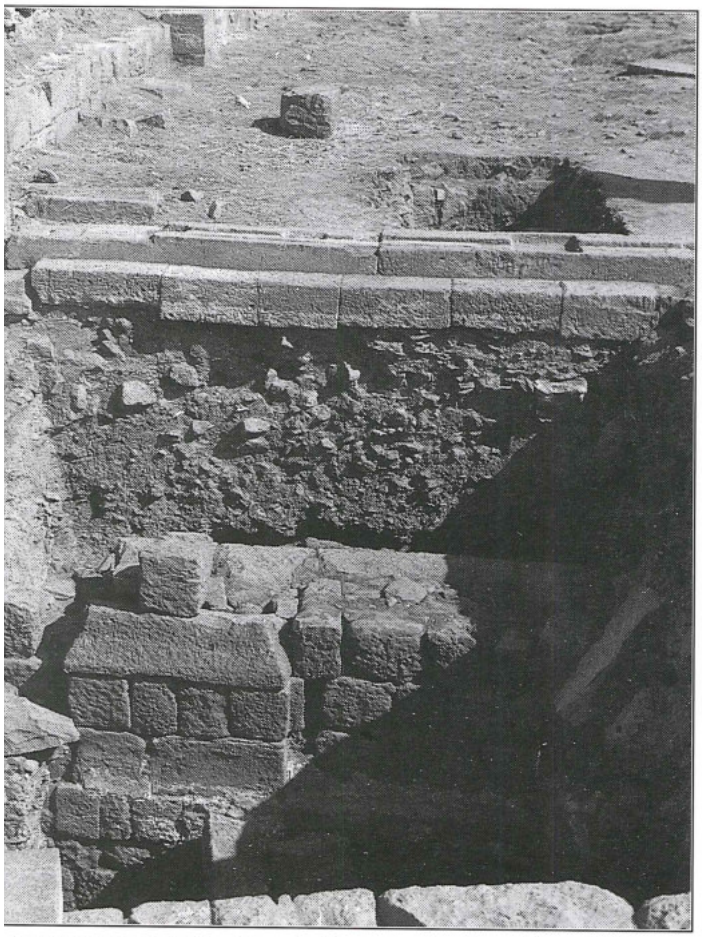
*Les fondations*

Si l'on en juge d'après tous les sondages réalisés en profondeur, l'ensemble de la surface construite a été d'abord nivelée soigneusement dans une opération qui a éliminé toute trace d'installation antérieure. Chaque fois que cela

[9] Buste d'empereur au droit, figure debout à gauche au revers.

[10] Une troisième monnaie (m323, secteur 10, US BB 1567) pourrait être nabatéenne tardive.

[11] *CRAI* (1981), p. 78 et s.; *Hauran* I, 2, Paris, 1986, p. 407-420.



. Tronçon du mur d'enclos nabatéen, sous le niveau du seuil du sanctuaire de la "Nouvelle Cathédrale".

st possible les constructions étaient implantées direcement sur le rocher dont les irrégularités de surface étaient compensées par des blocs de pierre sommairement quarris et des éclats de taille éventuellement liés par une erre argileuse, celle-là même qui se forme naturellement u contact de la roche mère.

Les murs sont implantés généralement dans une tranhée de fondation qui peut prendre des formes différentes: ainsi la tranchée de fondation du mur d'enclos ud, selon que l'on se trouve à l'intérieur ou à l'extérieur u monument. Elle est tantôt large (près de 2 m) et de ection oblique, tantôt pratiquement invisible: dans ce as les pierres du soubassement étaient littéralement colées contre le bord d'une paroi verticale. Ces variations ourraient s'expliquer par la topographie[12] et la nature du ol ou du remblai dans lequel est implantée la tranchée, erticale lorsque le sol est compact et homogène, (ici arce que très argileux), oblique dans une couche plus neuble et hétérogène ou au contact d'une zone caillouteuse.

Une forme caractéristique de substructure, utilisée à Bostra comme à Sî', est le radier constitué de blocs de basalte de grandes dimensions (dépassant le mètre en longueur), bruts ou légèrement équarris, avec des calages de petites pierres. Ces radiers parfois formés de plusieurs assises superposées, peuvent s'étendre sur des surfaces importantes. Pour l'implantation de l'Arc nabatéen il semble que l'on a commencé par excaver une surface étendue sans doute pour chercher le rocher. Dans cette excavation a été implanté un radier massif et continu plus grand que l'emprise du monument projeté[13] et prenant appui sur le rocher qu'il doit en même temps niveler. Les blocs sont liés à l'argile brun-rouge. Sur ce niveau général est implantée une assise de radier supplémentaire propre à chaque pile, de hauteur différente et limitée à l'emprise de la pile.

Sous la cathédrale, le radier (de nivellement) prend une forme particulière près de l'angle sud-est du mur d'enclos. Il sert de support au mur d'enclos, mais se prolonge jusqu'à plus de 2 m en avant de ce mur dans le coin sud-est pour diminuer ensuite de moitié vers l'ouest, en limite de fouille. Peut-être le constructeur voulait-il laisser, à ce stade, une certaine liberté pour l'évolution ultérieure du plan?

*Le stylobate du portique*

En 1990 a été dégagée une rangée de dalles étroites, juxtaposées par leurs longs côtés sur une ligne parallèle au mur à pilastres et dessinant un angle droit à environ 4,80 m de l'angle de l'enclos[14] (FIG. 3). Soigneusement dressées et assemblées, ces dalles constituaient un stylobate pour la colonnade d'un portique qui entourait la cour du sanctuaire. Une partie des dalles conservées est brisée — précisément aux emplacements des colonnes, semble-t-il — ce qui explique qu'elles ont été conservées: elles n'ont pas été récupérées par la suite comme les dalles intactes.

Les fondations du portique sont moins puissantes que celles du mur d'enclos. Dans les parties observées, l'assise du stylobate repose sur une seule rangée de blocs soigneusement calés et implantés dans une tranchée à fond plat. Les blocs du stylobate étaient calés avec des éclats dont certains sont conservés et permettent de restituer la largeur des dalles récupérées. Ce type particulier de fondation réservé au portique sur le chantier B (cathédrale), trouve un parallèle dans le chantier A (Arc Nabatéen) où le massif orné par une demi-colonne nabatéenne est posé sur quelques dalles débordantes, obliques par rapport aux orientations du secteur.

Ce portique était couvert par un toit de tuiles (*tegulae*

[2] Du côté sud le sol extérieur primitif était plus haut et a donc été entaillé. De ce côté la tranchée est très étroite vers l'extérieur.

[3] Il semble s'étendre sur 3 m au moins à l'est de la pile SE.

[14] Il y a une distance de 4,85 m entre M21 et M23 et de 4,60 seulement entre M7 et M24.



3. Stylobate du portique nabatéen.

et *imbrices*) comme l'indiquent les nombreux fragments de terre-cuite découvertes dans la couche de destruction de l'état portique. Des restes de variétés de tuiles différentes ont été conservés, ce qui fait penser à des travaux d'entretien ou de restauration.

*Pratiques de chantier*

Les dernières campagnes de fouille ont donné, au voisinage du mur d'enclos, des aperçus sur le fonctionnement du chantier de construction en faisant apparaître, au niveau des sols de travail[15], une fosse pour prélever l'argile utilisée pour liaisonner les pierres à l'intérieur du mur et des traces d'encastrements de deux diamètres différents[16] (FIG. 4). Ils étaient destinés à recevoir deux types successifs[17] d'échafaudages ou de rampes, les trous s'expliquant comme les traces en négatif soit d'un poteau retiré après le remplissage des tranchées, soit d'un dispositif assurant le calage d'un poteau posé à même le sol. Les plus petits ont dû recevoir un échafaudage plus léger constitué par des pieux de pin épointés et durcis au feu, pour des travaux de finition comme la pose de l'enduit ou de plaques de revêtements[18]. La stratigraphie relative confirme cette succession où l'on distingue clairement les étapes suivantes:

1. creusement des tranchées de fondation;
2. implantation des fondations sous la forme d'un radier général;
3. construction d'un soubassement constitué par trois assises de blocs soigneusement équarris formant une large semelle;
4. remplissage des tranchées;
5. mise en place des poteaux ayant pu servir à un engin de levage;
6. mise en place des blocs de l'élévation;
7. après démontage de l'engin de levage, mise en place de poteaux plus petits pour construire un échafaudage plus léger destiné à des travaux de finition (enduit);
8. enlèvement de l'échafaudage, nettoyage du chantier;
9. mise en place du sol de mortier.

*L'élévation*

*L'appareil réguliers, à joints vifs.* Dans l'élévation des murs deux variantes d'une même technique de construction ont été mises en œuvre. Elles ne se distinguent que par le soin consacré à tailler et assembler les blocs, le procédé de base restant le même. Il se définit comme une technique de construction à double parement avec des pierres taillées plus ou moins en sifflet, dont la queue s'enfonce dans l'épaisseur du mur. Les blocs sont disposés à joints alternés, avec des boutisses qui apparaissent plus nettement dans la pile nord-est et aussi dans le mur M de l'Arc nabatéen[19]. Dans l'Arc l'ensemble du noyau semble construit sans bourrage interne.

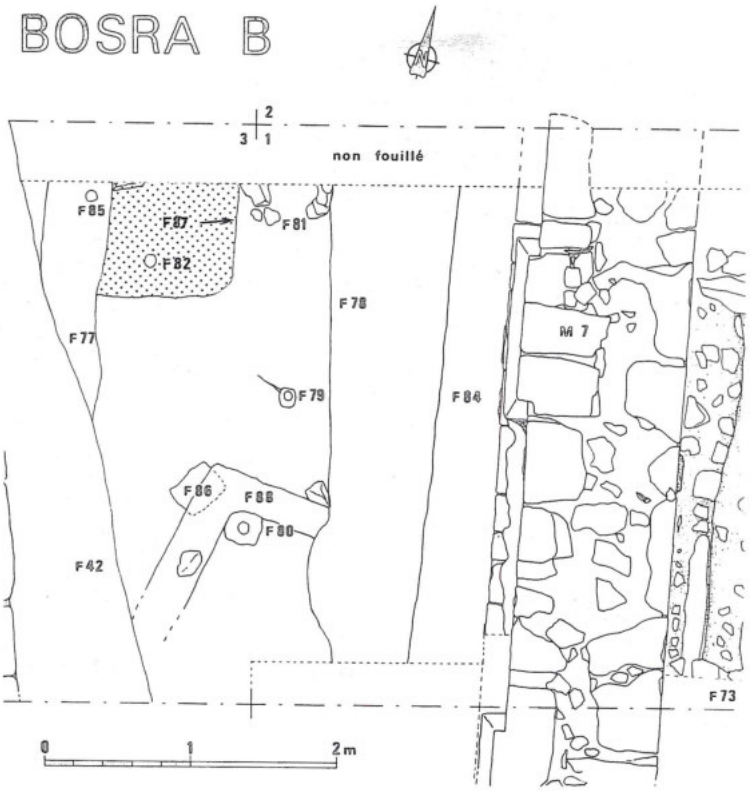
15 dont l'un a conservé un pot à cuire éclaté (modèle du Ier s. à lèvres épaisses; trouvé au voisinage du mur M23).

16 Au voisinage du mur M7.

17 Certains des trous de piquet percent le remplissage de la fosse d'angle.

18 La position des trous est irrégulière.

19 La disposition est moins claire dans la pile sud-est mais celle ci a été démontée d'une façon plus systématique au moment des travaux de restauration de l'Arc, entre 1955 et 1968.




4. Traces de chantier fosse à argile (F87), trous de piquets (F 85,82,79,80) calage de poteau (F81), foyer (F86), et tranchée de fondation (F84).

En parement tous les joints sont vifs, mais ces joints ne ont taillés avec précision que sur une profondeur réduite quelques centimètres. La taille en sifflet du reste du loc n'a pas pu assurer, à elle seule, un calage suffisant[20]. Ce sont sans doute des mouvements dans la structure qui nt fait subir à certains blocs des amorces de rotation ou le glissement[21].

Comme dans les radiers, le liant utilisé dans l'élévation des murs est de la terre argileuse. Un mortier semble cependant avoir été utilisé dans le massif X lié à l'Arc nabatéen.

Cet appareil soigné était utilisé dans l'élévation de la porte nabatéenne et dans le tronçon de mur orné d'une demi-colonne à chapiteau nabatéen, remployé dans la cathédrale. Le parement est soigneusement dressé, la taille est géométrique et les joints entre les blocs sont fins. Une ciselure dont la surface est dressée plus finement encore encadre la face visible de certains blocs le long des joints[22] (FIG. 5). Des blocs de ce type qui se trouvent réemployés dans la construction du mur extérieur de la cathédrale portent des marques de tâcherons.

*Assemblages particuliers*

La taille d'éléments complexes, comportant d'une part des profils de moulures et d'autre part des parements lisses sur une même assise a posé manifestement quelques problèmes d'assemblages aux tailleurs de pierre. Il est d'ailleurs probable que ces assemblages étaient finalement dissimulés sous un enduit. Les piédestaux moulurés des massifs X et Y, à l'est de l'Arc Nabatéen, présentent des irrégularités dans la mouluration[23], mais surprennent surtout par la stéréotomie des blocs (FIG. 6). A la base les deux massifs peuvent s'analyser comme un volume parallélipipédique[24] sur lequel se détache en façade un piédestal saillant mouluré qui sert de base à la demi-colonne nabatéenne. Matériellement ce volume a été obtenu en assemblant d'abord les éléments constituant le piédestal lui-même avec sa mouluration qui fait retour sur les faces latérales. C'est contre ces faces moulurées que l'on a appliqué ensuite, latéralement, les blocs complémentaires à parement lisse, taillés au préalable pour s'adapter assez grossièrement au profil des moulures du piédestal. Les pierres ne sont pas li-

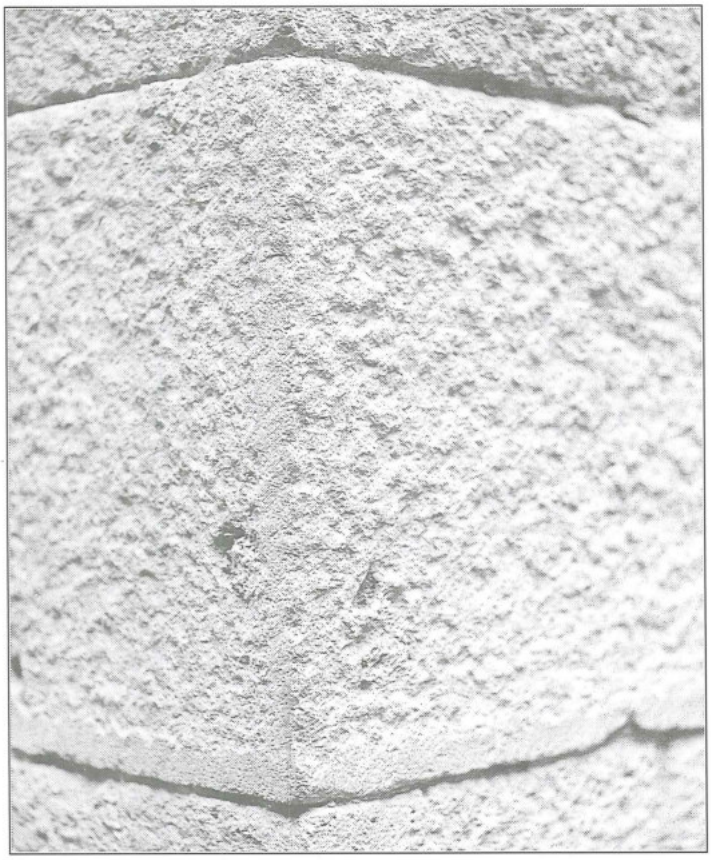
[20] En fait les calages devaient être assurés par des éclats de basalte soigneusement agencés.

[21] Observation de Ph. Tondon.

[22] Ce procédé est particulièrement visible sur des blocs de la pile nord-est de l'Arc et du massif X.

[23] Sur deux blocs contigus la même moulure ne présente pas toujours une hauteur et un profil identique sur toute sa longueur; c'est le cas pour la moulure supérieure du piédestal de la colonne X face est; même observation pour les moulures du piédestal de la façade est de l'Arc, différentes des moulures des faces contiguës de l'Arc.

[24] L'ensemble est posé sur une assise de réglage homogène.



5. Traitement piqueté et ciselures sur les blocs de parement de la pile nord-est de l'Arc.

aisonnées, et les joints peuvent être obliques. Il aurait été plus simple d'amortir les moulures sur le ressaut du massif au-delà du piédestal saillant et d'assembler les blocs par assises avec des joints verticaux. C'est d'ailleurs le procédé adopté à l'assise placée au-dessus du piédestal, celle de la base de pilastre et de demi-colonne où l'on voit une mouluration continue avec des angles saillants et rentrants taillés sur des blocs contigus.

La disposition des blocs des assises inférieures, qui ne suit pas une logique de construction systématique par assises[25], mais procède plutôt par juxtaposition d'éléments conçus d'une façon indépendante et édifiés sur une certaine hauteur, trouve des parallèles à Sî'. Les moulures de bases des pilastres qui limitent la façade de Si'8 sont, en effet, recouvertes aux extrémités nord et sud par la seconde assise du gradin qui borde la cour et le premier bloc a été taillé pour respecter, par un découpage complexe, le retour de la moulure du pilastre.

Cet agencement des blocs présente une apparence que l'on peut confondre avec celle qui résulte de "collages" d'éléments d'architecture réalisés dans des périodes successives. De fait il témoigne bien d'une succession d'états, mais ces derniers ne sont pas forcément éloignés dans le temps. Ils peuvent être simplement des opérations successives d'un même programme de construction. Cette façon de procéder peut s'expliquer par une division du travail, évidente dans le cas du monument de Si'8 où la façade proprement dite a été confiée à une



6. Assemblage des blocs moulurés du massif Y situé à l'est de l'Arc nabatéen.

[25] Les blocs n'ont pas la même hauteur d'assise. Entre les assises du piédestal des joints se superposent. Collages analogues dans le massif Y.

équipe de tailleurs de pierres — sculpteurs qui ont achevé leur tâche avant d'abandonner le chantier aux maçons chargés de construire le mur d'enclos. A Bostra les artisans les plus compétents se sont sans doute limités à tailler et à mettre en place — correctement — les blocs moulurés, de simples maçons intervenant ensuite pour ajouter des blocs d'appareil simple.

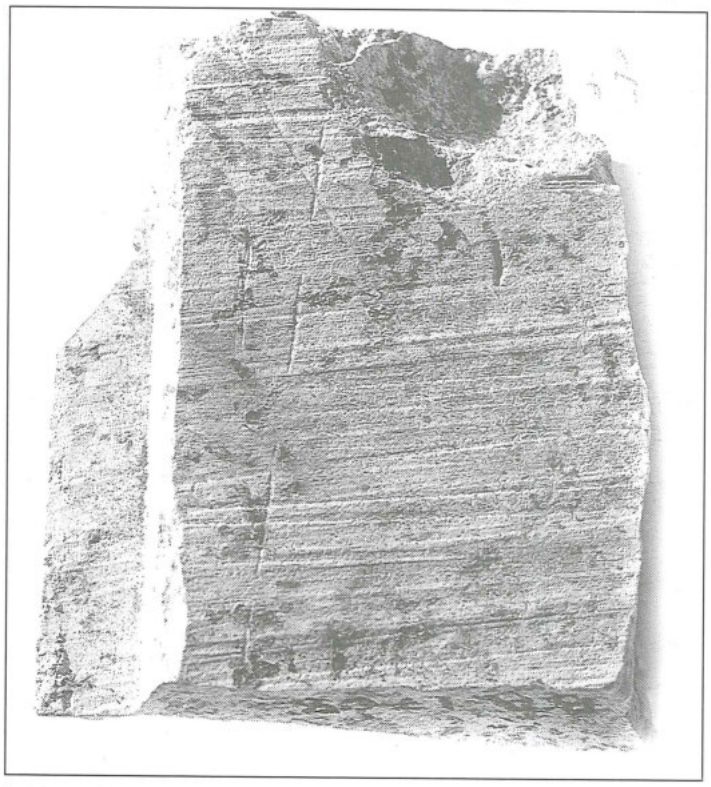
*Appareil à revêtements.* Une technique, toujours à double parement mais très différente, a été mise en œuvre dans le mur d'enclos découvert sous la cathédrale. La taille des blocs est plus grossière, la surface en parement irrégulière, et les joints épais. Le parement interne du mur, tourné vers la cour était en réalité couvert d'une couche d'enduit de chaux dont il reste des traces à la base. Un grand nombre de fragments d'enduit, souvent de taille importante, ont été trouvés dans le niveau de destruction du mur qui semble avoir été dépouillé de son revêtement avant d'être démonté. Certains de ces fragments présentaient des traces de couleur rouge et des motifs de bandes, sans doutes verticales, en retrait par rapport à la surface. Il faut noter que la surface externe, à l'est, du mur a été ravalée plus soigneusement et ne devait pas être enduite. Les joints devaient être rehaussés par un mortier jaunâtre.

Les fragments d'enduit peint faisaient partie d'un décor rythmé par des pilastres dont les bases ébauchées sont conservées en saillie à la base du mur. C'est en face des pilastres qu'ont été trouvés des morceaux d'enduit mouluré, y compris un chapiteau dont une volute a été identifiée. En revanche la surface de l'enduit était lisse entre les pilastres.

Des fragments de décor de nature différente ont été recueillis au voisinage du stylobate découvert devant la partie sud de l'enclos. Ce sont des fragments de plaques de revêtement en calcaire rose à grain très fin soigneusement taillé et poli après avoir été débité à la scie (les marques de sciage sont visibles au dos (FIG. 7). Des traces de piquetage indiquent sans doute un ajustage précis à la forme des colonnes[26]. On peut reconstituer des bandes à la surface bombée et bordées de baguettes rectangulaires en relief. Ces plaques regroupaient en alternance quatre de ces éléments (FIG. 8). La plupart présentaient latéralement une feuillure sous la baguette[27] qui permettait de les emboîter par recouvrement d'un bord, comme des tuiles. Des plaques de revêtement étaient fixées sur les tambours de colonnes grossièrement taillés, par des crochets en bronze dont certains sont conservés, encore scellés dans des tambours retrouvés. Cependant les plaques qui viennent d'être décrites ont un dos plat et devaient s'appliquer comme des facettes autour des tambours. Il faut également noter la présence d'un fragment de base de colonne moulurée en calcaire rose. Son profil externe est courbe. Le profil interne anguleux. Des graffiti ont été reconnus sur plusieurs des plaques de calcaire (personnages humains, animaux...). On peut mettre en relation avec ces crochets et le plomb qui servait éventuellement à les sceller les gouttes de bronze et de plomb fondus trouvées dans les couches de destruction de ce secteur.

Dans le même secteur et particulièrement près de l'angle sud-est de la cour ont été retrouvés un certain nombre de morceaux d'un stuc assez épais, à base de chaux (?), à grain assez grossier et présentant des traces de polychromie. Parmi eux on reconnaît des éléments végétaux pouvant provenir de rinceaux ainsi qu'une main à demi grandeur nature. Il est vraisemblable que ce décor s'appliquait sur l'entablement de la colonnade (frise avec rinceaux peuplés?).

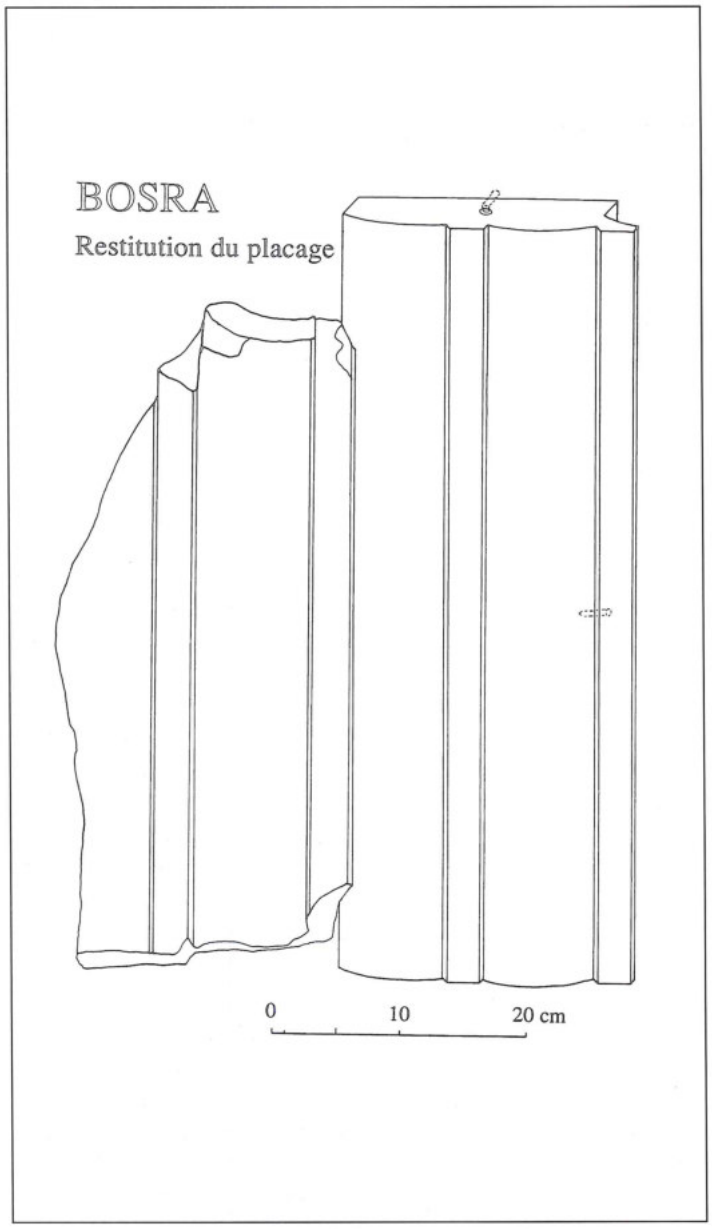
D'autre part, dans le parement des murs les plus soignés de l'Arc nabatéen et des deux tronçons de mur ornés de demi-colonnes à chapiteau nabatéen remployés dans la cathédrale, des petites cavités rectangulaires (environ 1 x 2 cm, profondes de 1-2 cm) devaient recevoir des éléments de décor métalliques plutôt que des placages. On hésite à dater ce décor de l'époque nabatéenne. En effet, des cavités analogues ont été trouvées sur divers monuments de Bostra de date postérieure (par



7. Traces de sciage au dos de l'une des plaques de revêtement en calcaire rose.

[6] Les traces d'un mortier gris sont visibles au dos des plaques.

[27] L'autre extrémité, bombée, étant amincie.




8. Assemblage de deux plaques de revêtement en calcaire rose.

exemple le "Nymphée" ou l'Arc Central).

**Conclusions**

Les techniques de constructions mises en œuvre dans l'Arc nabatéen et la cour à portiques se distinguent notablement de celles que l'on observe à Pétra. Elles sont conditionnées par les caractéristiques techniques propres au basalte et différentes de celles des grès plus encore que des calcaires. Les ressemblances frappantes dans les techniques de taille et d'assemblage des blocs avec les constructions de Sî' — où la tradition de la construction soigneusement appareillée est attestée au moins depuis le dernier tiers du Ier s. avant J.-C.[28] montrent que les commanditaires nabatéens ont fait appel à des constructeurs formés dans la région basaltique de Syrie du Sud. En revanche les différentes techniques de revêtement, depuis les enduits moulurés, les stucs en reliefs jusqu'aux placages de pierre à grain fin appliqués à un noyau d'un matériau plus grossier, sont bien attestés à Petra et dans le monde nabatéen[29]. Le décor architectural lui-même, jeux de moulurations et chapiteau nabatéen, très proche de celui d'une série de monuments de Pétra, peuvent apparaître comme une marque que l'autorité politique nabatéenne a délibérément imposée à ce programme.

[28] Sanctuaire de Baalshamîn daté entre 33 et 1 avant J.-C. H. C. Butler, *Publications of the Princeton University Archaeological Expedition to Syria, 1904/5 and 1909*, II A, Leyde, 1916, p. 374-385; J. Dentzer-Feydy, Hauran I, 2, p. 265-269.

[29] À Pétra: F. Zayadine dans *Petra: Neue Ausgrabungen und Entdeckungen*, (édit. M. Lindner), München, 1986, p. 244-247; *Studies in the History and Archaeology of Jordan*, III, Amman, 1987, p. 131-142; Ph. C. Hammond, dans *Petra: Neue Ausgrabungen*, p. 16-30; voir aussi R. Wenning, *Die Nabatäer- Denkmäler und Geschichte*, Freiburg-Göttingen, 1987, p. 240-245 (Qasr); p. 228-233 (T. aux lions ailés); dans le temple de Ramm: M. R. Savignac et G. Horsfield, *RB* (1935), p. 251-253, FIG.3.

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# Building Techniques in Palmyra*

Palmyra, situated on the crossroads of civilisation, was exposed to different cultural trends. Hellenistic and Roman influences on its architecture are very well attested, and although Palmyrene architects borrowed many Roman decorative motives and patterns, they were able to keep local building techniques for a long time. Moreover, they invented their own building system.

Up to the end of the first century BC, roughly dressed stone and mud-brick were basic materials for the construction of shrines, temples, tombs and other buildings. Examples are the tomb discovered in the Baalshamin Temple court, shrine of the Allat Temple, the Atenaten Tower and other tower tombs. The yellowish white soft limestone was employed for decorated parts.

The construction of the Bel Temple at the turn of the era became the turning point. The Temple applied Near Eastern fashion to gigantic architecture, of which 'Irāq al-Amīr and Ba'albak are the best examples.[1] The Bel Temple building resulted in the adoption of the best masonry techniques available in antiquity.[2] Implementation of the project required not only very well experienced architects and masons, but also high quality stone. Therefore, a new quarry of hard white limestone was opened 10 km north of Palmyra. In the next decades the hard limestone became the basic building material. Acquired experience of ashlar masonry was adopted in numerous buildings, such as the Agora, and the Temples of Nabu, Baalshamin and Allat. It also influenced the construction process of Palmyrene tower tombs. The walls of older monuments were built with undressed stones, while the later ones, from the end of the first century AD, were built with ashlars. This resulted in vertical outer walls. But the most important factor in tower tombs development was the use of hard limestone slabs for ceilings. In the early towers the slabs were rather short and did not exceed 1.5 m in length, therefore corbelling was necessary for their support. In later tombs the slabs reached up to 3 m in span, which allowed chambers to become more spacious and corbelling for supporting shorter slabs to be abandoned. Employment of the new building techniques influenced the design of the tower tombs, improving their building system.

From the middle of the second century AD the ashlar masonry was modified. In Near Eastern monumental architecture we observe the tendency to increase the dimensions of the blocks. In Palmyra this resulted in increasing the length and width while retaining the same weight of individual blocks. Thus the thickness of the blocks was considerably diminished. The classical form of cubic ashlars was abandoned in favour of larger but thinner blocks. The form of these blocks resembles ceiling slabs used in the first century AD. Their average size was 1 x 3.5 x 0.35 m. Pairs of such blocks were set vertically and joined together with thin mortar filling. Such walls were 70 cm thick and no dowels or clamps were used for strengthening them. This building system enabled the limitation of the number of elements needed for construction. Large blocks needed also less time for preparation and assembly. These factors resulted in a very efficient and cheap building system. Being original and unique to Palmyra, this form of masonry allowed me to name it "*opus Palmyrenum*" (FIG 1).[3] In this system, the ordinary "*opus emplectum*" method was visually improved by giving the impression of large ashlar masonry. This building method was employed in the beginning of the third century for the construction of houses, shops and other buildings. This building technique was used simultaneously with others. There were buildings where

* State Ateliers for Conservation of the Cultural Property and the Batory Foundation made presentation of this paper possible.

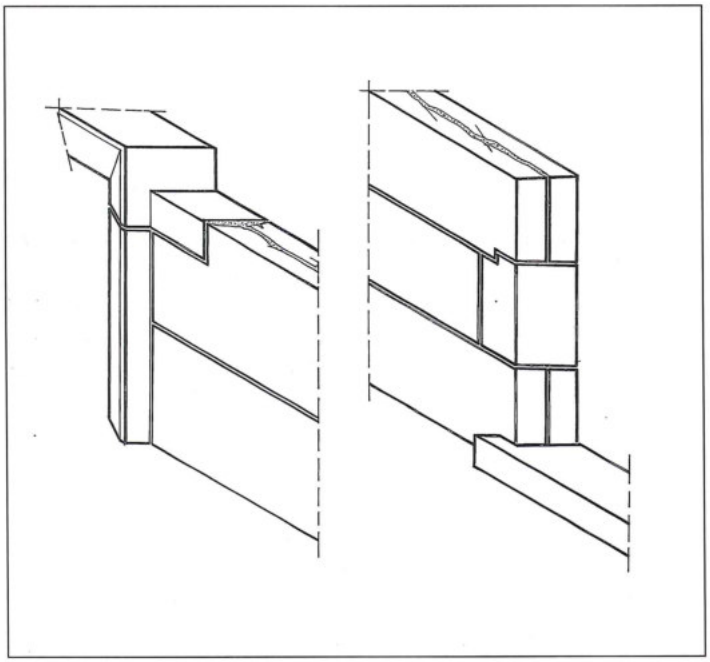
1 E. Will, 'Du trilithon de Baalbeck et d'autres appareiles collosaux', in *Mélanges offertes à K. Michalowski*, Varsovie 1966, pp. 725-729; M. Baranski, 'The Colossal Order in the Near East', in *Akten des XIII Internationalen Kongresses für Klassische Archäologie - Berlin 1988,* Mainz 1990, pp. 358-359.

2 R. Amy, 'Remarques sur la construction du temple de Bel', in E. Frezouls, ed., *Palmyre. Bilan et pérspectives,* Strasbourg 1976, pp. 53-68; *ibid.* in H. Seyrig, R. Amy and E. Will, *Le temple de Bel a Palmyre,* Paris 1975, pp. 96-112.

3 M. Baranski, '"Opus Palmyrenum"', *Damaszene Mitteilungen* 5 (1991), pp. 59-63; *ibid.* 'Development of the Building Techniques in Palmyra', in *International Colloquium on Palmyra and the Silk Road* (in print).

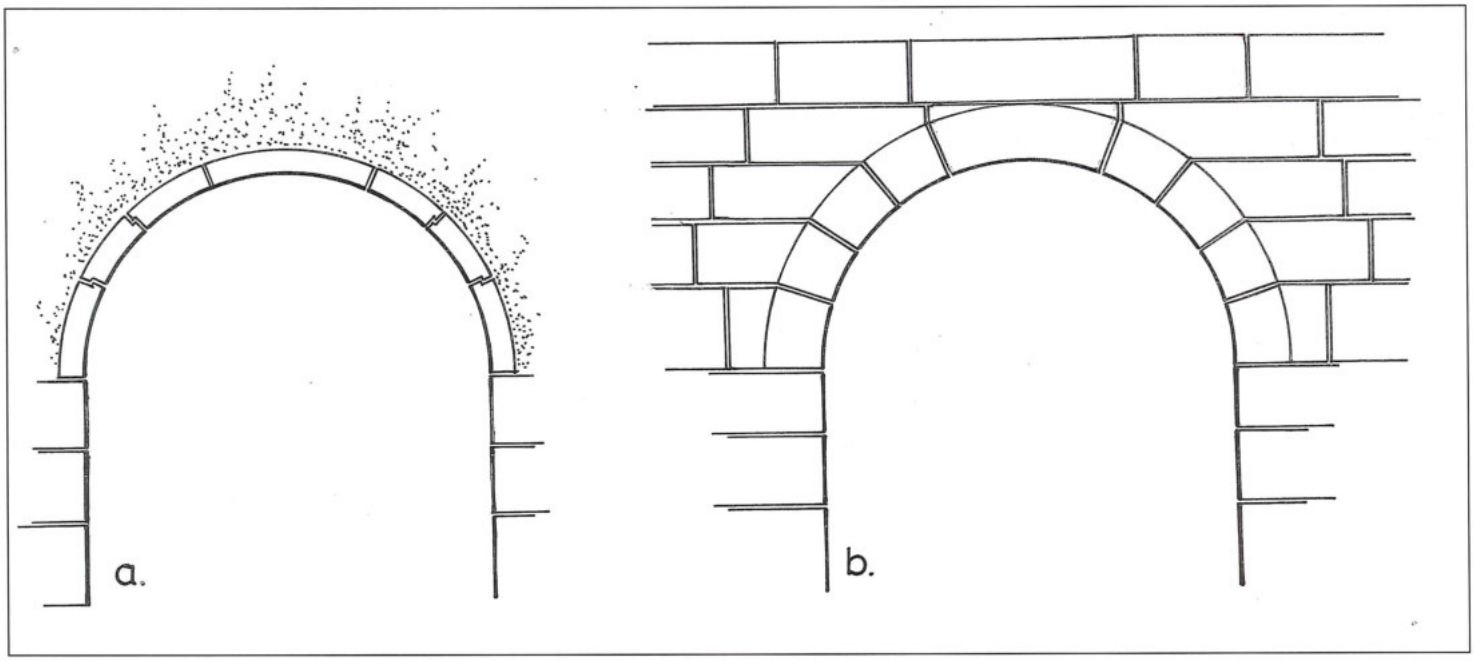
only first floors were constructed of stone blocks, while the upper floors were of mud-brick.

The new idea of constructing with large blocks was also adopted for the erection of columns. The older monuments had columns erected with small drums, while the third century ones employed monolithic shafts. This change can be easily observed in the Great Colonnade, where the columns had the same height. The second century columns were made of 7 or 8 drums. The next columns were constructed of 4 drums of which the drum bearing the *consola* was shorter than the others. Similar trends of using large block masonry can be observed at the same time in Gerasa. Earlier columns of the *Cardo* consisted of a greater number of drums than the later ones. In Palmyra, this crucial development of the building technique was caused by the change in the technique of limestone quarrying. The cutting of large slabs replaced cubic ashlars.



1. Solutions applied for the stability of "*opus Palmyrenum*" walls.

Palmyrene vaults and arches are also worth special mention. The oldest arch construction was found in the second century BC tomb excavated in the court of the Baalshamin Temple.[4] The next examples of such construction are tombs of the first century AD but arch construction employed there was done in a very special manner, which is obvious when comparing the thickness of voussoires and the quality of soft limestone. These vaults and domes had voussoires with specially dressed rebated joints (FIG. 2a). By overlapping each other, the voussoires formed a shuttering into which the lime mortar was poured, thereby constructing the solid structure. Such solution was adopted for vaults in hypogean tombs as well as for dome forming.[5] The largest construction spans up to 3.5 m. In the later monuments rebated joints and crosseted voussoires of abnormal length were used in solid stone constructions (FIG. 2b). Such forms of construction prove that Palmyrene architects doubted their




2. System of the first and second centuries arch constructions in Palmyra: a) vault with rebated voussoires; b) vault with crosseted voussoires of abnormal length.

[4] R. Fellmann, *La Sanctuaire de Ba'alshamen à Palmyre V. Die Grabanlage*, Rome 1970.

[5] Tomb no. 98, see: T. Wiegand, *Palmyra*, Berlin 1932, p. 55, FIG. 59; Tomb B, see: M. Gawlikowski, *Monuments funéraires de Palmyre*, Warszawa 1970, pp. 67-68, FIG. 32.

experience to built heavy stone vaults. In ordinary practice, extravagant cutting of crosseted voussoires is carried out purely for appearance sake, but in Palmyra this feature had structural meaning. It presumably assured the masons of structural durability. It seems that local masons knew perfectly the idea of arch and dome constructions, but they were afraid to introduce it in the regular form in stone buildings. This is clearly visible in the side entrance to the Bel Temple temenos, where two contemporary arches of identical span were differently constructed depending on their load bearing. The construction of the famous Monumental Arch of 6.9 m span should not be in fact recognised as an arch. Its main arches were formed as a structure of interacting blocks with a large beam acting as a key stone. Contrary to the second century monuments, arches of the third century were rather bland. At that time at least eight large arches were constructed in the Great Colonnade. They were built of 9 to 11 regularly shaped voussoires. The arch of 6.4 m span situated west of the theatre had 13 voussoires. Arches of nymphea built in the Great Colonnade had spans of about 8.5 m.

The development of the building trade in Palmyra should be united with the building activity and achievements in the whole region of Syria and Palestine. The new investigations confirm that the adoption of the new trends coming from Rome owed much to local architects and proper usage of locally available materials.[6] Innovative approach to building resulted in bold architectural development in the region where each town had its own building specificity.

From the beginning, commercial and cultural contacts between Palmyra and the region of Ḥawrān as well as the Nabataean Kingdom influenced Palmyrene architecture. Forms of architectural decoration, such as early Corinthian capitals, confirm these inter-relations.

Roman presence at the region enormously increased building activity. Due to Roman as well as experienced local architects, many brave constructions were erected in the cities of the Decapolis. Hadrian's Arch of 6 m span, and the baths with vaults of 10 m span and 7 m dome in Gerasa, as well as the baths and *cryptoporticus* in Bostra. These achievements were possible due to perfectly understood properties of locally quarried stone. Employment of arch construction was not limited only to vaults and domes, there were also relieving arches and flat arch lintels. In Palmyra such forms practically did not exist.

The problem of building arches in Palmyra is a very interesting case when compared with numerous constructions erected at the same period in the nearby Ḥawrān. The situation of the treeless Ḥawrān resembled conditions in Palmyra, but the development of the art of building differs considerably. Palmyrene monuments of the second century employed techniques that were introduced at the time of the Bel Temple building. Such long continuity is striking, especially when one observes the rapid accommodation of Roman building ideas in other cities. Dramatic change in Palmyrene architecture at the turn of the second and third centuries can be explained by the great development of the town. Presumably, the investment programmes were beyond the power of local architects. This may be a reason that some skilled architects were hired to Palmyra to continue or begin new prestigious projects. They brought the new ideas and experience of stone arch construction, which presumably pushed forward the development of Palmyrene building techniques.

[6] M. Waelkens, 'The Adoption of Roman Building Techniques in Roman Asia Minor', in S. Macready and H. Thompson, eds., *Roman Architecture in the Greek World*, London 1987, pp. 94-105; H. Dodge, 'The Architectural Impact of Rome in the East', in M. Henig, ed., *Architecture and Architectural Sculpture in the Roman Empire*, Oxford 1990, pp. 108-120.

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# From Public to Private Space: Changes in the Urban Plan of Bayt Rās/Capitolias

## Introduction

Bayt Rās/Capitolias,[1] located in northern Jordan, was one of the flourishing cities of the Decapolis[2] during the period between the first century AD and continuing (at least) through the ninth century.[3] Declared a *polis* in AD 97/98, the city was built only five kilometers north of Irbid, Roman/Byzantine Arbela. It has been argued elsewhere[4] that the founding of Capitolias was for political/administrative reasons. Although the cities were intimately connected, as is somewhat reflected in the textual documentation, Capitolias took precedence over neighbouring Arbela.[5] Recent archaeological investigations in Bayt Rās indicate continuity of occupation at the site from its foundation to the present.[6] However, the use of space has been altered considerably over time. As the site changed from city to village to town, the same space was utilized in different ways. This paper seeks to investigate the use of space in the archaeologically designated Area A.

## Area A: Summary of Excavations

Archaeological research in Bayt Rās is a combination of salvage, rescue and long-term strategies. The fact that the ancient site is an inhabited, growing village is both a hindrance and an advantage to the research. Through the combination of various research methodologies, e.g., archaeological, historical and anthropological, it is possible to discuss the changes in the site from its foundation to the present.

Excavations have been carried out in Area A since 1985 and are on-going. Area A is located in the northeast section of the village: north of the modern east-west asphalt road which bisects the village from the main highway. The modern asphalt road extends to the "Rās", the highest point in the village as well as in the ancient city.[7] The Area is bounded on the west by the modern guesthouse (*maḍāfa*) of the Ḥamouri family; on the east, the Area is bounded by the modern mosque. Visible through 1987 were two west-facing and east-facing vaults, (below and west of the guest-house, below and east of the mosque) delimiting the area in antiquity. The major architectural features presently visible are the nine north-facing vaults. The Area was archaeologically defined in 1985 as extending to the field wall in the north;[8] however, this was circumscribed following the 1988 excavations.[9] The present northern boundary of the Area is a

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[1] Survey was conducted in 1983 (privately funded) and in 1984 (the author was funded by NEH/ASOR). Since 1985, the project, directed by the author, has been supported by the Institute of Archaeology and Anthropology (Yarmouk University) and the Department of Antiquities. The "Friends of Archaeology" (Amman) supported the "CW" and "R" excavations in 1988. Summaries of research can be found in the following: C. J. Lenzen, 'Tell Irbid and Beit Ras', *AJA* 95 (1991), pp. 271-272; C. J. Lenzen, 'The Integration of the Data Bases - Archaeology and History: A Case in Point, Bayt Ras', pp. 160-178 in M. A. Bakhit and R. Schick (eds.), *Bilād al-Shām During the Abbasid Period, (Proceedings of the Fifth Bilad al-Sham Conference)*, Amman: The University of Jordan; C. J. Lenzen, 'Beit Ras Excavations 1988 and 1989,' *Syria* 67 (1990), pp. 474-476; C. J. Lenzen and A. M. McQuitty, 'The 1984 Survey of Irbid/Beit Ras,' *ADAJ* 32 (1988), pp. 265-274; C. J. Lenzen and E. A. Knauf, 'Beit Ras-Capitolias: A Preliminary Evaluation of the Archaeological and Textual Evidence,' *Syria* 64 (1987), pp. 21-46; C. J. Lenzen, 'Tall Irbid and Bait Ras,' *Sonderabdruck aus Archiv für Orientforschung* 33 (1986), pp. 164-166; C. J. Lenzen, A. M. McQuitty and R. L. Gordon, 'Excavations at Tell Irbid and Beit Ras, 1985,' *ADAJ* 29 (1985), pp. 151-159.

[2] "Decapolis" is loosely used here geographically, although more lay behind it, e.g., a political and/or administrative idea.

[3] Cf. articles above; and, G. Walmsley, *The Administrative Structure and Urban Geography of the Jund Filastin and the Jund al-Urdunn,* Unpublished Ph.D. 1987, University of Sydney.

[4] Cf. C. J. Lenzen, 'Irbid and Beit Ras, Integrated Settlements, A.D. 100-900,' pp. 299-301 in *Studies in the History and Archaeology of Jordan*, IV, Amman: The Department of Antiquities.

[5] Discussions of the textual documentation can be found in the articles cited above as well as in C. J. Lenzen, 'Tell Irbid: A Problem in Archaeological Interpretation,' *Biblische Notizen* 42 (1988), pp. 27-35; C. J. Lenzen and E. A. Knauf, 'Irbid (Jordanie),' *RB* 95 (1988), pp. 239-247; and, C. J. Lenzen and E. A. Knauf, 'Tell Irbid and Beit Ras, 1983-1986,' *LA* (1986), pp. 235-241.

[6] If there is a hiatus in occupation, current excavations do not indicate this.

[7] According to oral history, this road consisted of basalt blocks until the late 1950s. It would appear that this was the main *decumanus* of the city, as shown in G. Schumacher's map, cf. Lenzen and Knauf, *Syria* 64 (1987), pp. 21-46.

[8] Cf. Lenzen, McQuitty and Gordon, *ADAJ* 29(1985), pp. 152-153.

[9] The inability of the Department of Antiquities to purchase the entire tract of land has meant that a number of the architectural features discussed here are no longer visible, thus limiting future excavations.

partially visible courtyard wall constructed at the turn of the century.[10] The archaeological phasing of the Area is shown in TABLE 1.

**Table 1.** Bayt Rās/Capitolias phasing chart (Area A).

| | | | |
|---|---|---|---|
| Phase | I: | a. | 1980 to the present. |
| | | b. | c. 1950-1980. |
| | | c. | c. 1900-1920. |
| Phase | II: | | 19th/early 20th centuries. |
| Phase | III: | | c.AD 1500-1800. |
| Phase | IV: | a. | c. AD 1100-1500. |
| | | b. | c. AD 900-1100. |
| Phase | V: | a. | c. AD 700-900. |
| | | b. | c. AD 600-700. |
| Phase | VI: | c. | AD 300-600. |
| Phase | VII: | | Mid-1st century AD to c. 300.[11] |

The architectural features excavated in Area A, according to the phases, and their present status are shown in TABLE 2.

## Area A: Narrative

The Roman construction of Capitolias followed the natural contours of the land. The exposed bedrock was cut and used as the foundation layer for structures. Minimal foundation "channels" were cut in the bedrock with the lowest course of walls being stepped out to provide a secure aṣhlar block foundation. The bedrock was not only levelled, it was also cut vertically to form the support for the back wall of the vaults.[12] The space that is presently encompassed by the nine vaults would have accommodated three vaults of the size of Vault 9, the Roman vault. Construction of the other vaults, "1"–"8", occurred during the fourth/fifth century.[13] Evidence of a *probably* Roman structure was excavated below the three

**Table 2.** Bayt Rās/Capitolias (architectural features).

| *Phase* | *Features* | *Status* |
|---|---|---|
| Ia: | Vaults; west, north and central walls, tessellated pavements. | Visible as archaeological features; housing in courtyard and part of facade destroyed. |
| Ib: | Vaults, two north walls; east and west vaults; housing on street and across from vaults; courtyard wall with arch; fragmented small courtyard walls; construction of vault facade. | Vaults visible. Use as domestic and agricultural space, later as storage; housing on street destroyed. |
| Ic: | Vaults, west and north walls, east and west vaults; housing in courtyard constructed. | Vaults and walls visible. |
| II: | Use of the vaults as domestic space; east vaults as cesspit; ovens and courtyard walls. | Partially visible within vaults. Excavated, not visible. |
| III: | Vaults; dividing walls; arcade standing; "minor industrial" use/robbing. | Visible, e.g., in baulks and in standing features. Collapsed arcade excavated. |
| IVa/b: | Flagstone resurfacing; arcade standing. Central wall rebuilt to accommodate resurfacing. | Vaults and flagstone visible. Central wall visible. |
| Va/b: | Refurbishing of vault arches; construction of installation outside of church apses; central wall and tessellated pavements restored. | Vaults, central wall visible. Church out of use and no longer visible. |
| VI: | Vaults reconstructed; tessellated pavements laid; central wall built; church reconstructed. | Vaults, pavements and central aisle visible. |
| VII: | Vault 9 constructed; structure below church excavated. | Vault 9 visible. |

[10] The municipality of Bayt Rās has planned a road along this wall. At the time of this writing, the status of this road is unknown. The construction of this road will further encroach on the archaeological remains of the site.

[11] Phase VIII: Pre-mid-first century AD has not been excavated in Area A; although it is represented in survey data from the Rās.

[12] A preliminary analysis of the constructional techniques employed at the site can be found in: Zaydoon Zaid, *An Architectural Analysis of the Constructional Techniques in Beit Ras/Capitolias*. Unpublished Masters Thesis, 1989: Institute of Archaeology and Anthropology, Yarmouk University, Irbid, Jordan. Although the author is essentially in agreement with Zaid, much of what is contained here is *contra* Zaid's interpretations.

[13] It is tempting to correlate the rebuilding of the Area with either the AD 363 earthquake or with the growing power of the Byzantine/Christian authorities. The archaeological data, however, is silent; that is, there is no record of either as the rationale for the alterations. For a rather dogmatic approach to Christianity being the reason for the altering of the urban features, cf. 'Ali H. Zeyadeh, *An Archaeological Assessment of Six Cities in al-Urdun: From the Fourth to the Mid-Eighth Century A.D.*, Unpublished Masters Thesis, 1988: Institute of Archaeology and Anthropology, Yarmouk University, Irbid, Jordan. Although this author agrees that Christianity effected the urban features, witness the number of churches constructed in other cities, e.g. Jarash/Gerasa, the approach advocated is one less reliant on the religious/political phenomenon. For a discussion concerning the earthquake data in relationship to the archaeological record, cf. K. W. Russell, 'The Earthquake Chronology of Palestine and Northwest Arabia from the 2nd through the Mid-8th Century A.D.,' *BASOR* 260 (1985), pp. 57-59.

apses of the church.[14] To the north, a well-constructed wall, excavated in 1985, delimited the space. A space was created, albeit one for which there is minimal archaeological data.[15] Although the plan of Roman Area A is almost totally obscured, one can still assume that the space was defined during this period and remained essentially the same for several centuries following, through at least the beginning of Phase IV. The space was conceived as public in nature: vaults were built across from a structure with an open space between them. The Vaults were *probably* part of a market-place (*sūq*) across from a main structure.[16]

The Byzantine alterations of the space were extensive. Vaults "1" through "8" and the arches were reconstructed;[17] utilitarian tessellated pavements were laid inside and outside the Vaults; and the church was constructed. The configuration during Phase VI further supports the notion of this being a market-place. The major central wall was built at the same time as the Vaults and the tessellation; and, based on the constructional techniques, it would appear that the western and northern walls were built or rebuilt at the same time.[18]

The architectural features present by AD 600 remained essentially the same until Phase III. An arcade, founded on piers abutting the Vault facade and the central wall, was constructed *probably* at the same time that the upper courses were added to the central wall. As the construction of these courses is dated to the seventh/early part of the eighth century, the arcade can be safely dated to the same period. The date at which the church went out of use as a church cannot be determined based on the present data.[19] In the ninth/tenth century, the tessellated pavement outside of the Vaults was resurfaced with flagstone. This was eventually destroyed, during Phase III, when the area was robbed for marble.[20] After the collapse of the arcade, mud surfaces were laid and the Vaults were used as living units with the space in front used as a courtyard.[21]

## Area A: The Problem

The above review of the occupational history of Bayt Rās/Capitolias as depicted in the schematic presentation of the archaeological data may present no interpretative problems. The formulation of archaeological phasing into a schematic/narrative presentation, acceptable archaeological procedure, generally suffices for interpretation. Simply stated, Area A was utilized first as public space and, then, in approximately AD 1500 to 1800 (Phase III) it was used for minor industrial purposes. Eventually, the utilization was totally for domestic purposes. Up until 1983 the space was seen as changeable and alterable — as fluid space.

Only with the inception of an archaeological programme has this space become static.[22] The actual space defined initially in the Roman construction of the vaults and delineation of the space had no meaning in and of itself; nor did it in the following centuries.

Space is a "socially constructed phenomenon";[23] and, if interpreted as such one is compelled to look beyond the "facts" of archaeological data. The "facts" are generally the physical descriptions of a place (or a space) with the addition of a typological series of the material cultural remains excavated within the place (and/or the space).[24]

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14 A report on the church excavations can be found in C. J. Lenzen, 'Beit Ras Excavations 1988 and 1989,' *Syria* 67 (1990), pp. 474-476. The church is dated to the latter part of the fifth century on pottery.

15 The Roman archaeological data from the 1985 excavation of the natural cave and surrounding area to the north is not part of the present discussion.

16 Because of the continued use of the Vaults and the surrounding area, archaeological Area A, no *in situ* remains of the use of the Vaults has been excavated, nor should this be expected. See below, fn.'s 19 and 24. The forming of this "built" environment *may* be the one *typical* aspect of the introduction of Roman city-planning concepts into the region, cf. A. H. M. Jones, *Cities of the Eastern Roman Provinces* (Oxford: Clarendon Press, 1971); and the various excavation reports on the sites of: Jarash/Gerasa, 'Ammān/Philadelphia, Tall Abīl/Abila,Ṭabaqat Faḥl/Pella, Umm Qays/Gadara. Similar comparative data exists in Roman/Byzantine Palestina Prima, the Jund Filasṭīn, cf. excavation reports on Arsuf/Apollinia and Qaysariya/Caesarea Maritima.

17 It should be noted that no alterations to Vault 9 are evidenced in either the frontal arch or within the Vault. This Vault seems to have withstood whatever natural or other destructive events occurred which necessitated the building and rebuilding of the others. In the recent past, i.e. Phase Ib and Ic, the Vault was used as a cesspit.

18 This wall, parallel to the wall excavated in 1985, and the central wall were constructed during this period; the 1985 wall was rebuilt. Three parallel walls, extending east-west, existed in the Area. It is likely that the two most northern walls formed the north and south aisle walls for the church. The Phase I and II courtyard wall with the entrance arch (no longer visible) were constructed on generally the same line as the south (of the church and the middle of the three) wall; however, the existence of the extent of the wall across the Area may not have been known to the builders.

19 It is unlikely, based on the accounts of G. Schumacher (*Northern 'Ajlun,* 1886) and G. Lankester Harding (Notebooks on file at the Registration Centre, The Department of Antiquities, 1930s) that the pottery, initially used for dating purposes, was *in situ*. It is more likely that this pottery, like the fourth century sarcophagus excavated in 1989, was moved into the area within the last one hundred years.

20 The marble was probably broken down to be used as agricultural fertilizer in the surrounding fields.

21 A series of *ṭawābīn* (ovens) were excavated in this space during the 1989 excavations.

22 The transition from space perceived as fluid to static may not actually rest completely with the advent of the archaeologists; however, based on the accounts of the villagers and the results of the last few years, it is likely that very little if any of the archaeological remains would still be visible. The archaeological research has actually made the space mostly static. To this author's mind, this raises the issue of the validity of "cultural resource management". What "culture" is being managed? And, more importantly, whose perceptions of "culture" are being promulgated?

23 Cf. P. Lane, 'Reordering Residues of the Past,' pp. 54-62 in I. Hodder (ed.), *Archaeology as long-Term History*, (Cambridge University Press, 1987), p. 56.

24 As should be clear, the likelihood of finding *in situ* pottery and coins, the normative dating tools for Near Eastern archaeologists, is extremely slim in Bayt Rās. This is not necessarily only due to the occupational use of the site since c. 1800, but also due to the continued use and re-use throughout the site's existence. Essentially, one has to question some of our learned archaeological rules. For example, given the records left by Schumacher and Harding concerning this area, the oral history of the village and what the author has witnessed in the last decade, the "rule" that pottery outside of a *sealed* context can give a dating parameter is ludicrous. This is not, however, to create another dogmatic principle; but, merely to argue along with C. Renfrew (*Approaches to Social Archaeology* [Cambridge, MA: Harvard University Press, 1984], I. Hodder (*Reading the Past* [Cambridge: Cambridge University Press, 1986]) and several others that any site must be interpreted based on its specificity as well as its context within a broader understanding.

Little regard is paid to the conceptualizing of the space.[25] Whereas other disciplines have living informants, no archaeologist is fortunate enough to have this kind of data. The typological series, often mistaken for the chronology of a place or space, then takes on those characteristics of the living informant: the archaeologist "reads" the typological data and allows this to inform the interpretations of the space.

Pertinent textual documentation, whether it directly relates to the site or not, plays the same role as the living informant. An event *recorded* in text acquires significance without regard to site, place or specific space. As a consequence, the recording becomes the *event* and the archaeological "facts" are placed within the framework of the *recorded events*. The result is a schematic interpretation of events which is then anchored within a linear and by implication in an evolutionary understanding of time. Stated explicitly or not, the interpretation results are viewed as "peaks" or "highs" which devolve into "valleys" or "lows".[26]

As regards the urban environment of northern Jordan, such an approach produces clear results: urban areas flourished in the Roman and Byzantine periods, gradually fell into disrepair and eventually disappeared.[27] What is evident is an evolutionary approach, firmly anchored in linear historical events without regard to either natural events or social interactive contexts. The research is forced into taking a *position* or a *stance*. Once the particular *stance* is acknowledged, it becomes most important. It overrides the ability to formulate an interpretation of the past based on available data.

This is seen clearly in relationship to the urban centers of northern Jordan. It has been argued quite forcibly in various contexts that the alteration of the classical city plan of the Hellenistic and Roman world was a direct result of the Sassanian/Persian conquest of the region on the one hand and the take-over by the Muslim armies in the mid-seventh century on the other.[28] The alterations in the city plans of the major Roman/Byzantine cities have been interpreted as being a result of political changes within the region. Little attention has been paid to the degree of control exerted by the Sassanians or the early Muslims on the urban, physical, environment.[29] Textual documentation is evaluated as "meaningfully" constructed or not. The definition of "meaningful" has become whether or not it suits the argument proposed.

Underlying the interpretations is a conception of reality which is evolutionary and fraught with assumptions. The reasoning is something like this: before the conquest of northern Jordan urban life had not really evolved.[30] It was only with the conquest of the region by the Romans — and, indeed it should not be forgotten that it was a conquest — that a true urban environment was created. The accoutrements of the Roman city, as seen in the orthogonal street plan, theatres, odeons, hippodromes, forums, became the ideal. If that was the norm, then naturally anything that changed or was different from it cannot/could not, by definition, be ideal. This "historicist" understanding allows for what are determined to be fundamentals and for the establishment of entrenched categories.[31]

## Conclusions

Asem Barghouti[32] clearly states the basic concept involved: that the idea of the urban plan was simply one of many "institutions" introduced to Jordan by the Romans. Furthermore, Barghouti points to a local modification of the introduction of the plan. Whether or not the Byzantine alterations in the space defined by the Romans can be identified as some kind of local modification is not presently evident.[33] In conjunction with this conceptualization of the process involved in the use of the space from public to domestic is whatever understandings one has of the "Islamic City". Janet Abu-Lughod[34] has succinctly argued for the *isnād* (chains) of misunderstanding concerning the formulations of the ideal Islamic City. Her arguments are not all that dissimilar from Barghouti's in that there must be a realization of a con-

[25] Cf. D. Canter, *The Psychology of Place* (New York: St. Martin's Press, 1977), pp. 158-160 in particular.

[26] Anthropological literature addresses these issues. For a cogent summary cf. J. Rappaport, *The Politics of Memory: Native Historical Interpretation in the Colombian Andes* (Cambridge University Press, 1990), pp. 10-13.

[27] Cf. several of the articles mentioned above for refutations of the stance. Of course, the whole question of "objectivity" is raised as well as the idea of "history". R. Layton ('Conflict in the Archaeology of Living Traditions,' pp. 1-21 in R. Layton (ed.), *Conflict in the Archaeology of Living Traditions,* [London: Unwin Human, 1989], p. 5-7) states clearly his stance: "The failure to attend to cultural patterning in the archaeological record would be to disregard important aspects of variability in the data, even if the uniformed outsider cannot fully explain it."

[28] Cf. H. Kennedy and J. H. W. G. Liebeschuetz, 'Antioch and the Villages of Northern Syria in the Fifth and Sixth Centuries A.D.: Trends and Problems,' *Nottingham Medieval Studies* 32 (1988), pp. 65-90; H. Kennedy, 'The Last Century of Byzantine Syria: A Reinterpretation,' *Byzantinische Forschung* 10 (1985), pp. 141-183; H. Kennedy, 'From Polis to Madina: Urban Change in Late Antique and Early Islamic Syria,' *Past and Present* 106 (1985), pp. 3-27. An approach has been established which forces homogeneity on all cities; and, the *use* to which archaeological "facts" are put is somewhat suspect.

[29] It would appear to have been relatively negligible.

[30] This reasoning is certainly faulty and is bellied by, in particular, the Late Bronze and Iron Age fortified cities, e.g. Tall Irbid.

[31] Cf. M. Rowlands, 'Centre and Periphery: A Review of a Concept,' pp. 1-13 in M. Rowlands, M. Larsen and K. Kristiansen (eds.), *Centre and Periphery in the Ancient World*, (Cambridge: Cambridge University Press, 1987).

[32] A. N. Barghouti, 'Urbanization of Palestine and Jordan in Hellenistic and Roman Times,' pp. 209-229 in A. Hadidi (ed.), *Studies in the History and Archaeology of Jordan*, I (Amman: The Department of Antiquities, 1982). Barghouti is also speaking of Hellenistic urban planning, for which we have even less data available from north of 'Ammān/Philadelphia.

[33] Zaid's preliminary analysis certainly points in this direction, cf. fn. 12 above.

[34] J. L. Abu-Lughod, 'The Islamic City - Historic Myth, Islamic Essence and Contemporary Relevance,' *International Journal of Middle East Studies* 19 (1987), pp. 155-176.

textual understanding both in terms of the temporal and the spatial.[35]

Certainly, Bayt Rās/Capitolias easily falls into the category of a planned city in its broadest sense; it does not, however, easily fall into any of our present typological categories. And, perhaps that is the essential point: the occupational history of the site and the use of space need not be the same as other contemporary sites, nor need it diverge in all respects.

[35] This raises the important issue of the "privatization" of space. The Islamic City has been partially defined as one enclosed, i.e., the construction of the arcade outside of the Vaults would necessarily point some to identifying this architectural feature as *typical* of the Islamic City. The altering of space from public to domestic (private) easily rests within a category of from "high" to "low", a devolutionary process. Could this not merely be an "outsider's" view of poorly understood processes?

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**Jacques Bujard avec une contribution de Michelle Joguin**

# La fortification de Kastron Mayfa'a/ Umm ar-Raṣāṣ

La mission archéologique suisse de la Fondation Max van Berchem travaille depuis 1988 à l'intérieur de l'enceinte d'Umm ar-Raṣāṣ, l'antique Kastron Mayfa'a[1], situé à la limite du désert, sur le tracé d'une route antique menant au camp de Bethorus/Lajjūn[2].

L'existence d'un camp romain est assurée à Kastron Mayfa'a dès la fin du IIIe ou le début du IVe siècle grâce à la mention d'une garnison par Eusèbe de Césarée. Un siècle plus tard, vers 400, la *Notitia Dignitatum* y signale le stationnement d'une aile de cavalerie indigène promue (*equites promoti indigenae*)[3]. La mission a tenté de mieux dater l'enceinte de Kastron Mayfa'a/Umm ar-Raṣāṣ, les absides de deux églises géminées encastrées dans le mur oriental de la fortification ayant parfois fait croire à une construction byzantine, plutôt que romaine.

Les premières campagnes de fouille ont clairement démontré que les églises étaient postérieures à la fortification, deux tronçons du parement de l'enceinte ayant été démontés lors de l'insertion des absides[4]. Une analyse architecturale de la forteresse et un sondage au pied de l'enceinte permettent maintenant de distinguer sa disposition originale des apports postérieurs et de proposer une datation plus précise.

## La fortification primitive

### *L'enceinte et ses bastions*

La forteresse de Kastron Mayfa'a se présente sous la forme d'un grand quadrilatère de 158 m par 139 m entouré d'une solide muraille de 2 m d'épaisseur, parfois conservée sur sa hauteur originale d'environ 5 à 6 m (FIGS. 1-3). Cette enceinte, à l'appareil jointoyé à la terre proche de celui de la plupart des tours de la région, est bâtie avec d'énormes blocs, longs souvent de près de 1,50 m et hauts d'une cinquantaine de cm, grossièrement taillés et calés par des moellons plus petits. Elle est renforcée par des bastions-contreforts rectangulaires larges d'environ 8 m, mais saillants de seulement 1,00 à 1,25 m à l'extérieur. Massifs au rez-de-chaussée, ces bastions étaient au nombre de dix-huit, cinq au nord et au sud, quatre à l'est et à l'ouest. Un grossier dallage de pierre est préservé au sommet de plusieurs bastions, à un niveau inférieur de 0,30 à 0,60 m à celui de la courtine. Comme on peut encore le constater sur certains d'entre eux, l'étage des bastions était protégé du côté extérieur par des murs parapets de 0,75 m d'épaisseur; cet étage était primitivement ouvert à la gorge, soit du côté de l'intérieur du camp, ce qui, conjugué à l'absence de support intermédiaire ou d'arc, paraît indiquer qu'il n'était pas couvert (FIG. 3). Ces bastions ne devaient être accessibles pour la plupart que par des échelles, une seule fondation attribuable à un escalier de pierre adossé au mur d'enceinte ayant été retrouvée[5].

### *Les bastions d'angle*

Les quatre angles de la fortification étaient marqués par des bastions plus proéminents (environ 2,20 m), mais ne formant pas de véritables tours d'angle, puisqu'ils n'étaient pas saillants à l'intérieur de l'enceinte (FIG. 3).

### *La porte*

Une seule porte s'ouvrait à l'origine dans l'enceinte, à l'est, au milieu d'un des petits côtés; son passage, large de 3,50 m, est flanqué de deux tours rectangulaires aussi saillantes que les bastions des quatres angles (FIGS. 4-6).

[1] J. Bujard et M.-A. Haldimann, sous la direction de Ch. Bonnet, 'Fouilles de la Mission archéologique suisse (Fondation Max van Berchem) à Umm er-Rasas et Umm el-Walid en 1988', *ADAJ* 32 (1988), p. 101-113; J. Bujard, 'Les églises géminées d'Umm er-Rasas, Fouilles de la mission archéologique suisse (Fondation Max van Berchem)', avec des études du Père M. Piccirillo et de M. Poiatti Haldimann, *ADAJ* 36 (1992), p. 291-306; *Entre Byzance et l'Islam, Umm er-Rasas et Umm el-Walid, fouilles genevoises en Jordanie*, éd. par J. Bujard et F. Schweizer, Musée d'art et d'histoire, Genève, 1992, p. 3-9.

[2] S. T. Parker, *Romans and Saracens: A History of the Arabian Frontier*, Dissertations of the American Schools of Oriental Research, no 6, 1986, p. 45; F. Zayadine, 'L'espace urbain du grand Petra, les routes et les stations caravanières', *ADAJ* 36 (1992), p. 229.

[3] M. Piccirillo et T. Attiyat, 'The complex of Saint Stephen at Umm er-Rasas-Kastron Mefaa, First Campaign, August 1986', *ADAJ* 30 (1986), p. 349-350; M. Piccirillo, *Madaba, le chiese e i mosaici*, Milan, 1989, p. 305.

[4] J. Bujard, 'Les églises géminées d'Umm er-Rasas', *op. cit.*, FIG. 1.

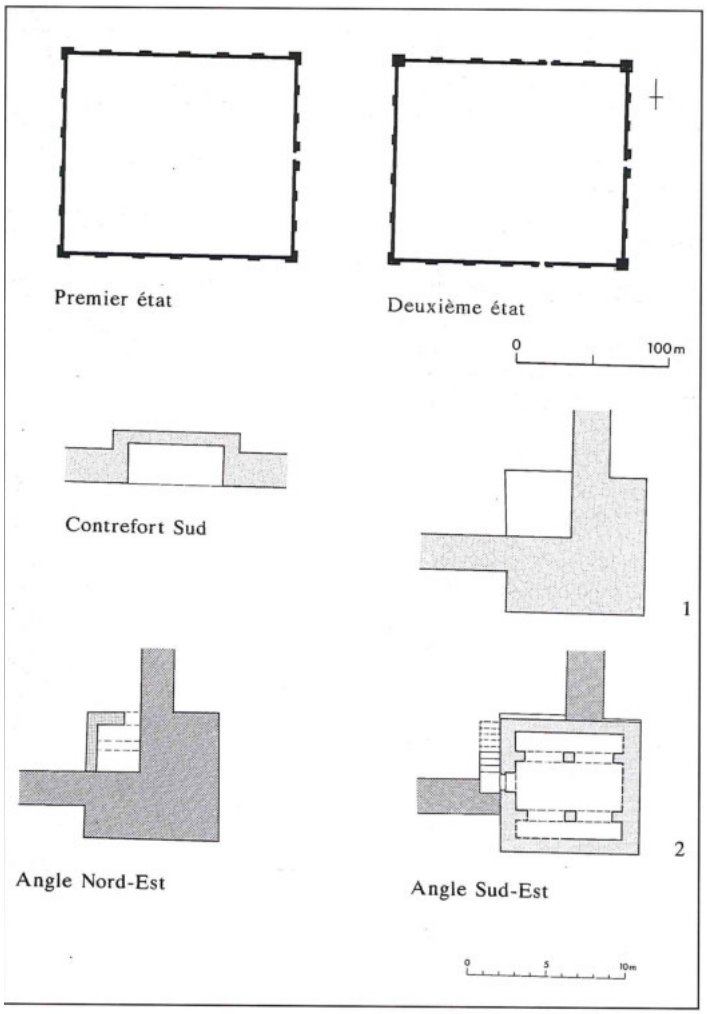
[5] Cet escalier a été démoli lors de la construction de l'abside de l'église géminée nord, qui recouvre ses fondations.



1. Umm ar-Raṣāṣ/Kastron Mayfa'a. Vue aérienne de l'enceinte rectangulaire et du faubourg nord (M. Piccirillo).



2. Umm ar-Raṣāṣ/Kastron Mayfa'a. Vue de la fortification depuis le nord-est (Département des Antiquités).




3. Umm ar-Raṣāṣ/Kastron Mayfa'a. Plans successifs de l'enceinte, lors de sa construction au IIIe ou au début du IVe siècle, puis après le percement des deux portes supplémentaires et la construction de trois tours d'angle au Ve-VIe siècle. Plans d'un des bastions-contreforts et de deux des tours d'angle: 1) état primitif, IIIe-IVe siècle; 2) ajout d'une salle à l'étage, Ve-VIe siècle (relevé C. Eyer, mise au net W. Trillen).

Une transformation tardive de l'entrée[6] a fait disparaître l'encadrement de la porte, mais, vu sa grande largeur et les matériaux à disposition, on peut penser qu'elle était couverte d'un arc plutôt que d'un linteau.

La tour nord a conservé les bases d'une petite salle occupant son premier étage. La paroi occidentale de cette salle, plus étroite que les autres, présente d'évidentes marques de reconstruction, la position de la porte de cette salle, curieusement rejetée dans l'angle sud-ouest, trahissant de plus un déplacement rendu nécessaire par l'édification d'un bâtiment contre la tour. Le dallage de *tegulae* conservé dans la pièce ne montre aucune trace d'un escalier qui aurait permis de monter sur le toit de la tour, de même qu'aucune porte ne reliait la salle à la courtine. Une salle identique devait se trouver sur la tour sud; il n'en est rien resté.

## Transformations de la fortification

*Les nouvelles portes*

Deux portes supplémentaires ont été percées par la suite dans l'enceinte, l'une au nord et l'autre au sud (FIG. 3). Toutes deux ont été ménagées en réduisant de moitié la largeur d'un bastion et en construisant un second renforcement de l'autre côté du passage. Les bastions choisis pour ces nouvelles portes n'étant pas ceux du milieu des deux grands côtés de l'enceinte, le *cardo* ne coupe pas l'agglomération en deux moitiés égales.

*La porte sud*

L'embrasure de la porte sud, large de 2,77 m, est très soigneusement appareillée en blocs de calcaire fin de couleur blanche. Le piédroit occidental a conservé un abaque chanfreiné à 2,20 m du sol, alors que les parties hautes de la porte ont été démontées au moment de sa fermeture par un mur. Les deux tours de part et d'autre de la porte, massives au rez-de-chaussée, étaient surmontées de chambres dont les murs ont été fortement reconstruits après la suppression de la porte (FIGS. 4 et 6).

Une poterne secondaire, pour les piétons, flanquait la tour occidentale; large de 1,50 m, elle est couverte d'un linteau droit. Cette poterne a, elle aussi, clairement été percée dans un mur plus ancien, comme le montre son encadrement en retrait du parement original et entouré d'un blocage de petit moellons. Elle n'a en revanche jamais été murée, suffisant aux besoins d'une agglomération dont les rues peu à peu envahies par les constructions ne permettaient plus la circulation de chars.

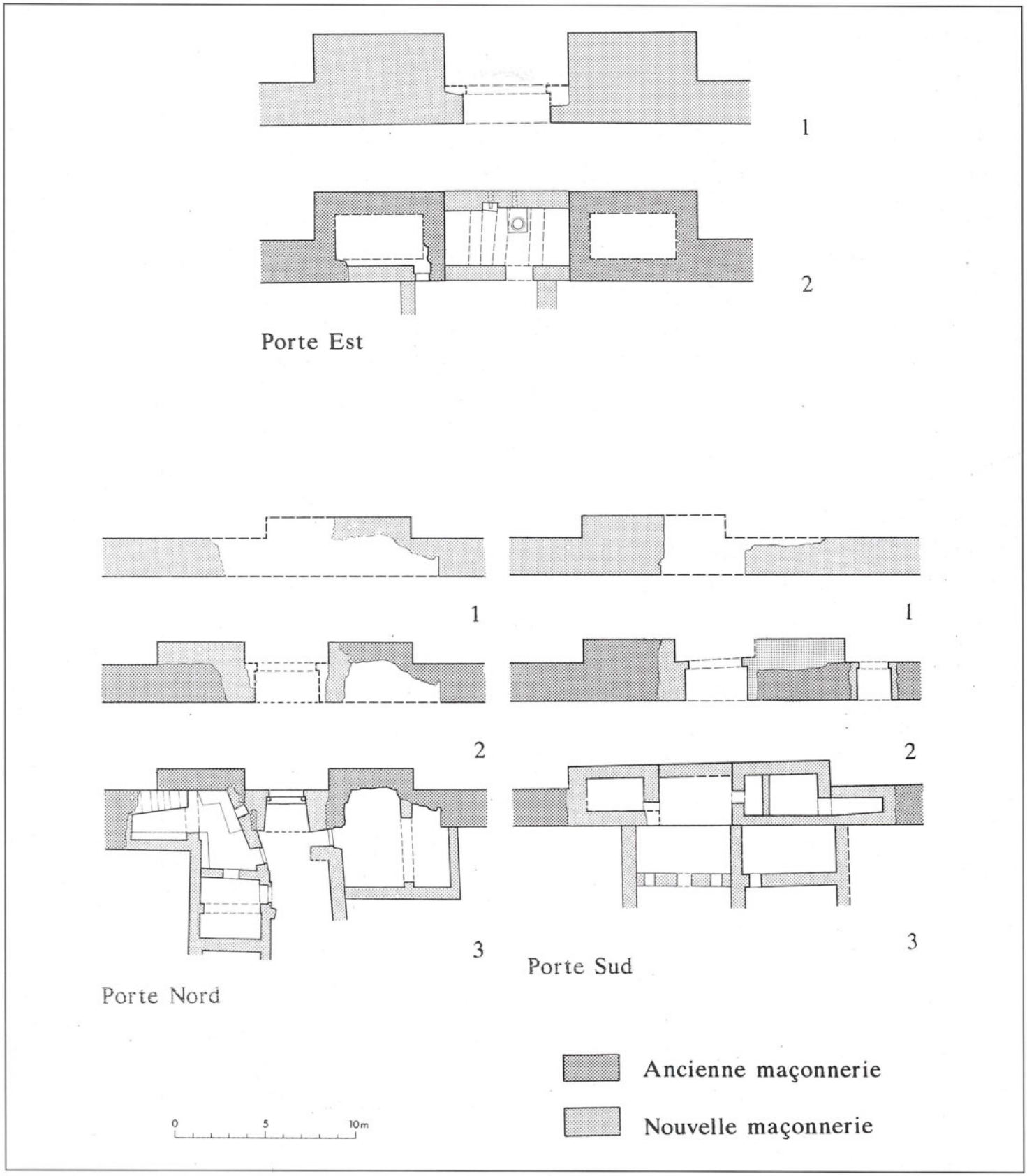
*La porte nord*

La porte nord a subi plusieurs transformations qui rendent difficile la lecture de son état premier (FIGS. 4 et 7). Entre deux tours semblables à celles de l'entrée sud, subsiste une partie du piédroit occidental d'une porte dont la largeur, restituable par symétrie, était d'environ 2,80 m. L'encadrement de cette porte paraît avoir été construit dans le même calcaire blanc que celle du sud, plusieurs fragments de blocs de qualité et de taille identiques ayant été remployés dans les maçonneries de l'ouverture postérieure. Les deux portes nord et sud, situées aux deux extrémité du *cardo* que leur percement a permis de tracer, appartiennent donc manifestement à une même étape de réaménagement de la fortification.

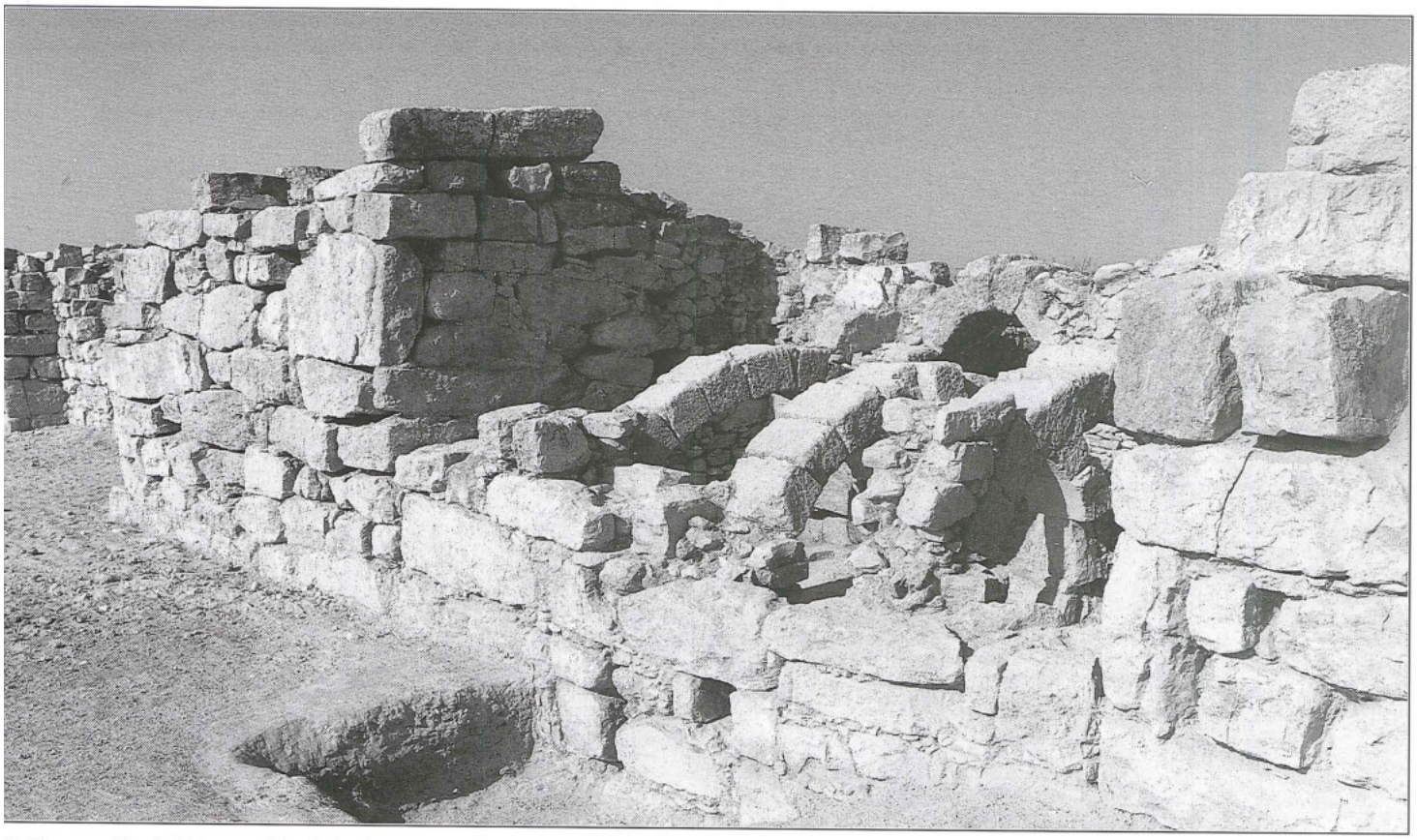
Lors de travaux ultérieurs, la porte nord a été reconstruite; son nouveau seuil, d'une largeur réduite à 1,85 m, montre les crapaudines d'une porte à deux battants.

Une salle de plan irrégulier, en partie creusée dans la

[6] La porte a été murée à l'époque ommeyade et un *Ḥammām* installé entre ses deux tours.




4. Umm ar-Raṣāṣ/Kastron Mayfa'a. Plans des états successifs des portes. Porte est: 1) IIIe siècle; 2) fermeture par un *ḥammām*, VIIIe siècle. Porte nord: 1) bastion, IIIe siècle; 2) porte, Ve-VIe siècle; 3) réaménagement de la porte, vers le VIIIe siècle. Porte sud: 1) bastion, IIIe siècle; 2) porte, Ve-VIe siècle; 3) fermeture de la porte et aménagement de salles à l'étage, vers le VIIIe siècle (relevé C. Eyer, mise au net W. Trillen).



5. Umm ar-Raṣāṣ/Kastron Mayfa'a. La porte orientale du camp romain; les trois arcs appartiennent à un *ḥammām* installé dans l'embrasure à l'époque omeyyade (F. Bujard-Ebener).

:our occidentale, a été aménagée après cette reconstruction à côté de la nouvelle entrée. Elle était reliée par deux portes aux bâtiments qui l'environnent et renfermait un escalier donnant accès au chemin de ronde de l'enceinte. Cet escalier et les banquettes maçonnées avec accoudoirs adossées aux parois indiquent manifestement une fonction de salle de garde.

Une autre salle, également de forme irrégulière et ménagée aux dépens de l'épaisseur de la tour, fait face à la salle de garde, de l'autre côté de la rue; pour des raisons statiques, elle n'a pas été entièrement fouillée.

*Les bastions*

Plusieurs des bastions les mieux conservés montrent les bases d'un mur venu fermer leur sommet du côté intérieur de l'enceinte. Ces murs, aux maçonneries disparates, ont manifestement été ajoutés lors de la transformation en tours de certains des bastions primitivement ouverts à la gorge.

*Les tours d'angle septentrionales*

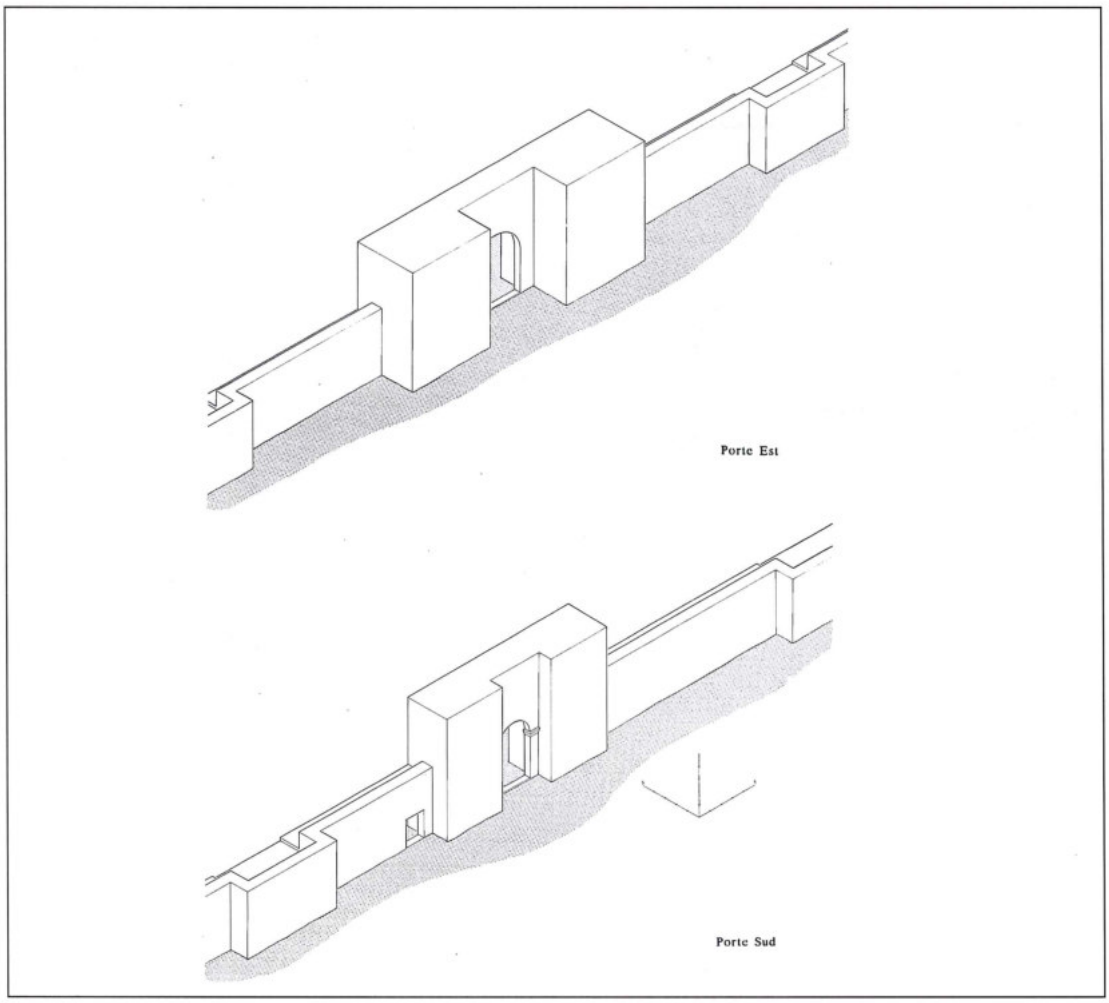
Les deux bastions des angles septentrionaux ont eux aussi été transformés par la suite en de véritables tours (FIG. 3). Celles-ci comprenaient toutes deux une petite pièce au rez-de-chaussée et une grande salle à l'étage; les pièces du bas sont adossées à l'enceinte préexistante et leur plafond de dalles de pierre était soutenu par un arc, resté intact dans la tour nord-est. Il ne subsiste en revanche que peu de traces des parois des salles de l'étage.

*La tour d'angle sud-est*

Une tour a aussi été ajoutée dans l'angle sud-est, mais à une époque différente, puisqu'elle est massive au rez-de-chaussée, contrairement aux tours septentrionales, et présente des maçonneries moins régulières (FIGS. 3 et 8). La salle carrée de l'étage était accessible par un escalier extérieur en pierre débouchant sur une porte placée dans l'angle sud-ouest de la pièce. Cette dernière était couverte d'un plafond plat en dalles de calcaire supporté par deux arcades dont il subsiste les bases des piliers. Le sol de la salle est constitué de dalles de calcaire et de schiste bitumineux, de formes irrégulières et placées sans ordre. Le linteau d'une fenêtre en forme de croix a été retrouvée au pied de la tour côté sud, tandis qu'une tombe musulmane a été installée à l'époque moderne dans l'angle sud-est de la tour ruinée.

**Datation de l'enceinte**

La confrontation des données archéologiques avec les documents historiques apporte quelques précisions pour




6. Umm ar-Raṣāṣ/Kastron Mayfa'a. Essai de reconstitution isométrique de la porte est, IIIe siècle, et de la porte sud, Ve-VIe siècle (relevé C. Eyer, mise au net W. Trillen).



7. Umm ar-Raṣāṣ/Kastron Mayfa'a. La porte percée dans l'enceinte nord à la fin du Ve ou au VIe siècle. Au premier plan: salle avec banquettes destinée probablement à la garde (F. Bujard-Ebener).

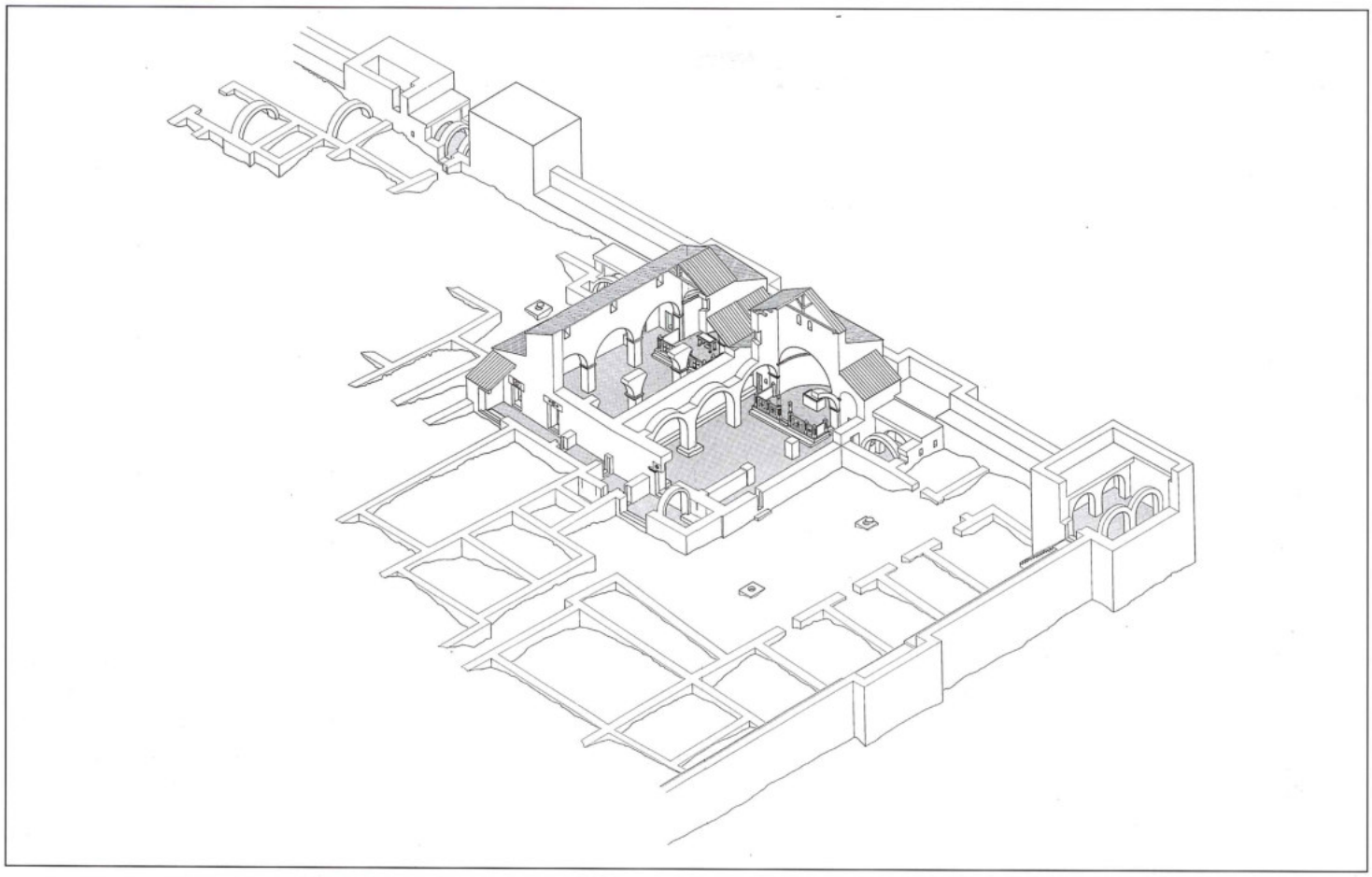
la datation de l'enceinte d'Umm ar-Raṣāṣ; rappelons les données disponibles:

- A la fin du IIIe ou au début du IVe siècle, Eusèbe de Césarée mentionne la présence de soldats romaines à *Kastron Mayfa'a*, à la limite du désert; la nature de cette garison n'est pas précisée, mais le terme de *Kastron* atteste l'existence d'une fortification.
- La *Notitia Dignitatum* rédigée vers 400 indique qu'une unité de cavalerie indigène promue à un statut indépendant est stationnée à Mayfa'a. S. T. Parker postule qu'elle a été détachée de la *Legio IV Martia* établie vers 300 au camp de Bethorus/Lajjūn à 35 km au sud-ouest de Mayfa'a[7].
- Enfin, une inscription fragmentaire latine, des années 306-307 semble-t-il, confirme une présence romaine à cette époque sur la site[8].
- Un sondage effectué de l'enceinte a livré quelques tessons datés en majorité des IIe et IIIe siècles ap. J.C[9]. Ce matériel montre que la fortification a été élevée au plus tôt au IIIe siècle, tandis que l'analyse archéologique

[7] S. T. Parker, 'The Fourth Century Garrison of Arabia: Strategic Implications for the South-Eastern Frontier', *The Eastern Frontier of the Roman Empire*, BAR International Series 553, Oxford, 1989, p. 356.

[8] D. Scarpati, 'Un'iscrizione latina da Umm al-Rasas-Kaston Mefaa', *LA* 41 (1991), p. 363-364.

[9] Voir *infra* la contribution de M. Joguin



8. Umm ar-Raṣāṣ/Kastron Mayfa'a. Reconstitution isométrique de l'angle sud-est de l'enceinte dans son état du VIIIe siècle, après la fermeture de la porte orientale.

des absides des églises géminées assure qu'elle est antérieure à la construction des églises au VIe siècle. L'absence de matériel des IVe et Ve siècles dans les niveaux de construction observés rend probable une érection dans la deuxième moitié du IIIe siècle ou au début du siècle suivant, sans qu'il soit possible d'être plus précis, vu le petit nombre de tessons recueillis.

## Conclusion

La fortification de Kastron Mayfa'a, avec ses 2,2 hectares, est à mi-chemin entre la forteresse d'une légion (environ 4,6 hectares) et les *quadriburgia*, fortins de 0,14 à 0,37 hectare selon T. Parker[10]. Elle est à l'évidence trop vaste pour une simple unité de cavalerie, *a fortiori* si on la compare avec Quṣūr Bshayr, tout proche, dont les écuries montrent qu'il a manifestement été élevé, vers 306, pour accueillir une telle unité[11]. Quelques hypothèses peuvent être envisagées pour expliquer ces dimensions:

Eusèbe de Césarée ne précisant pas la nature de la garnison, peut-être l'unité de cavalerie signalée vers 400 est-elle venue remplacer une troupe plus importante? De telles diminutions d'effectifs sont attestées dans la région dans le courant du IVe siècle[12]. L'enceinte de Kastron Mayfa'a pourrait de même avoir été réutilisée, voire construite, pour protéger le village d'une tribu arabe servant l'armée romaine. Cette hypothèse paraît être renforcée par l'évolution du site durant les siècles ultérieurs qui, outre le percement de portes supplémentaires, voit le développement d'une importante agglomération comprenant quatre églises à l'intérieur des murs et une dizaine à l'extérieur, développement qui n'a rien d'une réoccupation plus ou moins temporaire d'une fortification abandonnée et n'a évidement pu se faire sans l'accord des autorités militaires.

Cette dernière explication, qui rejoint certaines propositions du Père M. Piccirillo[13], pourrait être corroborée par la nature de la garnison, une aile de cavalerie indigène promue, formée de l'une de ces tribus d'aux-

10 S. T. Parker, 'The Fourth Century Garrison of Arabia...', *op. cit.*, p. 358.

11 *Ibidem*, p. 358 et FIG. 26.5.

12 *Ibidem*, p. 358-359; S. T. Parker, 'Retrospective on the Arabian Frontier after a Decade of Research', *The Defence of the Roman and Byzantine East*, BAR International Series 297, Oxford, 1986, p. 644.

13 M. Piccirillo, 'Les problèmes résolus et les questions posées...', *op. cit.*, p. 345-346.

iliaires arabes au service des armées romaine, puis byzantine et parfois ralliées ensuite aux califes ommeyades[14]. Ces unités d'auxiliaires ont été supprimées à l'époque abbasside[15], époque également du déclin, puis de l'abandon de Kastron Mayfa'a[16] sans qu'il soit possible de faire de lien entre les deux événements. Il est à noter que l'utilisation prolongée de la fortification de Kastron Mayfa'a pourrait confirmer cette hypothèse, la plupart des autres fortifications du *limes* ayant été abandonnées au début du VIe siècle[17].

Du point de vue architectural, le camp de Kastron Mayfa'a, avec ses bastions rectangulaires, ne trouve que peu de parallèles dans la région, même si les tours massives au rez sont répandues dans les fortifications de l'Orient romain, byzantin et ommeyade, à Jarash, Palmyre et dans les châteaux du désert par exemple[18]. Les camps de Lajjūn[19] et Udhruḥ[20] sont en effet renforcés de tours semi-circulaires, alors que les forts de Ḥallābāt[21], Azraq[22], Da'jāniya[23], Umm al-Jimāl[24], Khirbat az-Zona[25] et Khirbat as-Samra[26], par exemple, sont dotées de véritables tours quadrangulaires. Quant aux tours d'angle de Quṣūr Bshayr[27], elles sont un peu plus ressemblantes, puisqu'elles ne forment pas un carré complet, bien que leurs escaliers occupent les angles intérieurs de l'enceinte.

C'est au camp de Gadda/Ḥadīd, construit au nord-est d'Ammān entre 253 et 259 pour abriter des troupes transférées de Palestine en Arabie, qu'il faut chercher des dispositions comparables à celles de Kastron Mayfa'a[28]. Ce camp a une enceinte à peine plus petite que celle de Kastron Mayfa'a (158 m par 107 m, contre 158 m par 139 m), elle aussi renforcée par des bastions massifs, ceux des angles ne saillant pas non plus à l'intérieur. D'autres fortifications de Jordanie, dont Qasr ath-Thurayya[29] et le fortin de Zohar[30], daté de la fin du IVe siècle, présentent également des tours d'angles similaires à celles de Kastron Mayfa'a.

Des bastions massifs du même type que ceux de Kastron Mayfa'a seront adoptés quelques siècles plus tard par les constructeurs de l'enceinte ommeyade de la citadelle d'Amman[31]; celle-ci présente en effet des bastions rectangulaires et une poterne encadrée de deux renforcements quadrangulaires.

Les transformations subies par l'enceinte de Kastron Mayfa'a sont encore difficiles à dater précisément; néanmoins le relevé général des ruines actuellement en cours fait apparaître que les églises font parties des premiers bâtiments construits dans l'enceinte après la création du *cardo*. La datation de deux d'entre elles, les églises géminées, au VIe siècle, époque également de la construction des églises construites devant la porte nord, permet de placer le percement des deux portes supplémentaires au VIe siècle ou éventuellement dans les décennies qui l'ont précédé. Quant aux trois tours d'angle, elles sont datables de la même période, d'autres bâtiments byzantins étant venus s'y adosser.

## CÉRAMIQUE DÉCOUVERTE DANS LES NIVEAUX DE CONSTRUCTION DE L'ENCEINTE

*(Michelle Joguin)*

Un sondage effectué dans les niveaux de construction de l'enceinte, sous le dallage de l'annexe sud de l'église géminée méridionale, a fourni un petit lot de huit tessons de céramique et un tesson de verre. Cette couche peu épaisse a malheureusement été perturbée par la construction de l'église géminée au VIe siècle; de ce fait, la comparaison typologique des formes présentes dans cet ensemble nous amène à différencier deux périodes. La première, que nous pouvons placer aux IIe et IIIe siècles, est représentée par cinq tessons typiques de l'époque romaine, à savoir FIG. 9, nos 4, 5 et 6, particuliers au IIe siècle et FIG. 9, nos 2 et 8, à situer plutôt vers le IIIe siècle. A la seconde période appartiennent deux fragments, FIG. 9, nos 1 et 3, qui, autant par leur forme que par l'aspect de leur pâte, sont représentatifs de l'époque byzantine, plus précisément du VIe siècle.

1. (URa-EII/1-1). Fragment de cruche. Lèvre éversée, col droit. Pâte orange clair, fine (Dornemann 1990: 156, FIG. 2.18; Rasson et Seigne 1989: 143, FIG. 12.2).

14 M. Piccirillo, *Madaba, le chiese e i mosaici, op. cit.*, p. 305; 'Les problèmes résolus et les questions posées...', *op. cit.*, p. 345.

15 M. Piccirillo, 'Les problèmes résolus et les questions posées...', *op. cit.*, p. 345.

16 La céramique, en cours d'étude, retrouvée dans les dernières couches d'occupation de l'agglomération est datable du IXe siècle.

17 S. T. Parker, 'The Limes and Settlement Patterns in Central Jordan in the Roman and Byzantine Periods, *Studies in the History and Archeology of Jordan,* IV, Amman, 1992, p. 324.

18 M. Todd, 'The Aurelianic Wall of Rome and its Analogues', *Roman Urban Defences in the West,* The Council for British Archeology, Research Report 51, p. 58-67.

19 S. T. Parker, *Romans and Saracens, op. cit., p.* 55-58.

20 A. C. Killick, 'Udruh-1980, 1981, 1982 Seasons: A Preliminary Report', *ADAJ* 27 (1983), p. 231-243.

21 *Ibidem*, p. 30-32.

22 *Ibidem*, p. 19-20.

23 *Ibidem*, p. 93; P. W. Freeman, 'Recent Work on a Roman Fort in South Jordan', *Akten des 14. Internationalen Limeskongresses 1986 in Carnuntum,* Teil 1, Wien, 1990, p. 179-191.

24 S. T. Parker, *Romans and Saracens*, op. cit., p. 26-29.

25 *Ibidem*, p. 45.

26 J.-B. Humbert et A. Desreumaux, 'Huit campagnes de fouilles au Khirbet es-Samra', *RB* 97.2 (1990), p. 257-259; 'Khirbet es-Samra', *Contribution française à l'archéologie jordanienne,* I.F.A.P.O., Amman, 1989, p. 115.

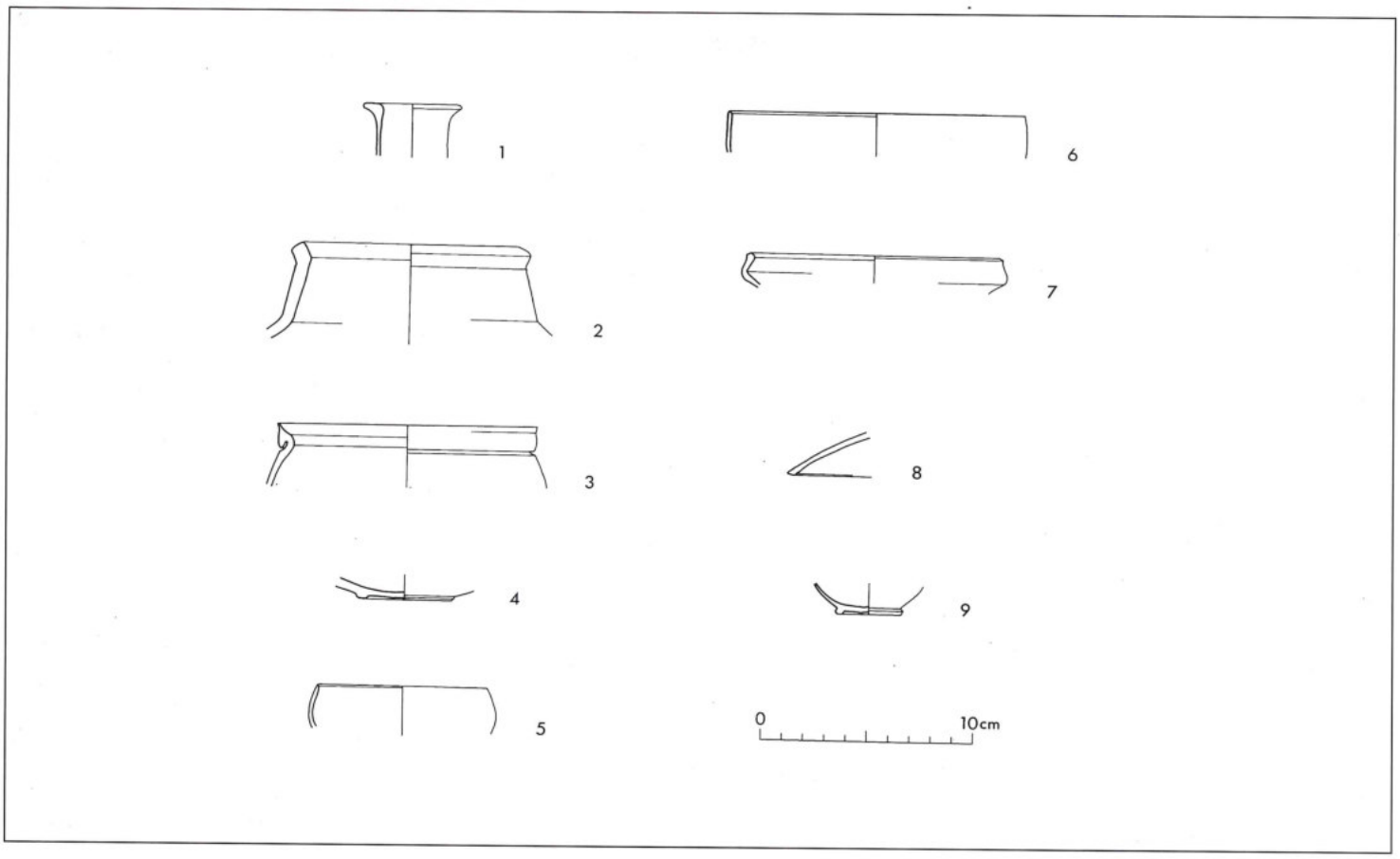
27 S. T. Parker, 'The Fourth Century Garrison of Arabia...', *op. cit.*, FIG. 26.5.

28 S. T. Parker, *Romans and Saracens, op. cit.*, p. 32-34; Th. Bauzou, 'Deux milliaires inédits de Vaballath en Jordanie du Nord', *The Defence of the Roman and Byzantine East, op. cit., p.* 5.

29 J. Lander, *Roman Stone Fortifications, Variation and Change from the First Century AD to the Fourth,* BAR International Series 206, Oxford, 1984, p. 201-202, FIG 198.

30 R. P. Harper, 'Upper Zohar: A Preliminary Excavation Report', *The Defence of the Roman and the Byzantine East, op. cit., p.* 329-336.

31 J. Wood, 'The Fortifications', dans A. Northedge, *Studies on Roman and Islamic Amman,* vol. I, History, Site and Architecture, p. 105-127.




9. Umm ar-Raṣāṣ/Kastron Mayfa'a. Céramique et verre retrouvés dans un sondage au pied de l'enceinte (dessin M. Joguin, mise au net W. Trillen).

2. (URa-EII/1-2). Fragment de pot à cuire. Lèvre éversée col conique et départ de la panse. Pâte rouge à large coeur gris-beige, engobe externe rougeâtre.
3. (URa-EII/1-3). Fragment de marmite. Lèvre "en poulie" et départ de la panse. Pâte orange clair (Rasson et Seigne 1989: 141, FIG. 11.1).
4. (URa-EII/1-4). Fragment de bol ou écuelle. Fond à pied annulaire, départ d'une panse évasée. Pâte brune à large coeur gris foncé, fine.
5. (URa-EII/1-5). Fragment de bol. Lèvre rentrante, légèrement biseautée vers l'intérieur, panse globulaire. Pâte orange, grise en surface sur le côté externe, fine (Minnis et Bader 1988: 294, FIG. 12.74; Falkner, non-publié: FIG. 9.128).
6. (URa-EII/1-6). Fragment de bol. Lèvre droite, légèrement biseautée vers l'intérieur, panse cylindrique. Pâte orange, fine.
7. (URa-EII/1-7). Fragment d'écuelle. Lèvre à inflexion interne, départ d'une panse évasée. Pâte orange, rougeâtre sur la face externe (Lindner 1992: 267, FIG. 8).
8. (URa-EII/1-9). Fragment de couvercle. Lèvre biseautée vers l'intérieur. Pâte rouge foncé, rugueuse, traces d'utilisation au feu sur la face externe (Sauer 1973: FIG. 2.24).
9. (URa-EII/1-10). Fragment de bol ou gobelet. Fond à pied annulaire et départ de la panse. Verre bleuté, fin.

Nous tenons à remercier Madame Anne-Michèle Rasson-Seigne, de l'IFAPO à Amman, de sa précieuse aide dans l'élaboration de ce catalogue.

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# The Typology of Roman and Byzantine Forts and Fortresses in Jordan

## I. Introduction

Jordan possesses some of the best preserved Roman and Byzantine fortifications anywhere in the Empire. But, until the late 1970s, none had been excavated. Therefore, understanding the typology of these forts was based on a handful which could be dated through *in situ* building inscriptions and comparisons with forts elsewhere. In addition, detailed plans of many forts were often problematic due to reliance solely on surface observations.

Beginning in 1977 with the excavation of the so-called "Barracks" at Umm al-Jimāl, a number of Roman and Byzantine forts has now been excavated. These excavations have dated these forts and elucidated their internal plans. Further, nearly all the unexcavated forts have now been surveyed, providing more dating evidence.

Although this new evidence offers the prospect of developing a typology of Roman and Byzantine forts, some problems remain. Many excavations have been limited to small soundings. In some cases detailed reports of excavation results have yet to be published. Perhaps the biggest obstacle is that the vast majority of excavated forts have proven to be of the Tetrarchy or later (fourth-fifth centuries). Thus knowledge of second and third century forts remains limited.

Nevertheless, evidence accumulated during the past fifteen years from excavation and survey, combined with the previously available epigraphic and architectural evidence and comparative material from other Roman frontiers, now permits the beginnings of a typology of these military structures. In addition, a recent major synthesis of Roman stone fortifications now allows us to place Jordan's Roman forts into a broader imperial context (Lander 1984). And a valuable typology of Roman forts has now appeared in an aerial survey of Rome's desert frontier in the East (Kennedy and Riley 1990). Although it will be clear below that my own typology differs in some significant ways from theirs, I must acknowledge my debt to their efforts in this regard.

In order to present such a typology of fortifications, we will first review the methodology employed. It will be seen that a number of sites can now be confidently dated, while others remain more problematic. Secondly, we will review the relevant evidence and the typology itself will be presented. Finally, some concluding remarks will be offered. This paper will exclude any discussion of city fortifications and watchtowers, both of which deserve detailed treatment but which cannot be offered here. Even the corpus of forts in Jordan cannot be exhaustive in a paper of this length.

## II. Methodology

In presenting and analyzing the evidence for Roman and Byzantine fortifications in Jordan, one is immediately faced by three major obstacles. First, the fact remains that most such structures are unexcavated. Therefore, the extant plan is usually only partially complete. At several sites, for example, the curtain wall of the fort survives and may be traced with certainty, but the internal plan may be partially or completely unknown. Second, the extant plan may well reflect several periods of later rebuilding that may be difficult to disentangle. Third, associated building inscriptions from these forts are rare. Therefore, dating the known sites that have neither been excavated nor yielded a building inscription remains problematic. In these cases one is reduced to offering a date based on the visible surface plan and surface pottery, with all the inherent dangers from these categories of evidence. However, surface-sherding has predicted with fair accuracy the occupational history of forts securely dated by inscriptions or later excavated (Parker 1986: 10-12).

Therefore, the typology offered below is based on the following criteria. In a longer version of this paper, some thirty-two sites identified as Roman forts in Jordan were discussed in terms of their overall plan, areal size, location and type of towers, gates, and internal arrangements. This more summary analysis will focus on the best dated examples. Each fort is assigned to one of six categories, based on architectural and chronological evidence.

## III. The Typology

Ancient epigraphic and literary evidence reveals the contemporary Roman terminology for the military structures under review here. Only two words seem to have been commonly used for "fort" in Roman Jordan. Inscriptions typically refer to a fort as a *castra* (Greek *kastra*, *kastron*) or a *castellum* (Greek *kastellos*).[1] To the Romans, these two words for fort appear to be interchangeable.

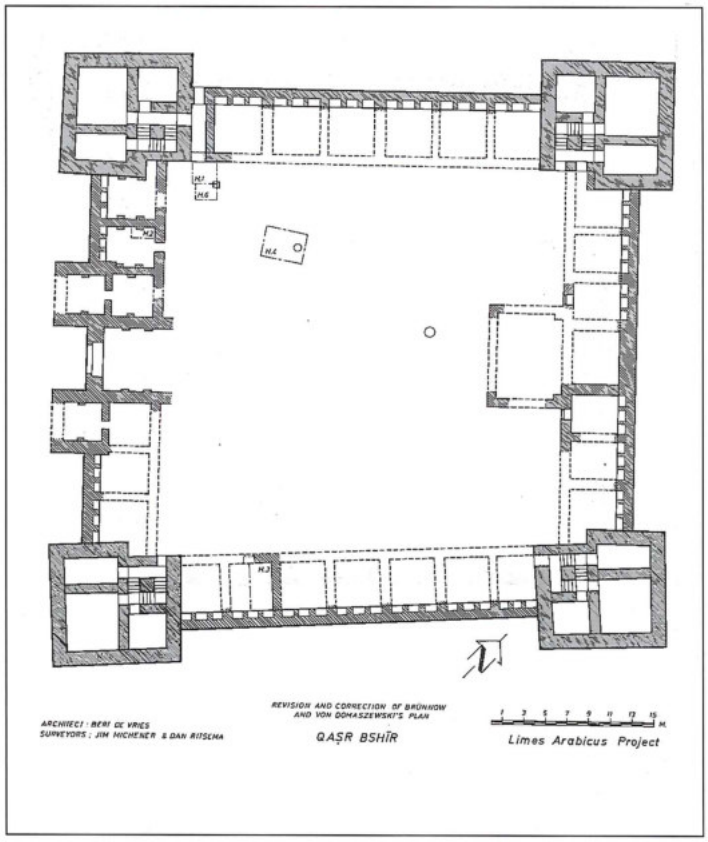
Architecturally, the Roman and Byzantine forts of Jordan may be grouped into six broad categories. These are:

1) *Quadriburgia* (small forts with four projecting corner towers).
2) Forts with external interval and corner towers (further sub-divided into small, medium, and large forts by size).
3) Small forts without external towers.
4) Large forts without external towers.
5) Large forts with rounded corners.
6) Fortresses with U-shaped and semi-circular external towers.

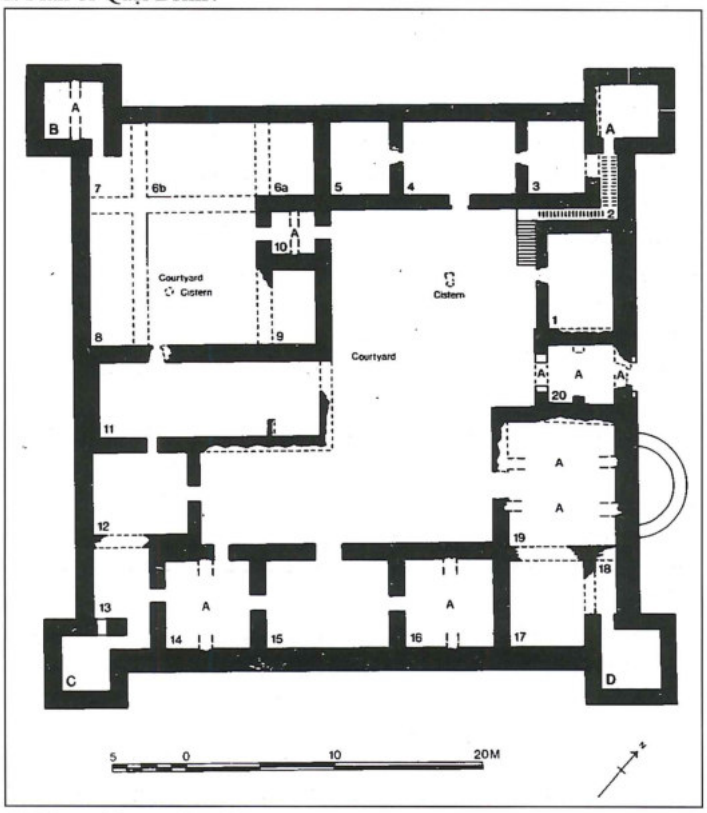
**1. Quadriburgia.** All these forts share similar features. They are quite small, averaging only c. 40 m² (0.16 ha). They are usually square or nearly square in plan, defended by four projecting rectangular corner towers with few or no interval towers, entered by a single main gate, and contain rooms built against the curtain wall around a central courtyard. This type may be called a *quadriburgium* or "four-towered fort" and are dated to the third and fourth centuries.

The best example is undoubtedly Qaṣr Bshīr (FIG. 1), securely dated to 293-305 by its building inscription. Recent excavations yielded fourth century coins from stratified contexts (Parker 1986: 53-55; Clark 1987; Kennedy and Riley 1990: 176-78). The fort, identified in its inscription as *castra praetorio Mobeni*, is a roughly square trapezoid 0.31 ha in size. Four large towers (12 m²) project from the corners; the towers are three stories in height and contain slit windows. Two smaller projecting towers flank the main gate. The internal plan consists of ranges of rooms in two stories surrounding an internal courtyard. Nearly all the ground floors of these rooms contain three recesses in the back wall interpreted as mangers. Thus these 23 rooms probably were stables. The second story rooms all lack these recesses and thus probably served as barracks for the presumed cavalry garrison. The single anomaly is the room directly opposite the main gate, apparently the *principia* or headquarters.

Other *quadriburgia* include Qaṣr al-Ḥallābāt (FIG. 2), Qaṣr ath-Thuraiya (FIG. 3), al-Quwayra, and Khirbat al-Khāldī (Parker 1986: 30-32, 50-51, 105-09).

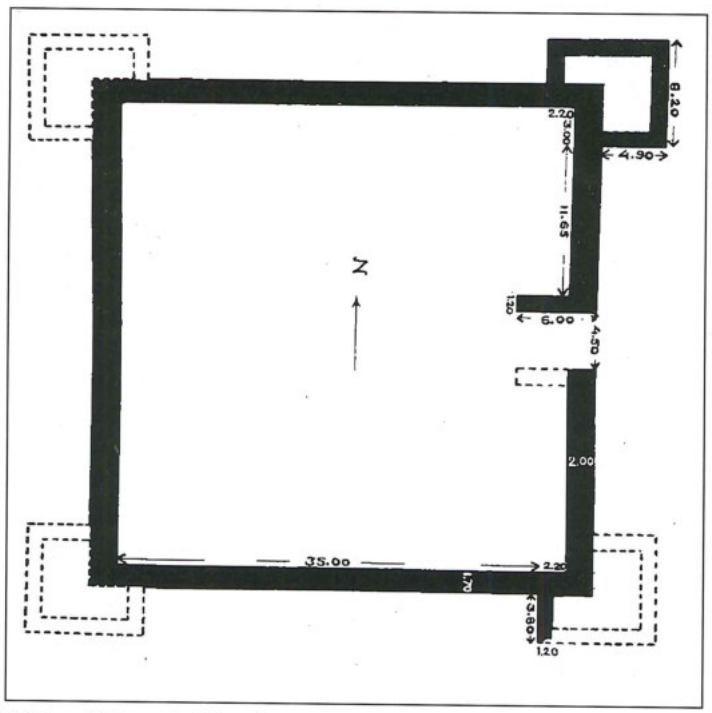



1. Plan of Qaṣr Bshīr.




2. Plan of Qaṣr al-Ḥallābāt.

[1] For Greek and Latin texts of most of these inscriptions, cf. Parker 1986: 17-18, 22, 24, 29, 30-32, 34; Clark 1987: 468.



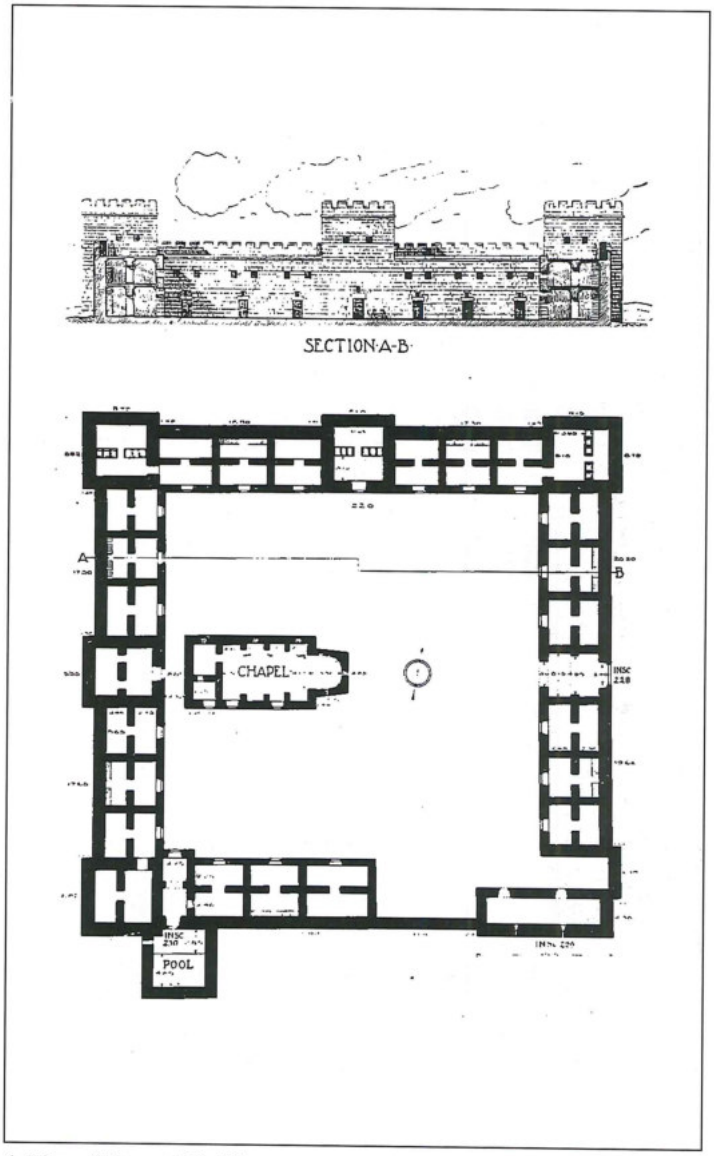

3. Plan of Qaṣr ath-Thuraiya.

**2. Forts with External Interval and Corner Towers.** These forts are substantially bigger than the *quadriburgia* discussed above. While the *quadriburgia* average only 0.16 ha in size, these eleven forts average 0.9 ha, more than five times the size of the average *quadriburgium*. These forts with external interval and corner towers may be divided into three subcategories: small (0.30 ha), medium (0.60 ha), and large (two forts are c. 1.0 ha, another is 3.0 ha). But it should be noted that even the small subtype is nearly twice as large as the average *quadriburgium*. Most of these forts are also square or nearly square in plan. But, in addition to projecting rectangular corner towers, these forts also have projecting rectangular interval towers, generally of similar size to the corner towers. The existence of interval towers may be due to the greater length of the wall circuits to be defended in these larger forts. Internal arrangements vary according to size. Most have rooms built against the curtain. The rooms of the smaller forts surround a central courtyard; larger forts have rooms both built against the curtain and detached structures within the interior.

Among the six examples of the small subtype, the most securely dated is Dayr al-Kahf (FIG. 4). An inscription, once *in situ*, refers to a *castellum* erected in 306. The fort is c. 61 m² (0.37 ha). Nearly square towers of three stories project slightly from three of the four corners (the other corner was rebuilt between 367 and 375). Interval towers of similar size and shape project from the middle of the north and west walls. A single gate, without flanking towers, pierces the east wall. Internally, two room suites were built in two stories against the curtain, surrounding a courtyard (Parker 1986: 21-24; Kennedy and Riley 1990: 178-79).

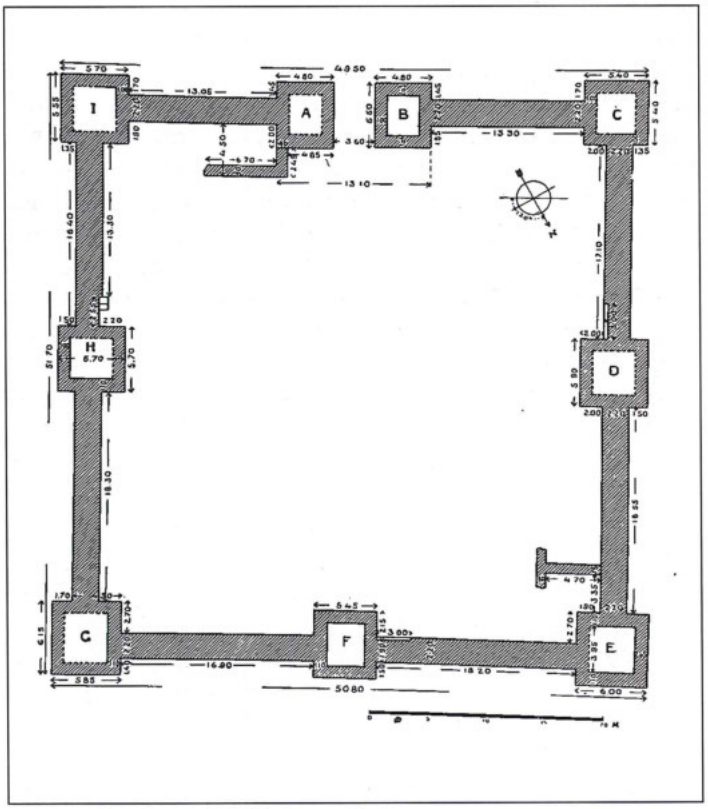
Another fort of similar size is the *castellum* at Khirbat as-Samra. This fort has been dated by excavation generally to the Tetrarchy (Humbert and Desreumaux 1990: 257-58).

Three other forts may be placed within this category of small forts with external corner and interval towers. These include Maḥaṭṭat al-Ḥajj (FIG. 5, upper fort 51.7x 49.5 m, 0.26 ha), Khirbat az-Zūna (FIG. 6, 49 x 44 m, 0.22 ha), and Khirbat al-Qīrāna (c. 50 m², c. 0.25 ha). None of these forts has been excavated nor can they be dated epigraphically. But surface pottery collected at all three provides some evidence as to their occupational history. On typological grounds a late Roman construction of these forts seems plausible (Parker 1986: 57-58, 45-46, 102-104).

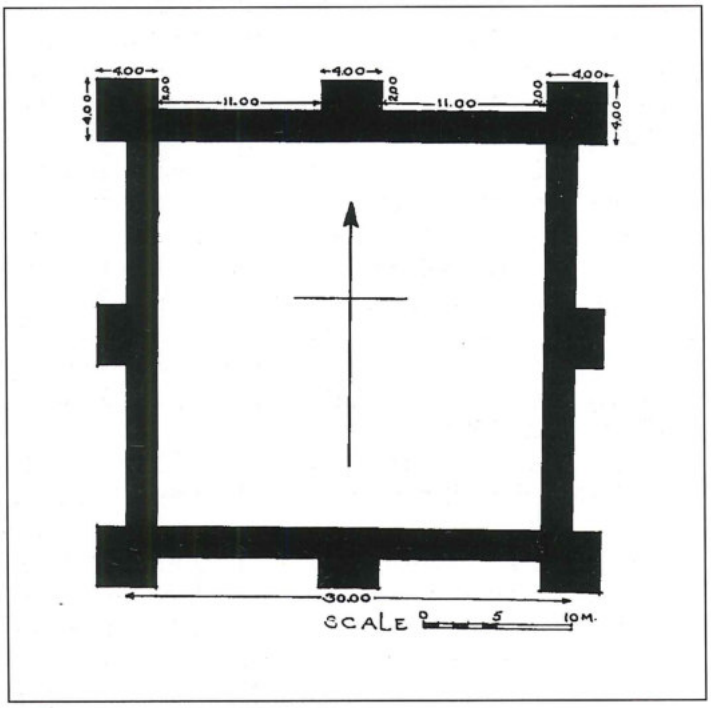



4. Plan of Dayr al-Kahf.

We now move to the second subtype of forts with external corner and interval towers, those of medium size (c. 0.6 ha). There are two examples in this category: one is securely dated by excavation, the other by epigraphic evidence.



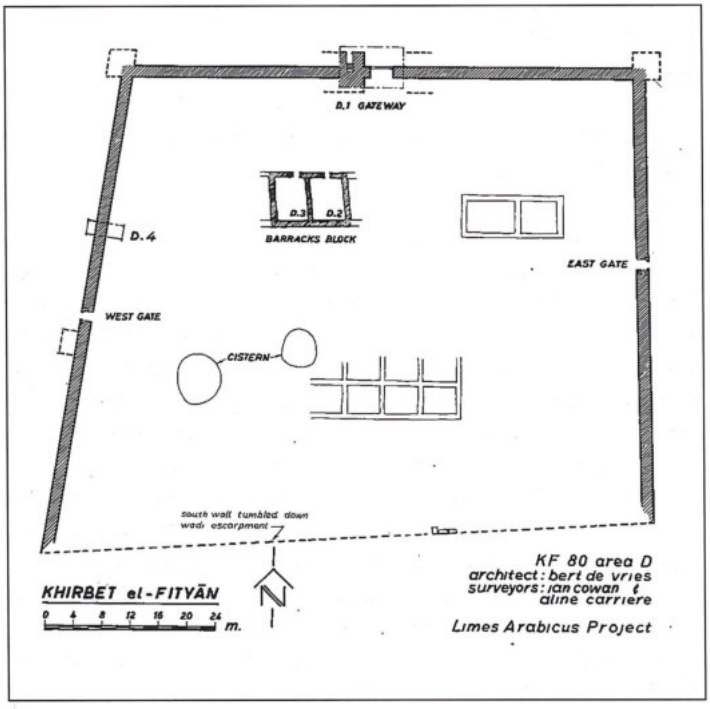

5. Plan of Maḥaṭṭāt al-Ḥajj (upper fort).



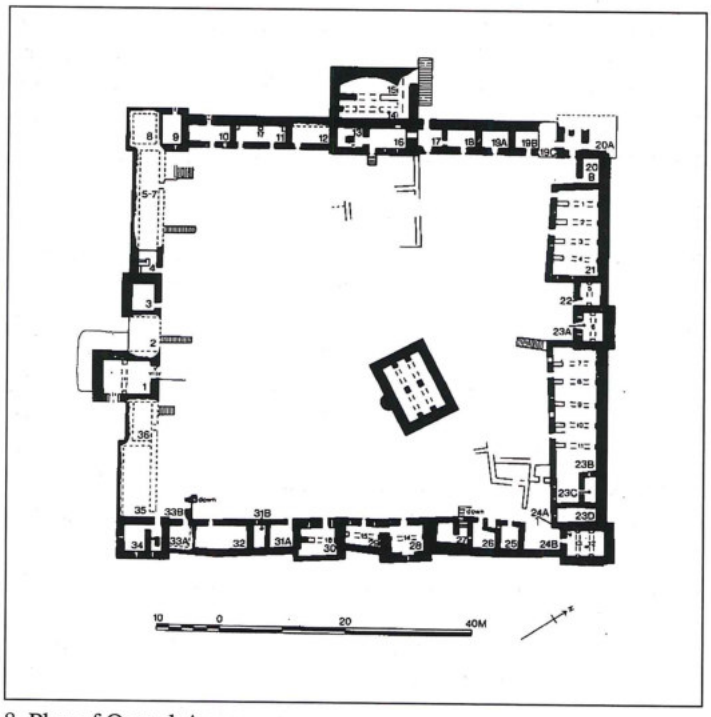

6. Plan of Khirbat az-Zūna.

Khirbat al-Fityān (FIG. 7), has long been interpreted as an ancillary post for the legionary fortress at al-Lajjūn, 1.5 km to the southeast. The *castellum* (c. 78.8 x 76.8 m, 0.6 ha) is roughly square, although the southwest corner does not form a right angle. Rectangular towers were once extant at all four corners, in the middle of the west and south walls, and flanking the main gate in the north wall. Smaller portals have been discovered in the east and west walls. The internal plan is problematic, but barrack-type rooms were excavated near the center of the fort and other rooms were built against the curtain. Excavation revealed that the west curtain was founded atop an earlier Iron Age wall, suggesting the presence of an earlier Moabite fort. But in the center of the fort the Romans scraped off all earlier occupation down to bedrock, on which they founded their barracks. Stratified pottery from the foundations suggested construction contemporary with the legionary fortress, c. AD 300 (Parker and Richard 1987: 429-446).

The second example of a medium sized fort with external corner and interval towers is Qaṣr al-Azraq (FIG. 8). This structure has been interpreted as a nearly square Roman *castellum* (c. 79 x 72 m, c. 0.57 ha) rebuilt in the medieval period. Rectangular corner and interval towers of three stories project slightly from the walls. Internal arrangements, though modified, may still basically reflect the original Roman plan. Rooms in two stories were built against the curtain around a central courtyard. Architecturally the plan is quite similar to the somewhat smaller fort of Dayr al-Kahf, discussed above. Al-Azraq is unexcavated, but two inscriptions of the early fourth




7. Plan of Khirbat al-Fityān.




8. Plan of Qaṣr al-Azraq.

century and a few surface potsherds of similar date, as well as the close parallels to the securely dated Tetrarchic fort of Dayr al-Kahf, suggest al-Azraq was also constructed in this period (Kennedy 1982: 69-96; Parker 1986: 19-20; Kennedy and Riley 1990: 179-181).

Finally, there are three examples of the third subtype in this category, large forts with external corner and interval towers. All are securely dated by excavation. Two are nearly identical in size, similar in plan, and contemporary in date.

The fort at Ḥumayma forms a rectangle measuring 204 x 147 m (3 ha). The large size of this fort, which dwarfs all others in Jordan except the great fortresses of al-Lajjūn and Udhruḥ, must be stressed. There are four gates, one in the middle of each wall. Excavation in 1993 revealed projecting rectangular interval and corner towers and suggest construction in the late second century and occupation until the fourth century (John Oleson, pers. communication). Thus Ḥumayma is the earliest Roman fort thus far attested in Jordan. Its size suggests it was designed for a typical 500 man auxiliary unit of the Principate. The internal plan remains unknown, apart from a large reservoir near the northwest corner.

The *castellum* of Da'jāniya (FIG. 9) is nearly square (c. 100 x 100 m, 1 ha). The main gate is located in the eastern wall; smaller posterns pierce the west and south walls. Rectangular towers project from the corners. Two rectangular interval towers sit astride (i.e. project both inwards and outwards) all four walls. In addition, the east wall has two more towers that flank the main gate. The internal plan is well preserved. The *principia* faces the *via principalis*. Barrack blocks fill most of the remaining interior, with additional rooms built against the curtain. Excavation suggests that the fort was founded in the late third/early fourth century (Parker 1991: 134-141).

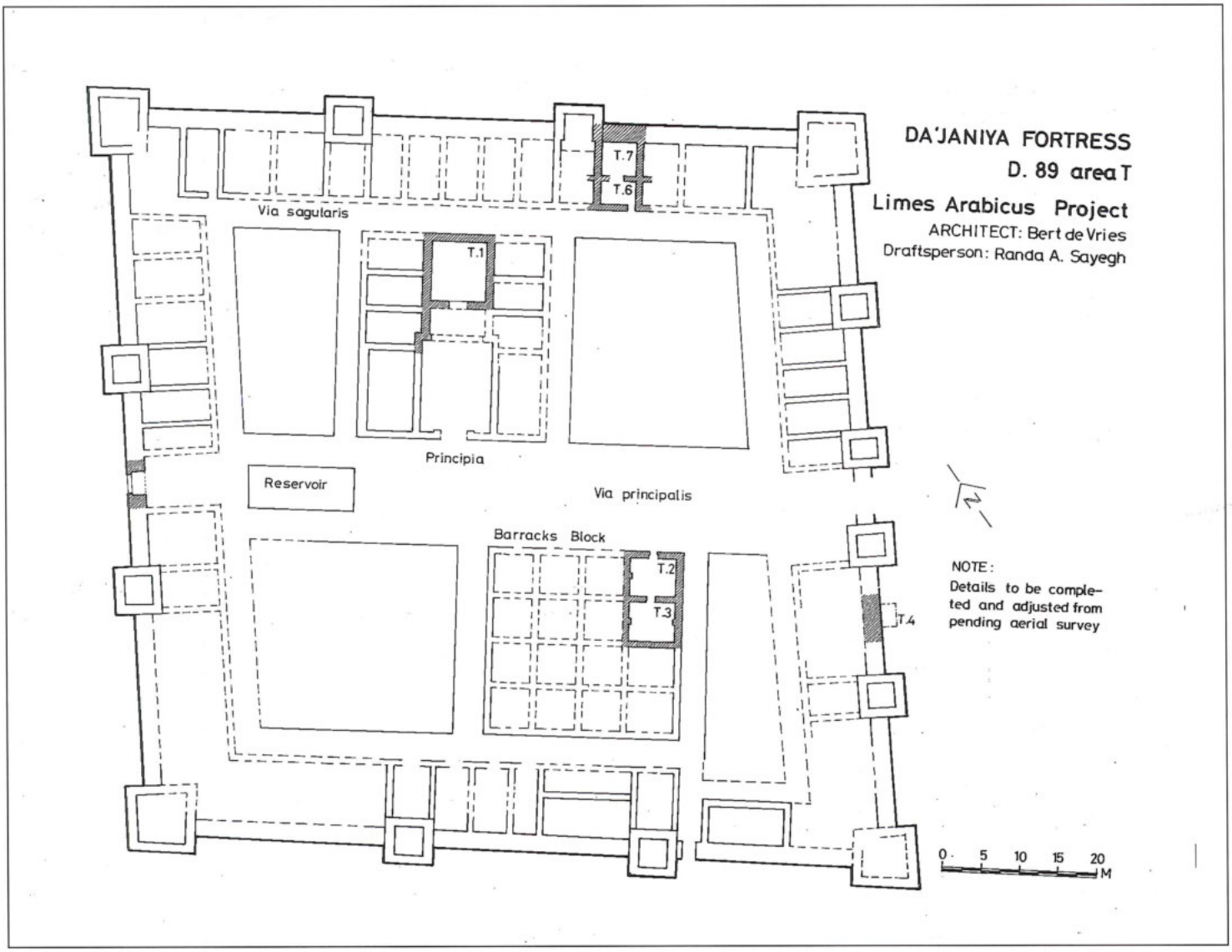
A similar *castellum* is located at Umm al-Jimāl (FIG. 10), built along the eastern city wall. It also measures c. 100 m on a side (c. 1 ha), but the southwest corner does not form a right angle, apparently to avoid encroaching on a pre-existing reservoir. Gates were built in the middle of the east, south and west walls; the latter two gates are flanked by rectangular interval towers that project both inward and outward. Rectangular towers also project from all four corners. Internal arrangements include an apparent *principia* and ranges of barracks. Other rooms were built against the curtain. Excavation suggested construction in the early fourth century (Parker 1986: 26-27).

It is interesting to note that four of these six medium and large *castella* in this class of forts with external corner and interval towers have internal rooms built both against the curtain and standing as independent structures. One exception, Qaṣr al-Azraq, has rooms only against the curtain around a central courtyard. But al-Azraq has not been excavated and was heavily rebuilt in the medieval period. Also, the courtyard is filled with a deep layer of animal dung that may cover the foundations of earlier internal structures. The interior of the other fort, Ḥumayma, is unexcavated.

**3. Small Forts Without External Towers.** The third major group of forts includes six examples. The two important criteria for inclusion in this group are their small size (0.17-0.31 ha, average 0.22 ha) and lack of projecting towers. Only one has been excavated, but two others can be dated by inscriptions. The remaining three are dated only by surface pottery.

Qaṣr al-'Uwaynid (FIG. 11) is an irregular quadrangle (c. 75 x 49 x 43 x 30 m, c. 0.25 ha). A free-standing tower (c. 8.5 m²) stands within the projecting southwest bastion. Rooms were built against the curtain surrounding a courtyard. The fort is dated epigraphically to c. 200-202. Surface pottery has been dated from the late first/early second century to the late third/early fourth century (Kennedy 1982: 124-126; Parker 1986: 17-19; Kennedy and Riley 1990: 159-161).

The second fort in this group is Qaṣr al-Bā'iq (FIG. 12), which was well preserved when surveyed early in this century. The fort was square (c. 41 x 41 m, c. 0.17 ha) and entered by narrow gates in the north, west, and south walls. Towers of three stories stood in each corner, but did not project beyond the curtain wall. The interior was filled by complexes of rooms built in two stories, a church, and two small courtyards. The fort is dated precisely by a once *in situ* building inscription of 411 (Park-




9. Plan of Da'jāniya.

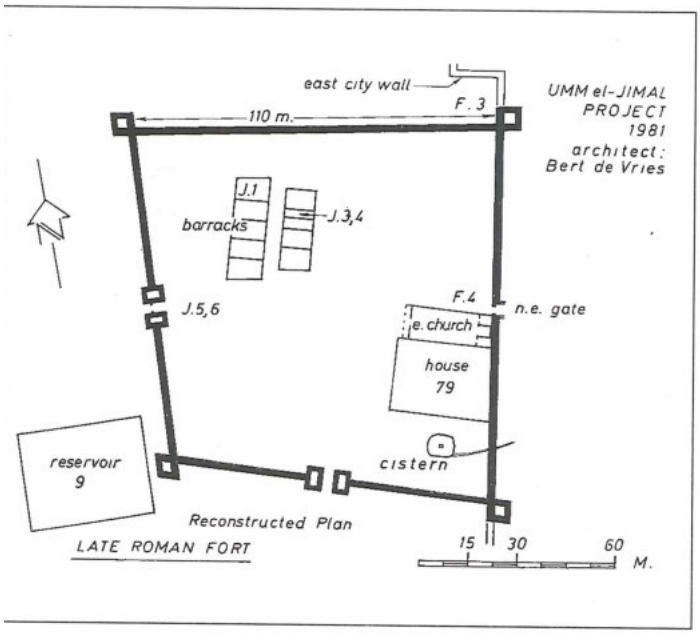
er 1986: 24-25).

Within the walls of Umm al-Jimāl is another fort, the so-called "Barracks" (FIG. 13). This fort is still well preserved and has been excavated. It forms a rectangle measuring 55 x 33.75 m (0.19 ha), with a chapel attached to the eastern wall. The single gate is also located in the east wall. There are two towers: one on the southeast corner rises six stories in height; the other in the middle of western wall rises to three stories. The interior consists of ranges of rooms (most of two stories) built against the curtain around a courtyard. Excavation suggested construction in the late fourth or early fifth century, corresponding to a building inscription found lying outside the structure, which refers to a *kastellos* erected c. 412-413, about the same date as Qaṣr al-Bā'iq just to the west (De Vries 1981; Parker 1986: 28-29).

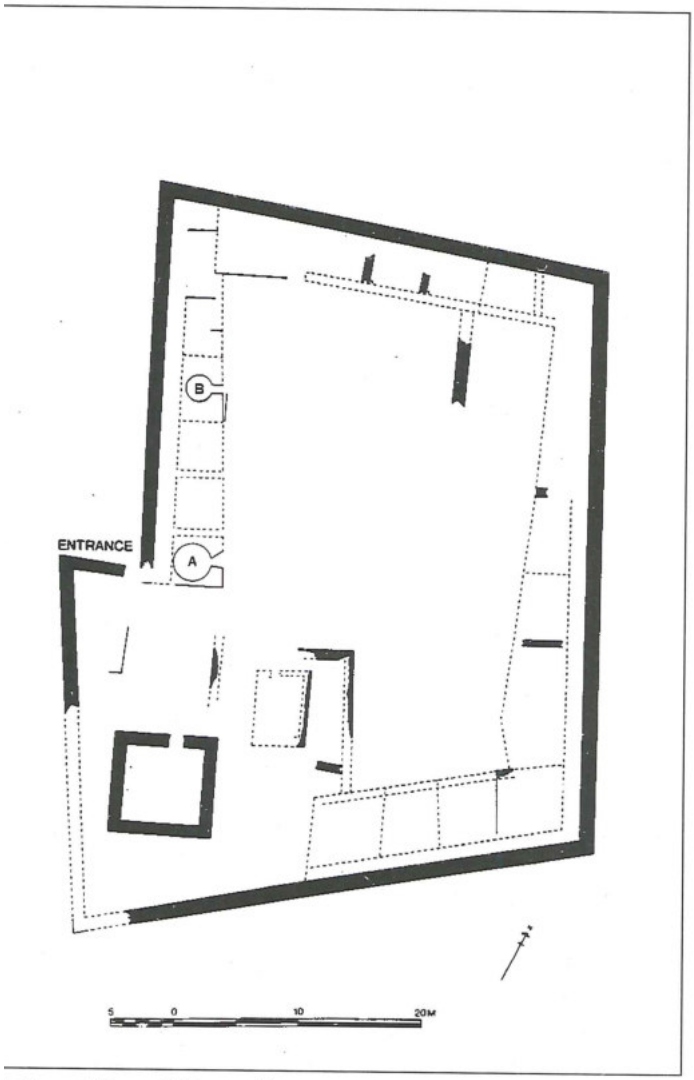
**4. Large Forts Without External Towers.** There are only two examples in this group and neither is securely dated.

The first is Umm al-Quṭṭayn, in northern Jordan near the Syrian border. A rectangular enclosure (156 x 120 m, 1.87 ha) has been identified as a Roman fort. It lacks projecting towers, but few other constructional details can be recovered because of later rebuilding. An inscription from the site refers to a part-mounted unit, the *cohors I [II?] Augusta Thracum Equitata,* which seems an appropriate sized unit of c. 500 men for an early imperial fort of this size (Kennedy and Riley 1990: 141-143). Without excavation or other evidence this remains conjectural.

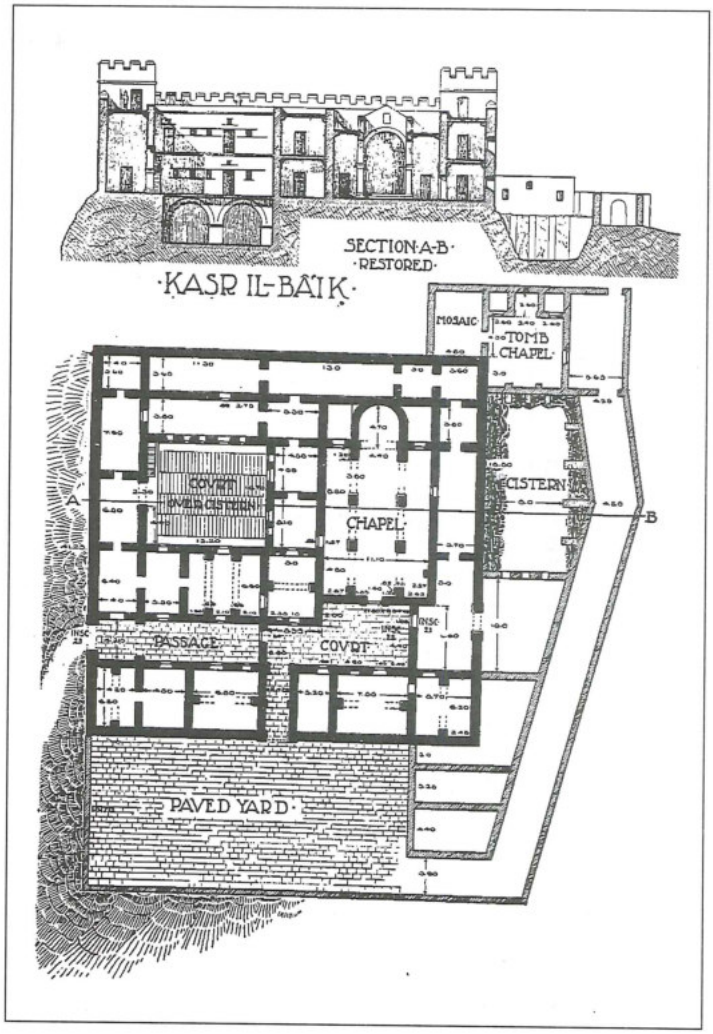
Second is Umm Ubtūlah on Wādī al-Ḥasā. This enormous irregular walled enclosure (c. 520 x 250 m, c. 13 ha) contains remains of apparent barrack blocks. Surface pottery suggests intensive periods of use during the Early Bronze Age and the Roman and Byzantine periods. If the




0. Plan of the *castellum* at Umm al-Jimāl.




. Plan of Qaṣr al-'Uwaynid.

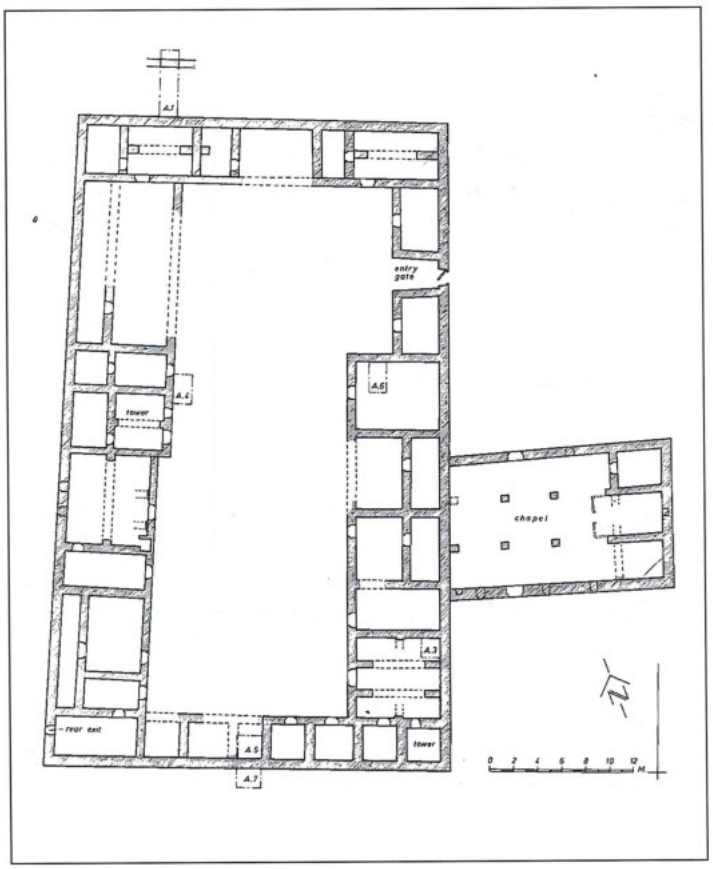



12. Plan of Qaṣr al-Bā'iq.

visible structure is indeed at least partly Roman, it may be a marching camp or siege camp of the Early Roman period (Parker 1986: 89; MacDonald 1988: 292, 294; Kennedy and Riley 1990: 223-224).

**5. Large Forts With Rounded Corners.** One puzzling phenomenon about Roman military architecture in the Levant is the scarcity of traditional Roman forts of "playing-card" design, so abundant in the European provinces. These are rectangular with rounded corners and without projecting towers. Traces of only two such forts have been reported from Jordan. Neither has been excavated and no dating evidence is yet available.

Tall Abara was discovered by aerial photography. The fort is rectangular (c. 150 x 120 m, c. 1.8 ha), with rounded corners, an external *clavicula* on one gate, but no visible towers. Nothing is known of its internal arrangements. It is similar to temporary siege camps, such as those at Masada (Kennedy and Riley 1990: 107), although it is possible that the fort is simply a permanent Roman playing-card fort of early type.




13. Plan of the "Barracks" at Umm al-Jimāl.

The other example of a "playing-card" fort was discovered in an aerial photo of al-Azraq. The remains visible in the photo unfortunately reveal only a portion of the original enclosure, but do suggest a fort of at least c. 100 x 125 m (c. 1.25 ha). No dating evidence is available (Kennedy 1982: 87).

**6. Fortresses With U-Shaped and Semi-Circular External Towers.** Both well-known examples in this category have been extensively excavated.

The fortress of al-Lajjūn (FIG. 14) was almost certainly designed for *legio IV Martia* and was constructed c. 300. It forms a rectangle measuring 242 x 190 m (4.6 ha). Semi-circular angle towers, probably once of three stories, project from all four corners. Twenty U-shaped interval towers project from the walls, each of which is pierced in the middle by a gate. The internal plan is reasonably clear, although much of the fortress reflects a major reconstruction following the 363 earthquake, when the legionary garrison was apparently reduced by 50% to c. 1000 troops. The *principia* is centrally located at the intersection of the two main streets. Barrack blocks occupy most of the eastern half of the fortress as well as portions of the western half. Excavation has also revealed other internal structures, including a bath, church, reservoir, and *horreum*. (Parker 1986: 58-74, 1987: 183-383, 1990: 91-104; 1991: 117-130).

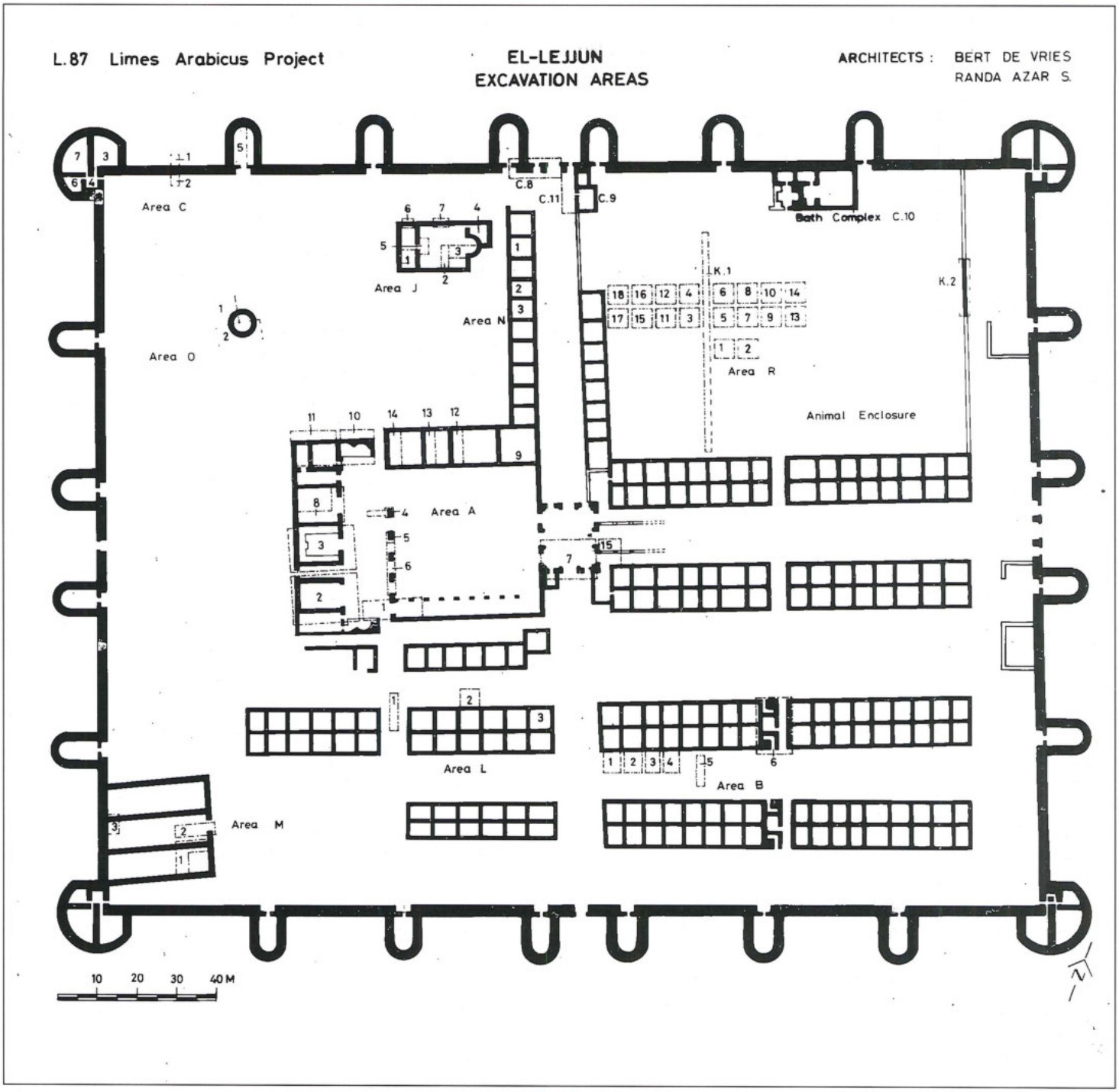
The fortress at Udhruḥ (FIG. 15) is a virtual twin of al-Lajjūn. Although not strictly rectangular, Udhruḥ (248 x 207 x 246 x 177 m, c. 4.7 ha) is virtually identical to al-Lajjūn in size, gates, and the number and plan of its corner and interval towers. Apart from the *principia*, little remains of the original plan, which was obscured by later rebuilding. Despite the obvious similarities to al-Lajjūn, the excavator of Udhruḥ initially suggested a construction date in the early second century (Killick 1983; 1986). While the site unquestionably was occupied this early, others have argued that the extant fortifications must be late Roman, contemporary with al-Lajjūn, or c. 300 (Parker 1986: 94-98; Kennedy and Riley 1990: 131-133). Unfortunately, detailed results of the excavation remain largely unpublished.

## IV. Conclusion

Several important conclusions may be drawn from the evidence presented above. Although some sites are not yet securely dated, several specific types emerge that may be closely dated.

First, the chronological distribution of the extant forts is heavily biased towards examples of the late third and early fourth centuries. We have only one securely dated fort of the second century. Without question, this is the most problematic period for the study of Roman forts in Jordan. Ironically, this is best documented and understood period on most other Roman frontiers. But in Jordan there is little evidence for this period. Most notable for its rarity is the typical Roman "playing-card" fort, so well known on the European frontiers and from the Roman siege camps at Masada and Machaerus. Apart from Ḥumayma, the only other possible second century forts are the "playing-card" forts of Tall Abara and al-Azraq and the large fort without towers at Umm al-Quṭṭayn. There are several possibilities for this dearth of second century evidence. Many units may have been based in towns or cities. Other units may have simply taken over existing Nabataean fortifications when the Nabataean army was incorporated into the regular Roman army and transferred out of the province. Finally, these earlier forts may have been dismantled by later Roman military construction, as apparently was the case at al-Azraq.

Second, two securely dated forts do exist for the Severan era (193-235): Qaṣr al-Ḥallābāt and Qaṣr al-'Uwaynid. Interestingly, these forts were built within a decade of one another and only a few kilometers apart, yet they display very different plans. Ḥallābāt fits nicely into the category of the *quadriburgia*, 'Uwaynid clearly does not. It lacks projecting towers (apart from the single "bastion") and is of irregular plan. Both Severan forts do share rooms built against the curtain and relatively small size. Both clearly were designed for small detachments




14. Plan of al-Lajjūn.

of auxiliary units of the Severan era.

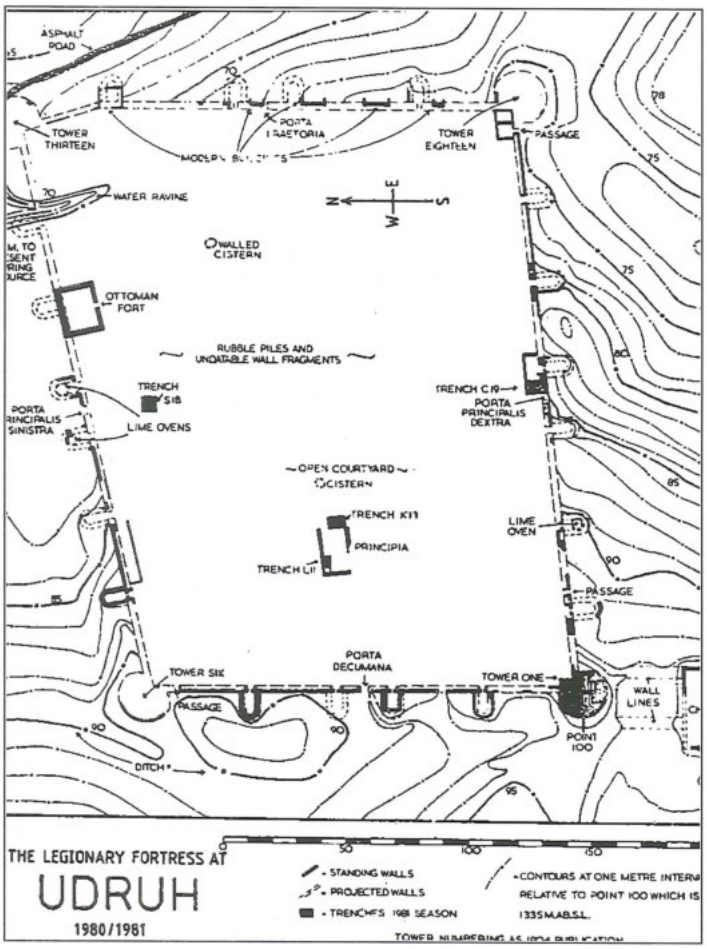
A substantial number of forts in Jordan date to the Tetrarchy, including *quadriburgia* (Qaṣr Bshīr, Qaṣr ath-Thuraiya), forts with projecting interval and angle towers (Dayr al-Kahf, Qaṣr al-Azraq, Khirbat az-Zūna, Khirbat al-Fityān, Da'jāniya, Umm al-Jimāl, Khirbat as-Samra), and both legionary fortresses (al-Lajjūn and, presumably, Udhruḥ). The forts with both interval and angle towers are considerably larger in size than the *quadriburgia*. The largest, at c. 1 ha, could have comfortably housed the reduced auxiliary units of the late Empire. The smaller of these forts contained rooms built only against the curtain, but the larger also display independent structures within the enclosure. All these Tetrarchic forts, regardless of size, share projecting towers. These are invariably square or rectangular for the *castella*, while both fortresses were defended by U-shaped and semi-circular towers.

Few forts can be proven to have been constructed in

the Byzantine period. The two well dated examples, the Barracks at Umm al-Jimāl and *castellum* at Qaṣr al-Bā'iq, reveal that by the early fifth century forts without projecting towers were again being built. However, both these forts were protected by *internal* towers. The Jimāl barracks follows the conventional placement of rooms built against the curtain around a central courtyard. But Bā'iq is exceptional in that its internal structures fill nearly the entire interior.

It is notable that the absence of external towers is generally not a useful indicator of date, nor is the presence of rooms built against the curtain wall.

In conclusion, the assembled evidence now permits a typology of Roman fortifications to be advanced. Certainly there are major chronological gaps over the half millennium of direct Roman rule. Yet most known forts in Jordan can now be assigned with some confidence to the typology presented above. These forts also compare readily with contemporary fortifications on other Roman imperial frontiers. By all appearances, most Roman forts in Jordan date to the late third or fourth century and thus reflect the late Roman army of that period. It seems that several different types of forts were built in the same period and even in the same region. Presumably this variety suggests different conditions or purposes for such divergent yet contemporary military structures. Clearly we still have much to learn.




15. Plan of Udhruḥ.

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# Military Architecture and the Defense "System" of Roman - Byzantine Southern Jordan – A Critical Appraisal of Current Interpretations

## I. Introduction

Studies on the military architecture and organization in Roman-Byzantine Jordan were initiated almost a century ago. The pioneering work of Brüunnow and Domaszewski (1904; 1905; 1909) provided the first detailed description of military structures, especially in the northern and central part of the country. The German scholars were followed by other researchers who, through surveys, excavations and comparative studies, attempted a further refinement of the chronology, typology and interpretation of military structures.

It has become conventional wisdom to apply the term *limes* to every frontier zone of the empire where the presence of Roman soldiers and military installations is attested. The term "*Limes Arabicus*" has been applied to denote a broad fortified zone in northern and central Jordan with a single fortified line along the *Via Nova Traiana* in the Ḥisma (Parker 1979: 184-185, 215, 218; 1987: 41). The "system" of fortifications and garrisons so defined served to hold off the nomads and to monitor their movements (Parker 1986a: 639). Consequently, the so-called "*Limes Arabicus*" is often viewed as a part of the large-scale frontier defense system of the Roman East. Furthermore, the ratio between the strength or readiness of this "system" to perform defensive function versus the potential external threat is being measured by the number of manned military installations in the frontier zone in existence during a particular period of time.

While this line of thought possesses certain logical value – after all, Roman *Arabia* and Byzantine *Palaestina Tertia* were both frontier provinces – its practical application and the terminology used to describe it may lead toward unwarranted conclusions. For example, when the term *limes* is used, it presupposes the existence of a "system" of defensive nature. Recent alternative interpretation of the military presence in the eastern provinces represents a shift from emphasis on its pure defensive role to one underlining the needs of internal security and the functioning of local administration and economy within the provinces. Such studies emphasize the role of the Roman army as an occupation force and the instrument of imperial policy in controlling local economy and the sociopolitical affairs of indigenous populations living under the Roman rule (Graf 1989; Isaac 1990).

While this understanding of the military role is also advocated in this paper, its primary goal is to not to further criticize the defensive system concept, but rather to review certain aspects of its data base. In particular, it will be suggested that this concept may not be entirely compatible with the spatial and temporal distribution of military installations. Further, the evidence available at this time, i.e. literary and epigraphic sources as well as architectural studies and surface ceramics, may be still inadequate to warrant the conclusions offered by the proponents of the so-called "*Limes Arabicus*" .

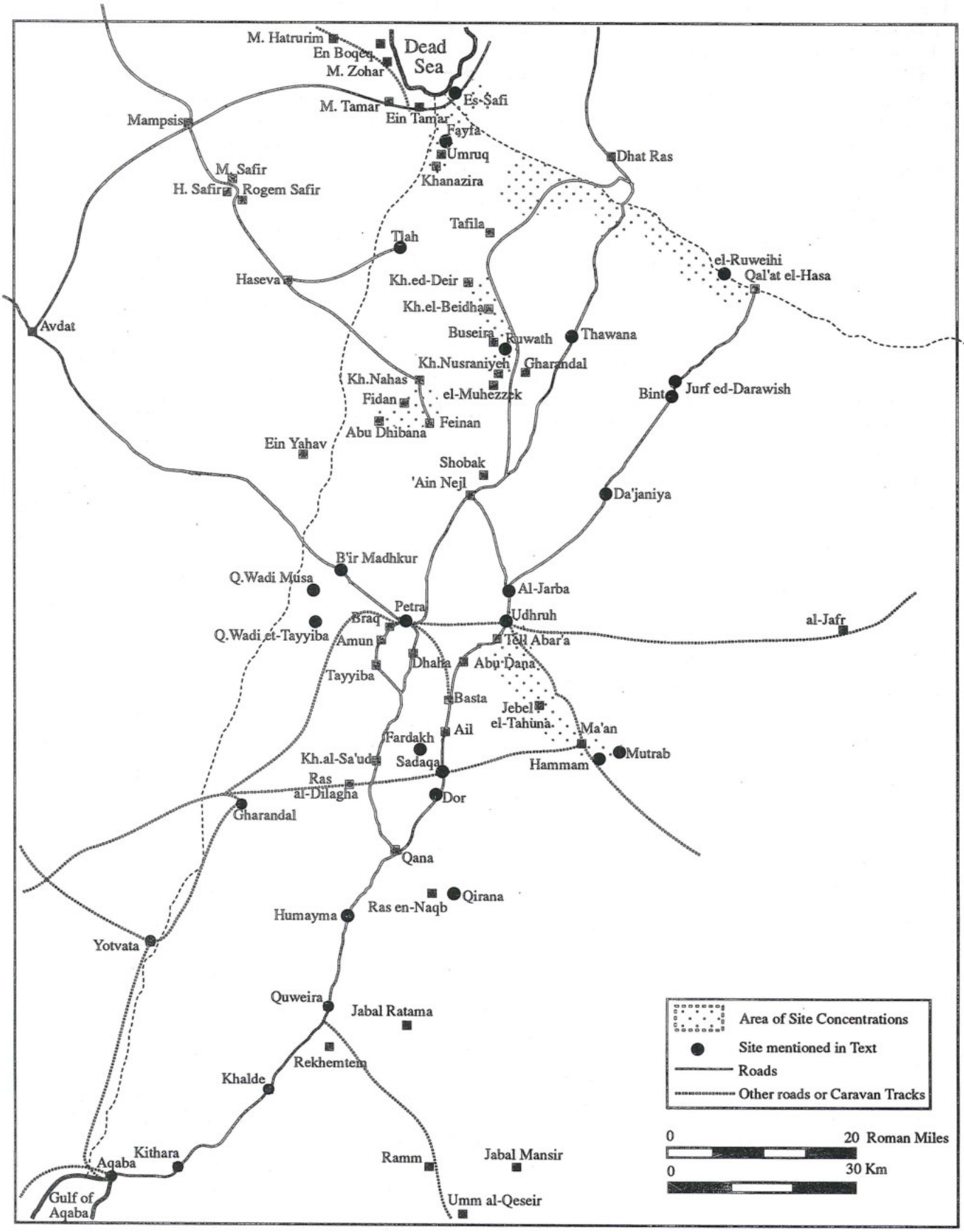
Southern Jordan, the area selected to test this review, is defined as the territory between Wādī al-Ḥasā and al-'Aqaba and limited by Wādī 'Arabah and the Syrian Desert (FIG. 1).

## II. Methodological Limitations

*Historical Data*

Initially, it is important to realize how scarce and incomplete is the evidence serving in the reconstruction of military arrangements in Roman-Byzantine southern Jordan. Doubtless, the investigations suffer from the very acute shortage of literary and epigraphic material. Besides brief notes mentioning some campaigns in "Arabia" which often cannot be specifically localized, the ancient historians are generally silent about the military situation. However, historical information on social unrest and internal disturbances, such as banditry, highway robbery and nomadic raids within Palestine and Sinai, is plentiful.

No military diploma are known from Arabia. Military inscriptions are few, often very laconic or undated, thus forcing conjectural interpretations. Important contributions concerning the *Exercitus Arabicus* have been made by T. Parker (1986b) and M. Speidel (1977), yet details




1. Roman - Byzantine southern Jordan.

concerning troop movements, transfer and duties remain largely in the domain of a guess. For example, discussion on the military aspects of the annexation of the Nabataean kingdom in AD 106, and the organization of the province seems still unresolved, in view of conflicting opinions on the identity of the first garrison of Arabia (Fiema 1987 and 1991 for bibliography).

The *Notitia Dignitatum* is the most relevant literary source for military arrangements in Late Roman-Byzantine Jordan. Its usefulness, however, is restricted to regions where the location of mentioned military units can be reasonably identified with the extant military structures, as in the Byzantine province of *Arabia* (Parker 1989). In the neighboring *Palaestina Salutaris/Tertia,* these attempts were less successful, or proved futile (Hartmann 1913; Fiema 1991: 295-305). This may be explained through the less-than-usual geopolitical situation of *Palaestina Salutaris/Tertia,* where more than half of the garrisons seem to have been located far away from the usually recognized "border" of the empire. In fact, positive identifications were made more on the basis of studies of other historical sources, such as the *Tabula Peutingeriana,* the Madaba Map, and the Bi'r as-Saba' Edict (Bowersock 1983: 165-186). As a result, only 10 out of 20 actual garrisons traditionally thought to have been located in the eastern *Palaestina Tertia* could be positively recognized (TABLE 1). This meager state of literary and epigraphic sources obliges a scholar to turn to archaeological data in search for a better understanding of the military arrangements in Roman-Byzantine southern Jordan.

*Spatial and Temporal Aspects of Archaeological Evidence*

Despite the original enthusiasm of the proponents of "new archaeology" (Binford 1968: 211), it becomes increasingly apparent that archaeology possesses its limitations in recognizing and understanding the patterns of past socio-cultural systems, except when in a coordinated and meaningful effort with anthropology and history (Shaw 1980: 47). Especially the impact of anthropological theory on the domain of culture change in Roman-Byzantine southern Jordan is still woefully inadequate. This is also related to the fact that military aspects are usually treated separately from other aspects of culture history. For example, this "separatism" is noticeable in the divided and unequal attention given to the spatial distribution of sites recognized as military. Preoccupied with a postulated "external threat" and defensive purpose, historical reconstructions offered in the past presented images of strings of military installations located primarily in the frontier zone of the province, either in a linear or a "defense-in-depth," East-to-West pattern. While this approach may be partially justified because of the generally recognized duty of the military in all times, defense against an invader, it tends to ignore both the requirements of keeping internal security and the available archaeological data. After all, more than a half of the recognized military installations in southern Jordan are located well behind the *Via Nova Traiana* and their function may not necessarily be related to providing a "second line/screen" of defense. Rather, their location seems related to according security to a par-

**Table 1.** Site indentifications.

| | **Notitia Dignitatum or. XXXIV** | Garrison | Indentification |
|---|---|---|---|
| 1 | AILA | Legio decima Fretensis | al-'Aqaba |
| 2 | ADMATHA | Ala Antana dromedariorum | al-Ḥammām |
| 3 | ARIELDELA | Cohors secunda Galatarum | Gharandal (S) |
| 4 | HAUANA (=HAUARRA) | Equites sagittarii indigenae | Ḥumayma |
| 5 | PRAESIDIUM (N) | Ala secunda felix Valentiniana | Qaṣr Fayfa |
| 6 | PRAESIDIUM (S) | Cohors quarta Phrygum | Khirbat al-Khāldī |
| 7 | ROBATHA | Equites sagittarii indigenae | Khirbat Ruwāth |
| 8 | TOLOHA | Ala Constantiniana | Qaṣr aṭ-Ṭilāḥ |
| 9 | ZOARA | Equites sagittarii indigenae | aṣ-Ṣāfī |
| 10 | ZODOCATHA | Equites promoti indigenae | Ṣadaqa |
| 11 | AFRO | Cohors duodecima Valeria | Wādī al-Ḥasā area (?) |
| 12 | ASUADA | Ala prima miliaria Sebastena | NE Wādī 'Arabah (?) |
| 13 | CALAMONA | Cohors prima equitata | Bi'r Madhkūr (?) |
| 14 | CARTHA (=SIRTHA?) | Cohors decima Carthaginensis | Wādī al-Ḥasā area (?) |
| 15 | HASTA | Ala prima miliaria | NE Wādī 'Arabah (?) |
| 16 | IEHIBO | Cohors secunda Gratiana | ??? |
| 17 | SABAIA | Equites promoti indigenae | Jibāl region (?) |
| 18 | SABURE SIVE VETEROCARIA | Equites primi felices sagittarii indigenae Palaestini | site in Wādī Ṣabra (?) |
| 19 | TARBA | Cohors prima argentenaria | environs of Jarba (?) |
| 20 | THAMANA | Cohors quarta Palestinorum | ??? |

ticular settlement, route or region, with no specific directional threat envisaged.

Another, though unintentional, limitation in the proper assessment of military arrangements stems from the fact that almost all data on military structures come from regional surveys. The notable exceptions are ad-Da'jāniya (Parker 1991: 134-141), Yotvata (Meshel 1989) and Udhruḥ (Killick 1986; 1987), although the latter still awaits a full publication. Thus the temporal aspect of occupation on all other sites is strictly subjected to the analysis of surface ceramic finds and architectural typology. Sauer's ceramic chronology, developed on the basis of the Ḥisbān excavations almost 20 years ago (1973), has been successfully tested in stratigraphic and numismatic controlled excavations at al-Lajjūn (Parker 1979: 22-26). It remains, however, less certain how accurately this chronology can be applied against the material from southern Jordan, where well-stratified and coin controlled sequences are few, and where the regional variations in longevity of certain types of wares may be easily implied.

A recent breakthrough in ceramic studies, effected by K. W. Russell (1990; 1991) on the basis of the material from Petra, strongly suggests the considerable longevity of Nabataean painted wares, with an implication of its existence up to the sixth century AD (e.g. 'Amr 1991: 318). It is possible then that a major chronological evaluation of sites with a Nabataean component, at least in southern Jordan, will be necessary.

Concurrently, the chronological assessment of occupation on the basis of surface finds is unlikely to provide precise information on possible gaps in occupation, the reoccupation of a site, or even a secure basis for the initial period of existence and the time of the final abandonment. Earlier studies on the Petra-Gaza road primarily based the date of its use on the surface ceramics recovered from the forts along this road (Meshel and Tsafrir 1974; 1975; Negev 1966), and concluded that the road went out of use in the latter first or early second century AD. However, subsequent excavations at Mawjat 'Awwād and Qaṣr al-'Abd (Hurvat Qasra) proved the continuity of occupation at these sites at least until the late third century AD; thereby showing that the Petra-Gaza road was still in use until that time (Cohen 1982).

*Character of Occupation and Architectural Typology*

Another problem which faces scholars of military studies is the proper assessment of the nature and occupation phases of a military structure. Frequently, the difficulty is of a purely semantic character, i.e. reflecting possible ambiguity in the terminology used. Not surprisingly, the same structures are interchangeably referred to in scholarly reports as forts, fortified caravanserais, *castella* or *stationes*. In fact, the ancient function of some of these structures might have included, simultaneously, both military and civilian capacity. Extant sources indicate that some military installations garrisoned by troops also served as hostelries or lodgings for travellers (Gichon 1990: 205-206).

Towers, as an integral part of the military architecture, were frequently the subject of elaborate classifications, typologies and tactical considerations (e.g. Gichon 1974). Despite that, the very function of these particular structures may be equally ambiguous, as that of the "forts". An instructive example is the polemic presented by E. Banning (1986; 1987) and S. T. Parker (1987), including a discussion on civilian versus military use of towers in Palestine and Jordan. Although the respondents seemingly presented opposite views, they tended to recognize the fact that the functional interpretation may be strongly influenced by a scholar's general perspective.

In the absence of non-ambiguous epigraphic material, architectural features – i.e. general layout, construction method, internal arrangement, presence and form of towers, gates, etc. – are usually recognized, in addition to the ceramic material, as the safest method of dating military structures. In practice, however, these features provide only very general information on the time-frame and possible reconstruction, which may be improved only when the research is supplemented by soundings or excavations. For example, possible gaps in occupation, or later civilian reoccupation of original military sites, may not be easily inferred without excavation. Further, the pottery found in structures recognized architecturally as military, is usually recognized as a temporal indication of the military occupation of a structure. But, since the pottery of both military and civilian contexts would be the same, a fort might have been militarily abandoned and reinhabited by civilians (Freeman 1990: 186).

While every attempt at assessment of the temporal span and phases of occupation of a structure should be appreciated, the following few examples illustrate the difficulties and the still-inadequate means of dealing with these problems, all of which may lead toward unintentional misinterpretation of the whole corpus of military remains.

The fort of ad-Da'jāniya, one of the largest and best preserved military structures in southern Jordan, has received much attention in scholarly literature. Original chronological assessment, through studies on the survey material, suggested an early date for this structure, perhaps as early as the Trajanic period, since Early Roman IV pottery was found among the surface material (Parker 1979: 142). Further studies, which concentrated on the fort's shape and internal layout, suggested a later date, probably the Severan period (Lander 1984: 144-146) or

the late third/early fourth century (Kennedy and Riley 1990: 172-175). Historical analysis, centering on the Ghassanid buildup of the early sixth century AD, leaned toward the Byzantine date for the fort's construction (Bowersock 1976: 226). Recent soundings at the fort presented firm evidence for early fourth century existence, although in some places traces of earlier occupation could have been removed if the fourth century marked only the reconstruction phase (Parker 1991: 140).

The major forts along the *Via Nova Traiana* in southern Jordan – Kīthārā, al-Khāldī and al-Quwayra – were originally thought to have been built by the Romans (Alt 1936). This conclusion was made on the basis of architectural features, mainly the masonry type and the general layout. Recent investigations and soundings revealed a very strong Nabataean "imprint," i.e. the typical Nabataean stone dressing marks and an inscription (Graf 1983: 650-653). The possibility of a thorough Roman reconstruction at the later period cannot be dismissed, yet the Nabataean origins of these structures, whether initially military or civilian, seem evident.

The initial controversy over the massive fortifications excavated by the University of Chicago in al-'Aqaba, whether of the early Islamic town of Ayla (Whitcomb 1987; 1988; 1990) or of an original legionary fortress (Knauf and Brooker 1988: 181) was mainly based upon the seemingly striking resemblance of these fortifications to the fortresses at al-Lajjūn and Udhruḥ. The ultimate solution to this controversy may be found when the lowest levels at Ayla, which lie under the current water table, are investigated. Furthermore, the ruins recently surveyed in western 'Aqaba (Meloy 1991) may, in fact, be a better candidate for the earlier settlement and the legionary camp of the *X Fretensis*. In addition, and despite its seemingly clear architectural parallel with Diocletianic fortresses, Udhruḥ is itself an enigma. While noting the existence of Early Roman material, the excavations have failed to produce a conclusive final statement concerning the chronological and structural development of the site.

The architectural parallells may then serve as useful indicators in a general temporal assessment. They fail, however, to account for regional variations, phenomena of reconstruction, rebuilding, gaps of occupation and civilian reoccupation, unless accompanied by a more comprehensive research based upon excavation. Furthermore, architectural studies should consider a potential combination of new elements, be it Roman or Byzantine architecture, with traditional architectural designs which could have been incorporated or subjected to subsequent modifications. Recent studies confirm the longevity of Hellenistic and Nabataean designs in military architecture. As recently suggested for the courtyard fortification pattern in southern Palestine, this architectural type represents an unbroken tradition since the tenth century BC (Gichon 1990: 206).

The critical remarks offered above are by no means intended to diminish the substantial scholarly contribution towards the better understanding of the military problems in Roman-Byzantine southern Jordan. These attempts at dating and classifying military installations, even though supported by a still-insufficient data base, should be appreciated. However, in light of the aforementioned difficulties and shortcomings, any general statement about spatial and temporal distribution of military installations, which insists on the existence of a defensive *system* with its growth and decline, is indeed based upon shaky ground. In the case of southern Jordan, it seems premature to discuss the phases of strengthening or weakening of the so-called "*Limes Arabicus*," because the term "*limes*," if defined as a working defensive "system," may not be the most appropriate designation for the extant remains of the military arrangements in that area. Furthermore, the overemphasis on the defensive aspects of the "*limes*," its strategic value and tactical arrangements will overshadow the integral relation between the military and the internal sociopolitical and economic situation in the province.

## III. Historical Comments

The TABLE 2 is by no means a complete inventory of military sites in southern Jordan. Initially, the sites presented here were tentatively recognized as larger installations of military significance (forts), although some may have been simple fortified road stations. Out of 30 listings, only 10 were directly related to the *Via Nova Traiana*, the major Roman highway in Jordan. Eight are located east of the Trajanic Road, and twelve to the west of it, within the province. The location of these sites will hardly account for the existence of a military monitoring zone, barrier, or a defense-in-depth system. Instead, the common feature which is enjoined by these sites is that all are located at places of importance for the proper administrative and economic functioning of the province, without, however, any common direction. These forts are located along the main roads, at the crossroads, high ground passes, or in the vicinity of major settlements or areas of economic importance.

Further, in reconstructing the military arrangements, one cannot dwell only upon the archaeological evidence of structures recognized as military. One should include sites recognized as civilian but with a possible military garrison component attested by extant sources. To these belong Petra (Bennett and Kennedy 1978; Zayadine and Fiema 1986), Zoara (N.D. *Or.* 34.26) and possibly at-Tuwwāna and Khirbat Ruwāth, the latter recognized as garrisoned (Robatha, N.D. *Or.* 34.27) but with no substantial traces of a military installation (Graf 1991, personal communication).

**Table 2.** Larger military installations in southern Jordan.

| Site | Remains | Location | V.N.T. | Nabataean | Roman | Fourth | Fifth | Sixth Century |
|---|---|---|---|---|---|---|---|---|
| 1 ar-Ruwayḥī | fort | Northern Jibāl | W | X | X | X | X | X |
| 2 al-Qaṣr | fort | Northern Jibāl | W | X | ? | X | X | X |
| 3 Rujm Farrīdiya | fort | Northern Jibāl | W | X | X | X | ? | |
| 4 WHS 296 | fort | Northern Jibāl | W | X | X | X | X | |
| 5 Jurf ad-Darāwīsh | fort | Eastern Jibāl | E | | Severan? | X | ? | |
| 6 ad-Da'jāniya | fort | Eastern Jibāl | E | | Severan? | X | X | until c. 520 |
| 7 Qaṣr Fayfa | fort | Southern Ghawr | W | | X | X | X | X |
| 8 Qaṣr aṭ-Ṭilāḥ | fort | NE Wādī 'Arabah | W | X | X | X | X | X |
| 9 Umm aṭ-Ṭuwābīn | stronghold | SE of Southern Ghawr | W | X | X | X | X | |
| 10 Udhruḥ | fortress-cum-town | East of ash-Sharāh | E | | X | X | X | garrisoned ? |
| 11 Jarba | fort | East of ash-Sharāh | E | | X | X | ? | |
| 12 al-Mutrab | fort | East of ash-Sharāh | E | | ? | X | X | |
| 13 al-Ḥammām | fort | East of ash-Sharāh | E | | | X | X | |
| 14 Ayl | fort | ash-Sharāh | X | ? | Severan? | X | X | mid 6th century |
| 15 Fardhakh | fort | ash-Sharāh | X | ? | X | X | ? | |
| 16 Ṣadaqa | fortified settlement/fort? | ash-Sharāh | X | ? | X | X | X | ? |
| 17 Dor | fort | ash-Sharāh | X | ? | X | X | ? | |
| 18 Suwaymira | fortlet | ash-Sharāh | X | ? | X | X | ? | |
| 19 Khirbat al-Qīrāna | fort | East of ash-Sharāh | E | ? | X | X | X | early 6th century? |
| 20 Ḥumayma | military (?) enclosure and two (?) forts | Ḥisma | X | ? | X | X | X | X |
| 21 al-Quwayra | fort | Ḥisma | X | X | X | X | X | |
| 22 Khirbat al Khāldī | fort + caravanserai (?) | Ḥisma | X | X | X | X | X | X (fort) |
| 23 Kīthāra | fort | Ḥisma | X | X | X | X | X | X |
| 24 Bīr Madhkūr | fort (?) | W. foothills of ash-Sharāh | W | X | X | X | ? | |
| 25 Qaṣr Wādīaṭ-Ṭayyiba | fort | W. foothills of ash-Sharāh | W | X | X | ? | | |
| 26 Qaṣr Wādī Mūsā (=Qaṣr Umm ar-Ratam) | fort (?) | W. foothills of ash-Sharāh | W | ? | X | X | X | |
| 27 Qaṣr as-Sa'īdiyīn | fort (?) | Central Wādī 'Arabah | W | X | X | ? | | |
| 28 Gharandal | fort | Central Wādī 'Arabah | W | X | X | X | X | |
| 29 al-'Aqaba | legionary fortress | on the Gulf of 'Aqaba | X | | late 3rd? | X | X | ? |
| 30 Ghadyān (Yotvata) | fort | Southern Wādī 'Arabah | W | | end of 3rd | X | | |

E=East of; W=West of; X=occupied/on the road; ?=uncertain; V.N.T.=Via Nova

Elsewhere (Fiema 1991) I have proposed that the political and military viability of southern Jordan varied in accordance with fluctuations in the economics of long-distance Oriental trade. In particular, it was suggested that economic conditions conducive to sociopolitical growth varied according to the volume of trade passing through the area, and that the process involved the appearance of concomitant forms of administrative and military arrangements which facilitated that trade. Conversely, the decline of trade in southern Jordan, as a function of political and economic decisions outside the area, resulted in subsequent changes in these administrative and military structures.

In the domain of military studies this economic argument implies two specific propositions. Firstly, the spatial and temporal distribution of troops and installations in the area is directly related to the sociopolitical and economic situation, primarily within the province and only secondarily in relation to some large-scale strategic considerations in the Roman East. Further, the strength of the military in the area, when measured by the number of military installations manned in particular time periods, does not necessarily mean increase/decrease of external threat, or "strengthening/weakening" of the "system", but rather is a function of a conscious and economizing investment policy on behalf of central government in relation to the economic significance of the province.

This hypothesis was tested through studies on extant settlement patterns of Nabataean through Late Byzantine periods, with emphasis on the spatial and temporal distribution of settlements, road network, military sites and the existence of exploitation activities in some regions with mineral resources. Although also based upon still-insufficient archaeological data, the results strongly indicate that the distribution of military installations directly followed the economic and administrative needs represented by the Nabataean kingdom and later the provinces of Roman *Arabia* and Byzantine *Palaestina Tertia*. It is clear that forts were constructed, rebuilt, regarrisoned and abandoned, not with regard to some large-scale strategic considerations, but, presumably, with regard to the constantly changing political and economic environment of the area. The military arrangements in southern Jordan hardly display any regard to the possibility of a large-scale, well-organized invasion which, in fact, did not materialize until the early seventh

century. Hence, the comparisons with the massive military buildup in other parts of the Roman frontier, such as the *Strata Diocletiana* in Syria, hardly seem appropriate. Low-intensity threat of nomadic incursions from the East could have been easily contained without a need of an elaborate defensive "system", and low-level protective measures (patrolling beyond the frontier, diplomatic negotiations) seem to have been a secure and sufficient means to preserve peace.

In general, throughout time the central government developed a logical and economizing policy in response to a fluctuating level of protective needs. The second century arrangements, characterised by Roman non-garrisoning of some Nabataean military installations, as well as the troops' location either in towns or in spots of commercial or communication importance, are a good indication of such policy. The third century arrangements may represent an increase in military deployment, in relation to the generally unstable political situation and the unrest among the eastern native populations under Roman rule. This situation had also partially contributed to the decline of international trade traffic in southern Jordan, and consequently to the general economic decline of the area in the later Byzantine period.

The suggested Tetrarchic buildup seems to be a phantom, at least in southern Jordan. Only three forts (al-Mutrab, al-Ḥammām, Yotvata) may be safely associated with the fourth century construction, while all previously constructed forts may have been manned as well. In fact, the fourth century situation indicates an economic recovery exemplified by unparralleled expansion into more remote marginal lands of the Byzantine East. Evidence of lively interregional trade, which had largely replaced the international trading contacts by the later third century, attests to prosperity in some areas. As one scholar observed, "sometimes evidence of increased military presence may reflect stability rather than insecurity" (Isaac 1986: 391).

The number of fortifications during the fourth-fifth century is only insignificantly higher than in the Severan period. It is clear that the greatest potential danger to the proper functioning of the province still remained within the province itself. The army was more involved in policing the countryside than preoccupied with an external threat. Not surprisingly, the extant historical sources describing the conditions of Palestine, an-Naqab and Sinai indicate that the endemic banditry, nomadic raids and social unrest all originated to the west of the so-called "*Limes Arabicus*" (Issac 1984: 194; Mayerson 1986: 38-40; 1989).

What has been suggested as a "gradual weakening of the Arabian frontier" starting in the second half of the fifth century (Parker 1986b: 152), is usually supported by the evidence of the abandonment of forts along the frontier. This numerical comparison may, however, be misleading. In fact, the abandonments represent a new policy of minimizing the investment in the areas of less importance to the empire, and are also related to changes in tactics. It appears that Justinian retained the older military perspective of preserving the military strength only where a real threat existed for the regions most important politically and economically. This is supported by the evidence of massive fortification reconstructions in Mesopotamia, Armenia and northern Syria (Procopius *De Aed.* 2.3). In southern Jordan, military arrangements reflected the gradual economic decline of the area, thus its relative insignificance in considerations of the central government. This decline is well perceived through the settlement patterns of the later Byzantine period, characterised by growing isolation of settlement clusters, and the disappearance of means for international and interregional communication. It is characteristic, however, that in areas still economically important, such as the Southern Ghawr, and the Udhruḥ and Ḥumayma regions, where agricultural production and interregional trade were still seemingly thriving, the forts and garrisons are still attested. The same applies to the main communication lines which largely bypassed southern Jordan but still run on its outskirts. The examples are Ayla and the roads between an-Naqab and northern Ḥijāz, and the Zoara region through which the communication lines passed between Palestine and Moab. The lack of necessity to maintain forts in other locations was also related to changed tactics in which the mobile groups of the *foederati*, well accustomed to policing the countryside, played the dominant role. One cannot consider the emperors of the sixth century responsible for the vicissitudes of the seventh. The political and military arrangements maintained in the Justinianic period were appropriate and adequate for the conditions of that century, but simply inadequate for those of the seventh.

The remarks offered above coincide with the new approach in military studies which points out that the Roman army in Arabia/Palestine was the force of occupation which, in addition to being an instrument of imperial trade policy both inside the province and across the frontier, performed the ever important task of policing the countryside and keeping security in towns (Isaac 1980: 894; 1990: 34). Additionally, the observed fluctuations in the number of the troops and the location of military installations may be better explained in relation to intricate sociopolitical phenomena such as dissidence and opposition of local populations to Roman rule (Graf 1978; 1991: 152) rather than in relation to the 'defense-in-depth' assumed to have been generated against nomadic incursions. Future military studies will be associated not only with more extensive archaeological exploration of forts and towers, and a search for better

classifying means, but primarily with a better understanding of the interrelationship and interdependence of the regional sociopolitical and economic situation and the military means effected by the empire to assure the proper and undisturbed functioning of these arrangements.

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# Remarks on Building Techniques During Umayyad Times

Architecture, just like any form of culture, cannot be improvised, nor can it emerge from nowhere. The architecture of Umayyad times inherited both forms and building layouts from previous cultures, taking into consideration the limited architectural tradition that existed in Arabia prior to the arrival of the Islamic culture. The first architectural constructions under Islamic rule were to a certain extent adaptations of those observed in other cultures, even though their own characteristics soon developed, particularly in those buildings destined to house the new functions specific to the new culture.

A similar process of assimilation occurred with respect to the building techniques, although obviously there was no innovation motivated by the adaptation to new needs, since the purpose was in fact the construction of the buildings themselves. Therefore there was no question of being conditioned to new functions. In the region of Bilād ash-Shām we can observe a distinct continuity in almost all the forms of building and in decoration, although innovations are soon to be seen, owing to the influence of building traditions of other cultures integrated into the Umayyad empire.

My proposal here is to analyze some specific aspects related to the construction techniques used in buildings in the Umayyad period in Jordan. I would like to emphasize the fact that this is no more than an elementary and restricted study of the subject.

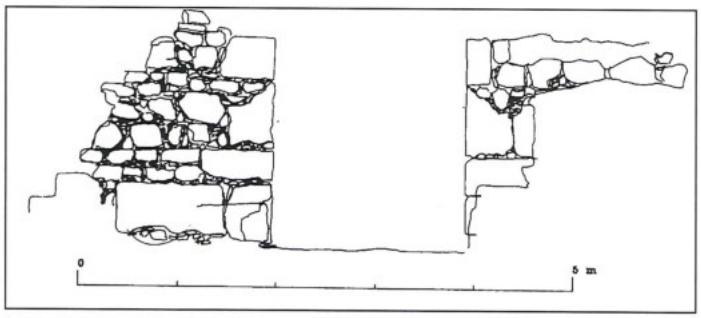
## Construction Materials

The building traditions of Roman and Byzantine times continue to prevail in almost all of the Umayyad buildings in Jordan. The use of local building materials necessarily meant following the same methods. The stone found locally is limestone in the central region and basalt in the north, and these are the materials used predominantly, and to a great extent they condition the manner of building.

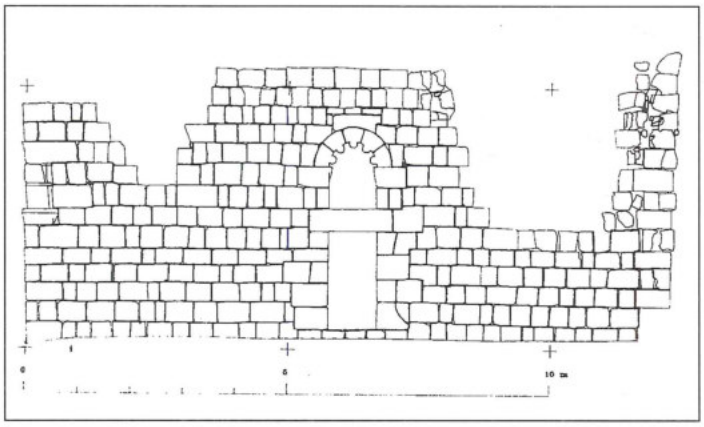
Stone is used, both in roughly-squared rubble masonry and in ashlar masonry. In rubble masonry the irregular stone is accompanied by numerous small fragments, which in the jointuring made with plentiful quantities of mortar become incorporated into the jointuring material (FIG. 1). This system eliminates both the need for dressing the stones and for pre-selecting the stones in order to ensure their correct placement in the structure of the wall, since this can be left to the smaller stones. However, walls constructed in this way are not particularly stable, especially if the mortar filling the joints and the inside of the wall is scant or lacking in resistance, and any slipping of this rubble may result in partial collapse of the wall. When limestone is used in these structures, one can rarely find stones connecting both faces of the wall, while on the other hand in constructions using basalt, the availability of longer stones favoured the use of these types of bonding.

In structures of ashlar masonry, when limestone is used, there continues to be a characteristic absence of connecting stones joining the two faces of the wall. The inner side usually consists of a mixture of mortar that is lacking in consistency and has small rubble stones. These characteristics can be observed in the walls of the mosque in Qaṣr al-Ḥallābāt (FIG. 2), in the entrance hall of the Qaṣr of ʿAmmān, in the palace walls at al-Qasṭal, etc.

Another feature in some of these ashlar structures is the presence of stone slabs that are higher than they are long, and that do not correspond to transversal connecting ashlars, as can be found in the constructions at al-Qasṭal (Carlier 1984: FIGS. 57-66) and ʿAmmān.




1. Rubble masonry in the door of building F in the Qaṣr in ʿAmmān.



2. Ashlar masonry in the mosque of Qaṣr al-Ḥallābāt.

The introduction of brickwork was one of the outstanding features adopted from the Mesopotamian culture. Although it was a well-used material in Roman and Byzantine times, it was scarcely used in the construction of walls in the region of Syria. In Umayyad times, and in two buildings in particular, bricks were used for the construction of arches and vaults. The most remarkable thing about the use of this material in Qaṣr al-Mushatta and Qaṣr aṭ-Ṭūba is its combination with a particular building technique that allows for the construction of arches and vaults without centering, and therefore eliminates the large amounts of wood usually necessary in such cases.

## Mortar

The conglomerates used in mortar are particularly interesting. This is one aspect where innovative influences can be appreciated with respect to the prevailing Roman and Byzantine traditions in the region. Throughout our research on the Qaṣr of ʻAmmān we observed different types of mortar, some of which appeared to be different from the traditional lime mortar, and which instead made use of gypsum as a binding substance. This led to our subsequent analysis of some other Umayyad buildings, such as Quṣayr ʻAmra and Kharrāna (TABLE 1).

The results of these studies demonstrated that mortar with a greater or lesser proportion of gypsum as agglomerate was used in some buildings, and within these buildings in specific structures and for particular purposes. This shows that in addition to the traditional techniques found locally, others of a more oriental origin from Persia and Mesopotamia soon appeared. The use of gypsum was almost unknown in Roman and Byzantine times, as far as we know. Only in Hispania, where gypsum is an abundant natural resource, can we find examples of gypsum used in decoration and relief work.

Gypsum had been known in Egypt since ancient times and was subsequently used in Mesopotamia and Iran, and was later the material commonly used in Parthian

**Table 1.** Results of the analysis of mortars from some Umayyad buildings.

| Sample No. | Origin of Sample of Mortar | Lime %$CaCO_3$ | Clay % | Gypsum % | Type of Mortar |
|---|---|---|---|---|---|
| 1 | Qaṣr of ʻAmmān. Main wall on the area of Zayadine's excavation | 76.0 | 6.3 | 15.4 | gypsum and lime |
| 2 | Qaṣr of ʻAmmān. Interior of south wall of the vestibule | 86.0 | 6.7 | 2.1 | lime |
| 3 | Qaṣr of ʻAmmān. Plaster of the pipe on the east facade of the vestibule | 84.0 | 5.6 | 8.2 | lime |
| 4 | Qaṣr of ʻAmmān. Interior of wall of the big cistern | 75.0 | 8.5 | 12.7 | gypsum and lime |
| 5 | Qaṣr of ʻAmmān. Plaster of the south side of the big cistern | 77.0 | 6.2 | 14.0 | gypsum and lime |
| 6 | Qaṣr of ʻAmmān. Wall of room on the east of the vestibule | 91.0 | 3.0 | 1.8 | lime |
| 7 | Qaṣr of ʻAmmān. Central column of the south īwān of building A | 60.0 | 8.3 | 27.4 | gypsum |
| 8 | Qaṣr of ʻAmmān. Plaster of room beside the west door of the complex | 94.0 | 1.0 | 2.2 | lime |
| 9 | Qaṣr of ʻAmmān. Foundation of wall of building B | 90.0 | 2.1 | 4.9 | lime |
| 10 | Qaṣr of ʻAmmān. Interior of wall of building B | 97.5 | 0.2 | 0.5 | lime |
| 11 | Qaṣr of ʻAmmān. Column in front of the east īwān of building B | 58.0 | 9.3 | 27.0 | gypsum |
| 12 | Qaṣr of ʻAmmān. Foundation of column of courtyard 3 | 59.0 | 5.4 | 31.0 | gypsum |
| 13 | Qaṣr of ʻAmmān. Interior of north īwān vault | 92.0 | 2.7 | 2.0 | lime |
| 14 | Kharrāna. Interior of wall | 49.0 | 10.8 | 36.5 | gypsum |
| 15 | Kharrāna. Plaster of wall | 70.0 | 6.5 | 18.5 | gypsum and lime |
| 16 | Kharrāna. Vault of staircase | 68.0 | 5.9 | 23.4 | gypsum |
| 17 | Quṣayr ʻAmra. Interior of wall | 89.0 | 4.0 | 3.5 | lime |
| 18 | Quṣayr ʻAmra. Plaster of wall | 92.0 | 2.2 | 2.6 | lime |

and Sasanian architecture. No doubt Islam spread its use because after the Muslim conquest of al-Andalus, it became a highly-used material, and in fact it was used almost exclusively in certain areas and times. This widespread use of gypsum as a building material must have stemmed from Umayyad times, after the Sasanian empire became absorbed into the territories of Islam.

It is particularly significant that the buildings in Jordan from which we have taken analyses of the mortar and found gypsum as a building material, are the ones that show the greatest oriental influence. The most obvious example can be observed in Qaṣr al-Kharrāna. Three samples were analyzed: one of mortar from inside the walls, another from the plastering on the surface of the walls, and another from inside a vault, and all of them were found to contain quite a high proportion of gypsum. If we take into account that the most abundant stone in the area is limestone, and that therefore the arids (sand and gravel) have similar characteristics, we should consider that an important part of the calcium carbonate found in the samples comes from the arids. Taking for granted that the proportion between the mixing agent and the arids is about 1 to 3 (Vitruvius, Book 11, chapter 5), we must suppose that mortar with 25 and 30% gypsum is a gypsum mortar. Such mortar usually has a greater clay content than lime mortar, because this material forms part of the impurities of gypsum, and therefore part of this clay should be considered an integral part of the conglomerate.

The proportion of gypsum in the three samples from Kharrāna were the following: 36.5% from the inside walls and 23.5% from the vault, showing that they are obviously gypsum mortars. The analysis of the layer of plastering on the wall contained only 18.5% gypsum. This proportion should be interpreted in light of a technique used even until recently in some areas of Spain, and specified in some building manuals, which consists of mixing the gypsum with the lime, usually lime dissolved in water (lime water). The proportion of lime used in these cases is usually 25% of the gypsum, which in the case of Kharrāna would again mean that the proportion of arids and conglomerates is 1 to 3.

I would like to insist on the fact that it was in a building that has until very recently been widely acclaimed as Sasanian, that gypsum was used as almost the only material for making the mortar. This mortar technique, together with the structural systems in the arches and vaults and the decoration show the marked influence of Sasanian architecture in the planning and carrying out of this building.

The opposite occurs in the case of a building such as the baths at Quṣayr ʻAmra, where all the signs point to Roman and Byzantine architectural influence. Two samples were analyzed, one from the interior of the wall, and another from the plastering, and they both undoubtedly point to the use of a high quality lime mortar, maybe even higher in the mortar of the fine wall plastering, but which in no case has a combined proportion of clay and gypsum exceeding 8%. The construction technique in this case corroborates the continuity of the classical Roman tradition in this building.

The analysis of various samples of mortars coming from different structures in the Qaṣr of ʻAmmān is of particular interest. Within this palace are three different types of mortars. One type that clearly corresponds to the lime mortars contains about 90% or more calcium carbonate. Another group of samples corresponds to gypsum mortars, with a proportion of about 30% gypsum. Last of all, there is another group of mortars with a gypsum content of approximately 15%, which we may conclude is a mortar combining gypsum and lime, with a percentage of the latter of about 50% of the gypsum.

It is also fascinating to analyze the sources of each of these types of mortars. The lime mortars, which generally contain wood-ash, were used systematically on the inside of the walls and for plastering throughout the palace. The presence of ash is frequent in other types of mortar, as it is in the bedding layer of mosaics and paving. Although in the latter case there may be technical reasons for its presence, since this mortar would be more porous and protect against damp, this is not justified in the case of mortar on the inside of the walls unless it were the manner of baking the lime together that resulted in it becoming mixed with the ash in the kiln. Another reason for this presence of ash could be the experience that it sometimes gives slight hydraulic characteristics and strength to the mortar, in the same way as crushed bricks do.

Gypsum mortar is used in very specific structures when necessary because of the structural forms. It is used specifically in the columns in the courtyards of different residential buildings belonging to the palace, and in the lintels of the doors of these buildings. In these cases construction would have been difficult to carry out with lime mortar, because of the length of time it takes to set, and this would have meant a slow building process to avoid crumbling. In these cases the builders resorted to building techniques that were completely alien to local and traditional methods but that were linked to elements of an obviously Sasanian origin. Such is the case of the columns in the patios mentioned previously, and the formation of door lintels using irregular stones instead of monolithic slabs. There is no doubt that these elements were contemporary with the rest of the palace. It is sufficient to analyze the union of the lintels with the rest of the construction of the walls to realize that it was carried out as a whole. The fact that the gypsum was used as a material for delicate elements from the very beginning is

confirmed by the fact that the columns of carved stone in the northernmost patio of the Amīr's residence are built on a foundation of small stones and gypsum mortar (Almagro 1983: 184, sample 12).

Finally, mortars with a mixture of lime and gypsum are to be found in the southeastern area of the building complex, around the large reservoir. This origin is remarkable, since the use of gypsum in hydraulic construction does not seem to be entirely suitable, although the mixture of gypsum with lime does increase its impermeability and resistance to damp.

It is my opinion that a study of the composition of the different mortars could prove to be an interesting field of research that might enable us to determine with greater certainty technical influences on architecture in different periods, and it might allow us in the future to place some of the buildings of uncertain date in their correct chronological period.

**Covering Systems: Arches and Vaulting**

Arches and vaults are both common in Roman-Byzantine and Sasanian architecture. The Syrian tradition of using well-carved stonework still prevailed in Umayyad times in the construction of vaults. In the Qaṣr of 'Ammān, in particular, the most significant and at the same time the largest areas were covered with well-carved ashlar stonework vaulting. On the other hand, simultaneous work in other smaller areas of the palace show the use of vaulting with rubble masonry (Almagro 1983: 108). This system of construction was widely used in other buildings, such as in Quṣayr 'Amra (Almagro 1975: 34) and, according to Butler (1909: 76), in the mosque of Qaṣr al-Ḥallābāt. In the nearby baths of Ḥammām aṣ-Ṣarāḥ, vaulting with well-carved stonework is combined with other uncarved stone (Creswell 1969: 499-501). All of these building systems may be considered as a continuity of local tradition, and do not offer any innovations with respect to preceding systems of construction.

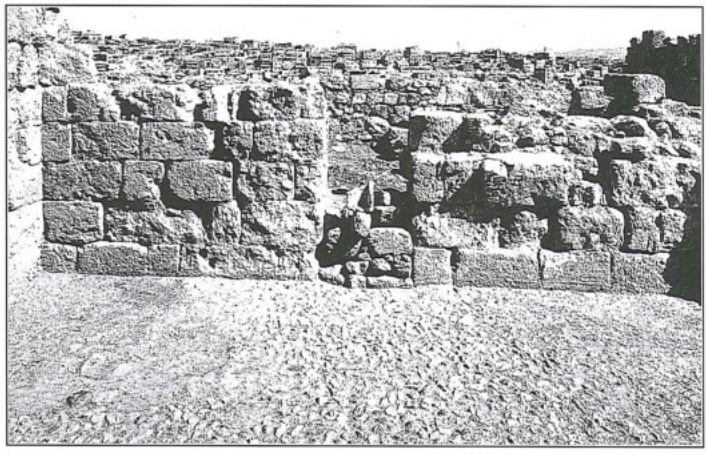
In Qaṣr al-Mushatta and Qaṣr aṭ-Ṭūba, however, there is an obvious alien influence in the vaulting (Creswell 1969: 588-590) because it was built of brick, using a technique that undoubtedly came from Iraq, where the Sasanians used bricks in constructions such as the great vaulting in the īwān of Ctesiphon (Creswell 1969: FIGS. 17D, 19D). Those vaults are constructed without the use of centering or any other supporting system, since the bricks, joined with gypsum mortar, have been laid from the edge of the wall, in such a way that the widest surface of the brick is laid first with its face to the wall, and the successive rings to each previous one. Thanks to the binding qualities of gypsum and to the wide surface of the brick used to join it to the bricks already laid, no supplementary structure is necessary as a provisional support for the vaulting once the mortar hardens.

This system dates back to ancient Egypt and Mesopotamia, and from there it extended under Muslim rule to the west, where we can observe vaults built in a similar way in al-Andalus in different periods, and particularly in the Nasrid times, in both the Alhambra and other contemporary buildings (Almagro 1991: 21-22).

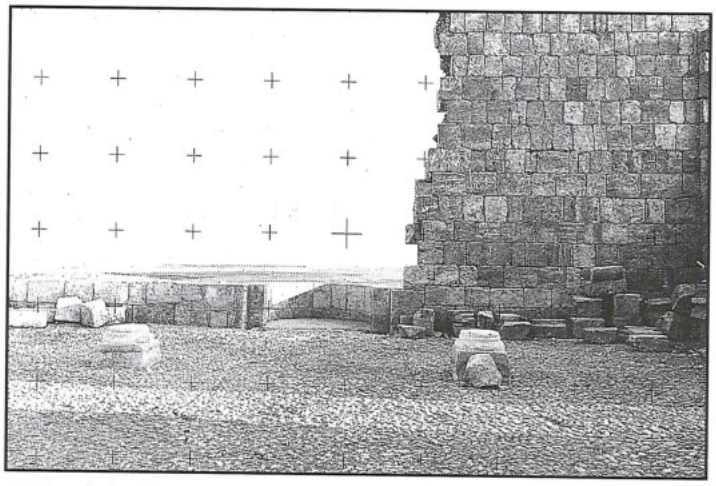
**Mosaic Pavements**

Excavations carried out by the Spanish Archaeological Mission in the northern area of the Qaṣr of 'Ammān show quite clearly that the two main rooms in that area, the īwān and the cruciform hall, had mosaic floors. Remains of this flooring appeared on the west side of the cruciform hall where it was possible to appreciate the composition of the different layers of preparation and setting of the flooring. The cubes remained fixed and set with a grouting of about 2 cm. Underneath this, there is another layer formed by lime mortar with wood-ash and gravel, and beneath this yet another layer of paving stones of 5-10 cm diameter, with lime mortar and wood-ash. This latter layer lies on another one of limestone sand and gravel without lime, which levels out the terrain and facilitates the drainage (Olávarri-Giocoechea 1985: 51). This arrangement can be observed in the īwān where the mosaics and the layer immediately below have disappeared, and the small stone paving has been exposed (FIG. 3). Remains of this paving also appear in some corners of the great cruciform audience hall, which leads us to suppose that this building also had a mosaic floor. The same disposition in preparing the flooring has been observed in the mosque of Qaṣr al-Ḥallābāt, where the only remaining layer is the stone paving characteristic of the sub-base of a mosaic (FIG. 4). The nearby palace has beautiful mosaics, the setting of which we have been unable to analyze, but which we can imagine to be similar.

This technique proves to be similar to the one used in the Byzantine mosaics in the area (Barogi and Giorgi 1991: 92), which maintained the continuity of a technique practically unchanged over centuries.



3. Mosaic bedding in the north īwān of the Qaṣr in 'Ammān.



4. Mosaic bedding in the mosque of Qaṣr al-Ḥallābāt.

## Plastering

We can find the same continuity in the plaster that covers the faces of both interior and exterior walls. This plastering is usually done with a base of lime mortar and done generally in two or sometimes three successive layers. The surface of the first layer generally has V-shaped incisions hacked by the builder's trowel. This technique can be seen in the intrados of the arches in the entry of the well at Quṣayr 'Amra. A similar disposition is found in the plastering in the palace at Qaṣr al-Ḥallābāt, in this case the plaster over the basalt slabs, and on the rubble masonry walls in the Qaṣr of 'Ammān (Almagro 1983: PL. 53). On top of this lower layer that fills up the joints of the rubble masonry and levels out the surface of the wall with a thickness of several centimetres, there is another finer layer, just a few millimetres thick and a completely smooth finishing, which constituted the base for wall decoration. Similar techniques have been described in Byzantine buildings at Umm al-Jimāl (Marino 1991: note 8) and do not vary a great deal from the Roman type of construction.

It is worth pointing out that the technique of V-shaped incisions with a trowel was used in the mortar covering the pendentives supporting the dome of the caldarium of the Quṣayr 'Amra baths. However, there are clear signs that lead us to believe that these pendentives were decorated with mosaics, to judge from the large amount of cubes that appeared in the excavation of the hypocaust, and that could only come from that part, since the dome is painted and the walls were covered with marble panels (Almagro *et al.* 1975: 38). It can therefore be deduced that such an arrangement was also used in the initial layer of the wall mosaics.

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# The Miṣr of Ayla: New Evidence for the Early Islamic City

## Introduction

The "Islamic city" is a much discussed phenomenon; among the many aspects of this problem is the character of urbanization in the early Islamic period.[1] The early Islamic cities, the innovations of the seventh and eighth centuries, had a powerful influence on subsequent urbanism in Islamic regions. Consideration of this subject has received a new impetus from recent archaeological research.

The problem of understanding the early Islamic city is bound with the creation of the *amṣār* (sing. *miṣr*), or military camps. It was the establishment of these *amṣār* which defined the process of urban foundation through regional incorporation into the Muslim empire (Dār al-Islām). Until now, the topography of not one of the *amṣār* has been studied from an archaeological perspective; this is not surprising in that many of the better known (al-Fusṭāṭ [Cairo], al-Baṣra, al-Kūfa, Shīrāz) continued to grow and develop, even up to modern times, thus obscuring the earliest phases. Nevertheless, as Sauvaget has clearly shown, earlier plans can often be deduced from the later palimpsest by using good city plans.[2] The search for these earliest foundations is usually possible, needing only initial hypotheses to guide the researcher.

This paper will suggest that the *amṣār* developed out of two differing urban traditions. The first is the orthogonal city plan found in the Classical cities of the Near East and particularly those of the Decapolis. A morphological correlate of this city type was the legionary camp, which became a model for the core of the *amṣār*. Examples of this developmental trajectory are Ayla, the desert castles, 'Anjar, and ar-Ramla. The second, but no less important, tradition of urban planning was that of south Arabia.[3] This urban type is far less defined but a model may be constructed from Umm al-Jimāl, with amplifications based on Mābiyāt and especially al-Madīna. Finally it will be postulated that the great capital of *Miṣr*, al-Fusṭāṭ, may have blended both of these urban traditions into a new entity, the early Islamic city.[4]

## A. The *Miṣr* of Ayla

The first postulate of this paper is that the early Islamic site of Ayla was founded as a *miṣr*, adjacent to an earlier Byzantine town (Ailana, see below).[5] While no documentary evidence for dating this foundation is available, the period within the caliphate of 'Uthmān ibn 'Affān, about A.D. 650, is likely.[6] Literary evidence confirms this date through the traditional association of Ayla with the Umayyad family and later references to some of its original residents as *mawālī* (clients or partisans) of 'Uthmān.[7] Further, 'Uthmān's support for mercantile expansion may be seen in his development of the ports of al-Baṣra and Jidda (and perhaps the ports on the Levantine coast under his governor, Mu'āwiya). The foun-

[1] The literature on Islamic cities is vast; for one critical overview, see J. L. Abu-Lughod, 'The Islamic City — Historic Myth, Islamic Essence, and Contemporary Relevance,' *IJMES* 19 (1987), 155-176.

[2] J. Sauvaget's brilliant work is best known in 'Le plan de Laodicée-sur-Mer,' *BEO* 4 (1934), 81-114; and *Alep, éssay sur le développment d'une grande ville syrienne, des origines au milieu du XIXe siècle* (Paris, 1941). The exclusive identification of orthogonal plans with the Classical city in the Middle East is countered by E. Wirth, 'Die Orientalische Stadt,' *Saeculum* 26 (1975), 63.

[3] This urban tradition is postulated as having its developmental core in pre-Islamic south Arabia (Yemen) and having spread northward during the first half of the first millennium A.D. Description as "south Arabian" and "Arabian" will be used interchangeably for present purposes.

[4] A preliminary version of this paper was read at the workshop, 'Land Use and Settlement Patterns in the Byzantine and Early Islamic Near East,' the Late Antiquity and Early Islam Research Project, London, 1991 (repeated in the panel, 'The Amsar: New Perspectives on the Early Islamic City,' MESA conference, 1991).

[5] The suggestion that the excavated site of Ayla was a *miṣr* was first presented in 'First Report,' 266. and 'Umayyads,' 174-176 (see n. 10 for Aqaba bibliography).

[6] Archaeological evidence for this foundation date is presented in Whitcomb, 'Umayyads,'167-172 based on eight stratigraphic soundings. The ceramic assemblages, generally from 3-4.5m below surface, had an impressive consistency (confirmed by further work in 1988 through 1993 and separate investigations of nearby kilns); these types are usually described stylistically as late Byzantine (sixth-seventh centuries A.D.). Though the water table has interfered with further digging, there is no indication of Roman levels (third-fourth centuries) beneath this phase (rarely, earlier Nabataean sherds are found in all levels). Thus, initial occupation of this site may be placed in the seventh century, under the Rashidun or first Umayyad caliphs, before ceramic traditions began to change.

[7] See Whitcomb, 'Umayyads,' 174-175.

dation of a new port at al-'Aqaba would fit well with this pattern of commercial development.

Historical evidence indicates that there was a pre-Islamic town at al-'Aqaba, here called Ailana to distinguish it from early Islamic Ayla. The bishop of Ailana made a treaty with the Prophet well before the Muslim conquest. For the locational relationship of the *miṣr* of Ayla to the Byzantine town, one may turn to the widely-traveled geographer, al-Muqaddasī:

> Wayla, a city on the edge of the branch of the China Sea, is very prosperous, ...the port of Palestine and the storehouse of the Ḥijāz. The people call it Ayla, but the ruins of Ayla are nearby....[8]

This [true] Ayla, which al-Muqaddasī thought was Elath, the "town by the sea" mentioned in the Qur'ān and Bible, now may be identified with the vast ruin field of the Nabataean, Roman and Byzantine town. Surface sherding to the northwest of the early Islamic city walls, for a distance of about 500 meters, has produced concentrations of sherds of these periods. The slight mounding of this area suggests that the remains of the Byzantine town lie next to the Islamic town and it is these extensive ruins which could still be seen in the 10th century.[9]

The discovery and delineation of the plan of the early Islamic city of Ayla is the result of recent excavations (from 1986 through 1993; FIG. 1).[10] These excavations have revealed a walled city with towers and four gates, preserved 4.5m in height. A length of some 80 meters of the northwest city wall was cleared in 1987, including two semi-circular towers flanking the Egyptian gate (Bāb Miṣr). In 1988 two further gates, the Sea gate (Bāb al-Baḥr) and southeast gate (Bāb al-Ḥijāz), were discovered. The plan of the city (165 x 140m) is marked by axial streets dividing the town into four quadrants. The central crossing originally had a tetrapylon, excavated in 1987; this building later became a wealthy merchant's residence.

At our present stage of research, the plan of the fortified complex, or *miṣr*, of Ayla shows irregularities resulting from later structural changes during the Abbasid and Fatimid periods (ninth - 11th centuries). There is discernible, however, an original plan characterized by formal elements done in Byzantine style. This fine, early construction may be seen in the monumental and well-carved arched gateways and the arches of the tetrapylon. Further, the massive towers are based on much earlier prototypes and do not seem primarily defensive (see below). The artifactual assemblage accompanying these early structures continues the late Byzantine style typologically, as one might expect.[11]

### B. Orthogonal Cities and Military Camps

There is no direct evidence for the configuration of an Arab military camp in the early Islamic or immediately pre-Islamic periods. The apparent militaristic character of Ayla derives from the similarity in plan between these remains and Roman/Byzantine legionary camps. The suggestion that Ayla was actually built as the camp of the 10th Fretensis legion, briefly stationed at 'Aqaba during the fourth century, has no archaeological basis.[12] An alternative interpretation, which better fits the evidence, is that the urban plan of Ayla takes its inspiration from remains of older Roman camps, which in turn reflect the prevalent style of orthogonal planning.

There are important comparisons between the fortified complex being excavated at al-'Aqaba and Roman legionary forts (especially in southern Jordan). Architectural comparison may be based on parallels with the legionary camps at al-Lajjūn[13] and Udhruḥ[14] in Jordan.

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8 Al-Muqaddasī, *Kitāb Aḥsan al-Taqāsīm fī Ma'rifat al-Aqālīm*, (M. de Goeje, ed.) (Leiden, 1906; BGA 3), 179. His use of the name, "Wayla," is apparently a diminutive and suggestive of the extent of Byzantine ruins still visible in the 10th century.

9 Archaeological evidence for the pre-Islamic settlement has recently been surveyed; west of the site of Ayla, the remains of this Nabataean/early Roman site are at least 250 x 200m in extent. Preliminary descriptions may be found in Whitcomb, *The Oriental Institute, Annual Report 1989-1990* (1991, 45-48) and in J. Meloy, *ADAJ* 35 (1991), 397-414.

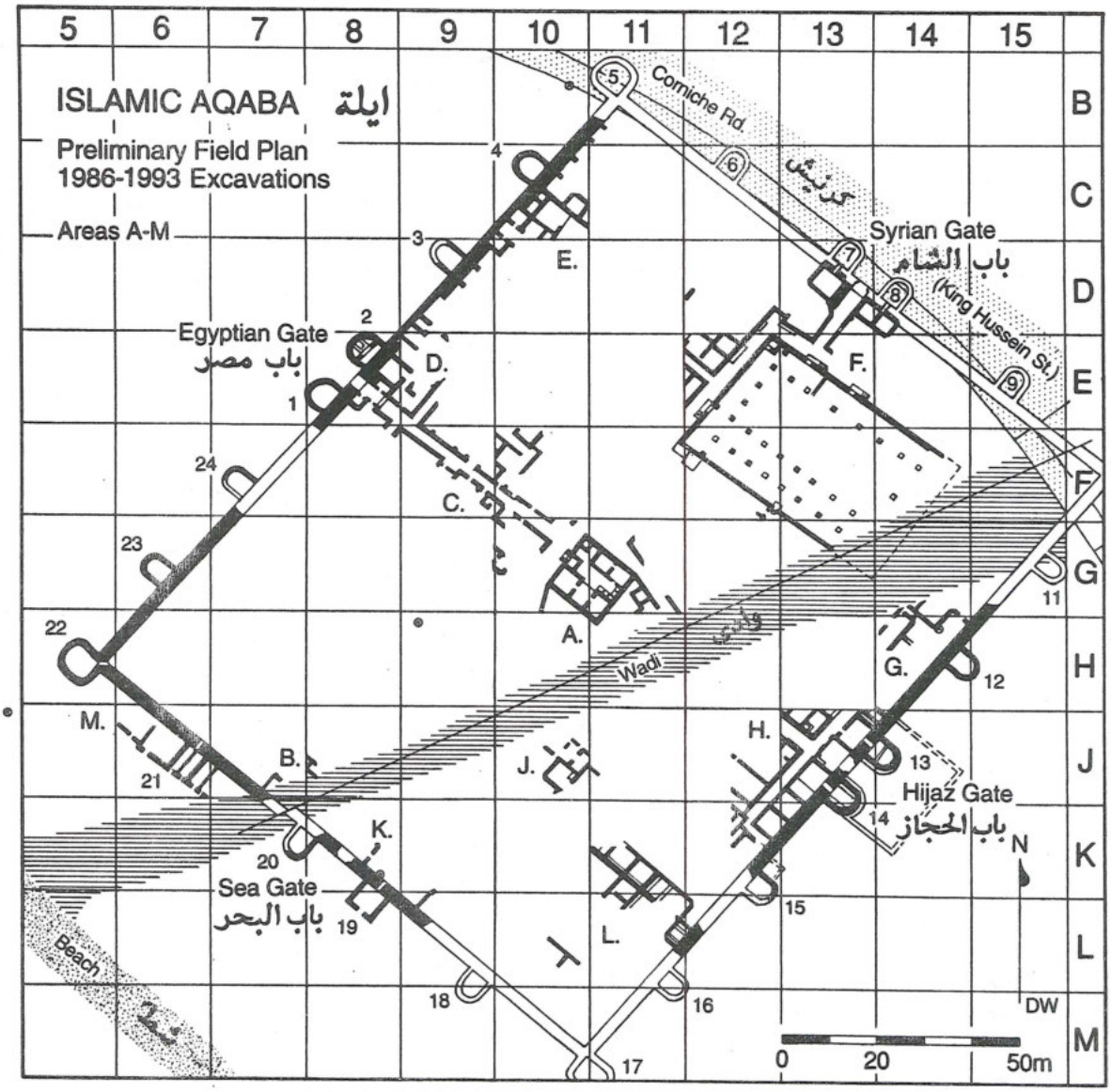
10 The excavations in al-'Aqaba are a joint project sponsored by the University of Chicago and the Department of Antiquities of Jordan under the direction of the author. The success of this project is due to the assistance of many individuals, especially Dr. Ghazi Bisheh, Dr. Dureid Mahasneh, and Mr. Mohammad Balqar. Funding was provided by the University of Chicago, National Geographic Society and USAID.
Results of these excavations appear in a series of articles: D. Whitcomb, 'Excavations in Aqaba: First preliminary report,' *ADAJ* 31 (1987), 247-266; 'A Fatimid Residence in Aqaba, Jordan,' *ADAJ* 32 (1988), 207-224; 'Evidence of the Umayyad Period from the Aqaba Excavations,' *The Fourth International Conference on the History of Bilad al-Sham During the Umayyad Period* (M. A. Bakhit and R. Schick, eds.) (Amman, 1989), 2, 164-184 [hereafter, 'Umayyads']; 'Coptic Glazed Ceramics from the Excavations at Aqaba, Jordan,' *JARCE* 26 (1989), 167-182; 'Mahesh Ware: Evidence of early Abbasid occupation from southern Jordan,' *ADAJ* 33 (1989), 269-285; 'Glazed Ceramics of the Abbasid Period from the Aqaba Excavations,' *Transactions of the Oriental Ceramic Society* 55 (1990-91), 43-65; 'The Fourth Gate at Ayla: A Report on the 1992 Excavations at Aqaba,' *ADAJ* 37 (1993), 533-547; and A. Melkawi, K. 'Amr and D. Whitcomb, 'The Excavation of Two Seventh Century Pottery Kilns at Aqaba,' *ADAJ* 38 (1994), 447-468.

11 Deep soundings give stratigraphic evidence of the historical sequence from the mid-seventh century to the arrival of the Crusaders, a period of 450 years. The location of the congregational mosque was discovered in 1993, the structure formerly labeled the Large Enclosure. This mosque encroached over the axial Syrian street in early Abbasid times; the configuration of the earlier mosque remains to be determined.

12 This hypothesis has appeared in a review by E. A. Knauf and C. H. Brooker in *ZDPV* 104 (1988), 179-181. Evidence against this interpretation may be found in Whitcomb, 'Umayyads' and a detailed response in *ZDPV* 106 (1990), 156-161. The location of the legionary camp remains problematic. The presence of Roman and Byzantine sherds suggest the camp should be nearby. It is worth noting that the pre-Islamic site consists of flat ground with very few sherds, just like the site of the present excavations before work began in 1986. The current excavations have revealed city walls, now cleared over 4m deep and 2m wide, which had left *absolutely no trace on the surface*. This problem may soon be resolved with the excavations of S. Thomas Parker in West 'Aqaba.

13 S. T. Parker, *Romans and Saracens: A History of the Arabian Frontier* (Winona Lake, 1986).

14 A. C. Killick, *Udhruh, Caravan City and Desert Oasis* (Romsey, 1987).




1. Plan of al-'Aqaba, resulting from 1986-1993 excavations.

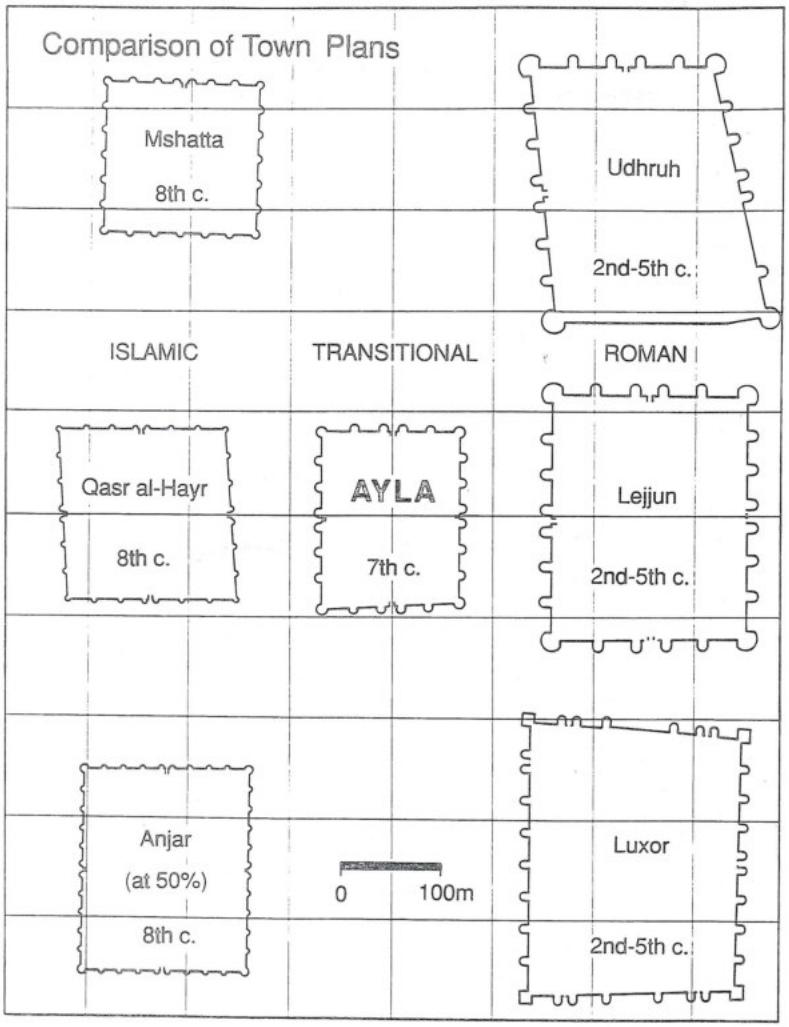
To these examples might be added the camps at Luxor and Babylon in Egypt[15] and at Pelusium in north Sinai.[16] The elements for comparison are the rectangular form and the presence of four gates, U-shaped towers, and a central structure (tetrapylon). Proportions of these rectangular complexes are very close, but the overall size of the structure at al-'Aqaba is much smaller than that of the Roman forts (see FIG. 2). Parker notes the area of al-Lajjūn at 4.6 ha. and Udhruḥ at 4.7 (Luxor may have been roughly the same); the walls of Ayla enclose a space of less than 2.5 ha, making this exceptionally small as a camp.[17]

The very deep, U-shaped towers, apparently typical of the four Diocletianic camps described, are markedly different from the Ayla towers; these latter towers are much closer to those of early Islamic sites illustrated in FIG. 2. The only point of comparison between the towers at al-'Aqaba and the Roman towers is the open interior, which differs from the solid construction typical of the early Islamic "desert castles." Finally, the central structure or "tetrapylon" at al-'Aqaba, though only partially known at this point, is apparently distinct from all other examples cited.

[15] M. el-Saghir *et al., Le camp romain de Louqsour* (Cairo, 1986).

[16] M. Abd el-Maqsoud, 'Excavations at Tell el-Farama (Pelusium),' *ASAE* 70 (1984-1985), 3-8.

[17] Parker, *op. cit.*, 63.




2. Comparison of Roman legionary camps (second-fifth centuries) and early Islamic sites (eighth century) to town plan of Ayla.

*"Desert Castles" as Amṣār*

The so-called early Islamic "desert castles," found most often in isolated circumstances, are composed of many elements: baths, reception halls, lodgings. While they usually have strong walls with gates and towers on the periphery, there is no specific evidence of a militaristic function.[18] One might suggest that the walls and formal, peripheral elements composed definitional limits for the urban entity, rather like the towered walls used as the symbol for cities on early maps. One must also bear in mind that, whatever the function of these structural complexes, they are unlikely to have been loci of innovation but rather reflective of architectural developments within (or adjacent to) cities.[19]

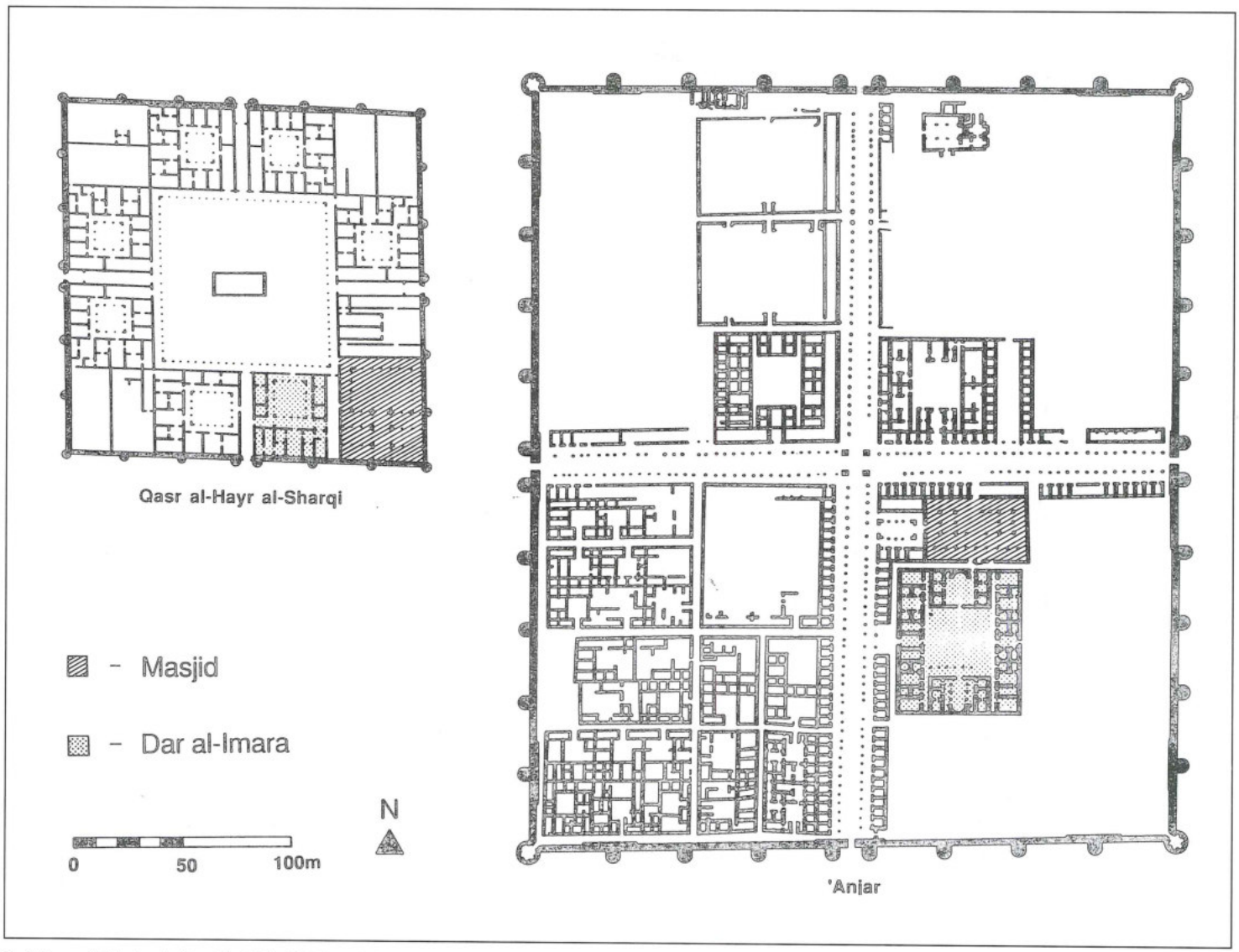
The Large Enclosure at Qaṣr al-Ḥayr ash-Sharqī, which forms one of the closest parallels to Ayla in external configuration (FIG. 3), is another example of an early Islamic urban foundation. This complex is described by Grabar as "a planned urban entity — essential units of a medieval Islamic city: mosque, sūq, bath and residential quarters;" and indeed, he identifies this site as the "*madīna*" of a lost inscription.[20] The enclosure had four gates, though two were sealed shut quite early, rather like the Ḥijāz gate at Ayla. The six *buyūt* of this structure seem a rather limited residential area for a city, unless this complex is for representatives of six groups (tribes or clans?). On analogy with the larger *amṣār* (see below), primary residential areas would be outside this structure, where Grabar did find extensive mud-brick ruins.[21] The mosque and room identified as the *Dār al-*

[18] The defensive elements at Qaṣr al-Kharrāna have long been cited and are now convincingly disproved; see S. Urice, *Qasr Kharana in the Transjordan* (Durham, NC, 1987).

[19] This view is contra that of Urice, *op. cit.*, and S. Helms, *Early Islamic Architecture of the Desert: A Bedouin Station in Eastern Jordan* (Edinburgh, 1990).

[20] O. Grabar *et al.*, *City in the Desert, Qasr al-Hayr East* (Cambridge, 1978), I, 40-89; see especially, 79-80. The plan on FIG. 3 is after his FIG. 23D.

[21] Grabar, *op. cit.*, 106.




3. Plans of 'Anjar (after Chehab 1975) and Qaṣr al-Ḥayr ash-Sharqī (large enclosure; after Grabar 1978, FIG. 23D).

*Imāra* are located in the southeast quadrant, as in the larger site of 'Anjar, suggesting that this section of urban sites in Bilād ash-Shām may have special significance.[22] Clearly the original plan of the *miṣr* of Ayla will fall between the examples of 'Anjar and Qaṣr al-Ḥayr ash-Sharqī.

*'Anjar and ar-Ramla as Islamic Settlements*

As noted above, the original plan of Ayla seems to have formal aspects (walls, towers, and street plan) reminiscent of Byzantine urban forms. These structural details may have been taken from the neighboring Byzantine town or other settlements in the region (e.g., Udhruḥ, al-Lajjūn). Another early Islamic foundation clearly illustrates this principle. The city of 'Anjar ('Ayn al-Jarr) in southern Lebanon is securely dated to the Umayyad period. The size of 'Anjar is almost exactly twice the dimensions of Ayla, ca. 370 x 310m. The towered walls, axial streets, tetrapylon, and other details indicate a common architectural tradition with Ayla (see FIG. 3).[23] Beyond the elements of a Classical town, there is the mosque and Dār al-Imāra located in the southeast quadrant of the town. Whatever other details should emerge from these excavations, this site must stand as a prime testament to planned urban design in the early Islamic period.

Another city which should have special interest for the student of the early Islamic city is ar-Ramla, founded

[22] This locational hypothesis was tested in Ayla during the short 1989 season of excavations; the results were inconclusive.

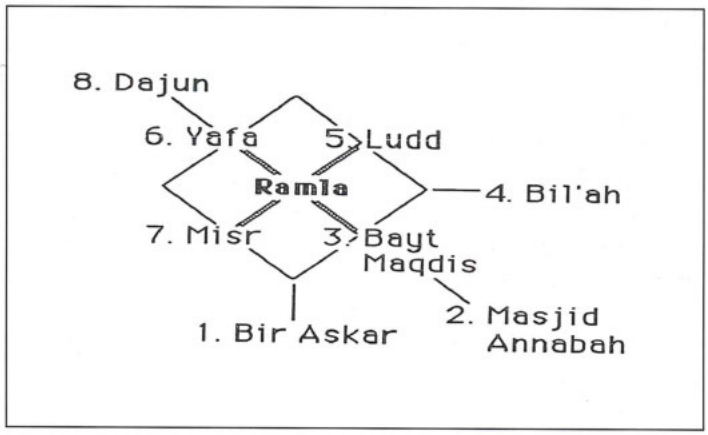
[23] For the unfortunately limited information on this important site, see H. Chehab, 'The Umayyad palace at 'Anjar,' *Ars Orientalis* 5 (1965), 17-27, and his 'Les palais omeyyades d'Anjar,' *Archaeologia* (1975), 18-25, as well as J. Sauvaget, 'Les ruines omeyyades de 'Andjar,' *Bull. Musée de Beyrouth* 3 (1939), 5-11. The plan on FIG. 3 is after Chehab's 1975 article.

by Sulaymān ibn 'Abd al-Malik before 717. This city was founded with the clear intention of serving as a new capital of Filisṭīn, administrative center of this important province. The city held a palace, mosque, "dyer's house" (*Dār aṣ-Ṣabbāghīn*) with a large tank in the center; an aqueduct fed a series of water reservoirs. Abū'l Fidā' mentions a palace built by 'Abd al-Malik before the town was founded, a report which may reflect the character of the original urban core (as remembered in the 13th century).

Al-Muqaddasī's report on ar-Ramla in the 10th century is most interesting: within an area of a square mile (ca. 2 x 2km) were numerous public buildings (caravanserais, baths, mosques), wide avenues, large markets, and residences constructed of dressed stone and fired brick. His description of the gates of ar-Ramla offers a key to the configuration of the eighth century city and later expansions.[24] The gates (numbered 1 to 8, FIG. 4) begin in the south and move counter-clockwise around the city to Miṣr (7) in the southwest. Dājūn (8) appears to be added as an afterthought. The Umayyad gates appear to be named for important destinations in four directions: Bayt al-Maqdis (Jerusalem) in the southeast (3), Ludd (the pre-Islamic antecedent) in the northeast (5), Yāfā (the port of Jaffa) in the northwest (6), and Miṣr (Egypt) in southwest (7). This arrangement of gates strongly indicates that the original plan was a rectangle or square with axial streets meeting in the center (paralleling the arrangement found at 'Anjar and al-'Aqaba).

The remaining gates (1, 2, 4, 8) are more localized toponyms, suggesting an expansion of the 10th century city principally to the southeast (this is indeed the direction of the modern town; e.g., Survey of Western Palestine map XIII).[25]

Excavations at ar-Ramla have been remarkably vague in site location; the clearest is the map published by Rosen-Ayalon. This shows her excavations in 1965 at Shikun Giora, where there was a pottery workshop on the "south-western margin of the city" and datable to the eighth and beginning of the ninth century. Northwest of this area is the White Mosque, presumably the congregational mosque of the town; excavations by Kaplan in 1949 and 1956 indicated an original Umayyad construction. Finally a remarkable series of eighth century mosaics was excavated by M. Brosch in 1973 to the southeast of this mosque and possibly associable with the Dār al-




4. Reconstruction of the ar-Ramla gates.

Imāra or other official building.[26] The spatial implication for the organization of the Umayyad city is that the White Mosque must have been in the southern quadrant and not the center of the city.[27]

Amṣār such as Ayla, 'Anjar, and Qaṣr al-Ḥayr ash-Sharqī were settlements of a type intermediate between the theoretical camp and the metropolis; as structures comprising residential, religious and political functions, they may properly be designated as urban centers. The example of ar-Ramla, while not proven to have been orthogonal in design, adds another dimension to the *amṣār*. This is the transformation of the term to refer to capital cities, best exemplified in al-Muqaddasī's system. The largest and best known of the *amṣār*, al-Baṣra, al-Kūfa and al-Fusṭāṭ, have a direct relation with these smaller early Islamic cities. Each of these cities may be posited to have had orthogonal central elements, called the Ahl al-'Aliya, "Ahl al-Kūfa," and Ahl ar-Rāya respectively. Each urban center apparently had axial streets, residential areas (*qaṭā'ī*) and a relatively open institutional center (containing the mosque and *Dār al-Imāra*). The plan of Ayla, and perhaps the "desert castles," may represent models of the urban core (orthogonal central elements) around which the larger city developed. The Ahl ar-Rāya at al-Fusṭāṭ is one such urban core (to be discussed below).[28]

### C. *Amṣār* and Arabian Cities

The second urban tradition, that of south Arabia, is non-orthogonal and its principals of organization are less well understood. Indeed, the very identification as urban has

[24] Al-Muqaddasi, *op. cit.*, 165.

[25] Names of the later gates were taken from the quarter (*darb*) suggesting that urban sprawl by the 10th century encapsulated some of the gates. Again modern toponyms allow a relative location of these gates: Masjid 'Annābah (the present village of 'Annābah) in the southeast, Bil'ah (Balah, associated with Abū Gawsh) in the east, and Dājūn (the village of Bayt Dajan) in the northwest. The remaining gate, Bir 'Askar, may be located approximately to the south; this follows from the order of al-Muqaddasī's list. This system parallels precisely the list of gates in early Islamic Shīrāz, see D. Whitcomb, *Before the Roses and Nightingales: Excavations at Qasr-i Abu Nasr, Iran* (New York, 1985), 227.

[26] J. Kaplan, 'Excavations at the White Mosque in Ramla,' *'Atiqot* 2 (1959), 106-115; M. Rosen-Ayalon and A. Eitan, *Ramla Excavations: Finds from the VIIIth century C. E.* (Jerusalem, 1969), and Rosen-Ayalon, 'The First Mosaic Discovered in Ramla,' *IEJ* 26 (1976), 104-119.

[27] D. Sourdel, 'La fondation umayyade d'al-Ramla,' *Studien zur Geschichte und Kultur des Vorderen Orients: Festschrift für Bertold Spuler* (H. R. Roemer and A. Noth, eds.) (Leiden, 1981), 388-395.

[28] An earlier version of this paper makes a case for central urban cores at al-Baṣra (Ahl al-'Aliya) and at al-Kūfa.

often been questioned; there are many who would state that pre-Islamic Arabia had no cities or was at best in a proto-urban stage of development. The direct ramification of this attitude is that the *amṣār* have been characterized as primitive military camps, as "mass encampments, tent or makeshift settlements ... of bedouin migrants."[29] The cultural denigration implied in these accounts is a dominant historical tradition, reflecting negative prejudices and clouding evaluation of subsequent developments.

One must begin with a definition of urbanism, a field of continuing scholastic discussion. The city (or town) as an archaeological artifact is a built form reflecting a distinctive social, political and economic organization. A definition used here is that "...the city is not merely an aggregation of population of critical size and density but also an organizing principle, an agent of regional integration ... a creator of effective space."[30] Thus cities are nodes of interaction networks characterized by the institutional exchange of both information (encompassing administrative and ritual functions) and material goods (primary economic functions). These administrative, ceremonial and economic functions may have archaeological manifestations in architectural features indicating urban sites. Thus the presence of a *Dār al-Imāra*, congregational mosque, and *sūq* necessarily indicate urban functions relating the particular settlement to a regional system.

An urban style of life is more recognizable in the classically derived towns of north Syria than the settlements of western, and more particularly southwestern, Arabia.[31] A delineation of archaeological features which may be taken as indicative of the Arabian urban type would require a detailed study in and of itself, far beyond what might be attempted in this paper. There now appears to be a growing corpus of archaeological evidence — unfortunately still very incomplete — which bears on this subject.

One may begin with the site of Umm al-Jimāl in northern Jordan as an example of an Arabian city. The status of this settlement as a town has not been questioned, nor does it derive from its classical antecedents. The most recent plan is, in the words of its excavator, a settlement of the sixth and seventh centuries (FIG. 5). The standing ruins of more than 150 buildings (within ca. 800m x 500m) are grouped into three irregular clusters.[32] Knauf has pointed to the expansion of domestic architecture and claims these houses as typical of the Arabic dār.[33] The multiplication of small churches suggests a social fragmentation (clans?). The settlement was not enclosed within a defensive wall. The occupation of this town continued throughout the Umayyad period, though there is little explicit evidence published. One aspect of this early Islamic period appears to be the "deluxe refurbishing" of the praetorium; what appeared to be similar to a "desert castle" might be the urban administrative center (the *Dār al-Imāra* ?).[34]

A second archaeological example is the site of al-Mābiyāt, identified as the town of Qurḥ (or Wādī al-Qurā).[35] Al-Muqaddasī describes Qurḥ in the 10th century as the second largest city of al-Ḥijāz (after Makkā), "as well as the most flourishing and populous, the most abounding in merchants, commerce and wealth ... a Syrian, Egyptian, Iraqian, and Hijazite city all in one."[36] Materials from the initial survey in 1968-69 strongly suggests an eighth century date, indicating an Umayyad foundation.[37] There are abundant connections with ceramics of Umayyad and early Abbasid (Mahesh wares) at al-'Aqaba.[38] The plans published to date suggest an irregular structure, a defensive perimeter made up of adjacent house complexes (FIG. 6A).

The city of al-Madīna was the pivotal focus for Jazīrat al-'Arab in the early Islamic period. While there have been interesting studies of the mosque of the Prophet in al-Madīna,[39] further archaeological work has been limited for obvious reasons. The pre-Islamic settlement of Yathrib has been taken as a type pattern for proto-urbanization in al-Ḥijāz. King has recently pondered, "Was there any town center [in pre-Islamic Yathrib]? Or was Yathrib a scatter of fortified farmsteads and hamlets

29 I. M. Lapidus, 'The Evolution of Muslim Urban Society,' *Comparative Studies in Society and History* 15 (1973), 21-50. His discussion of early Islamic urbanization, here taken as typical of widespread assumptions, is found on pages 24-28.

30 This discussion follows the position of P. Wheatley, *Nagara and Commandery: Origins of the Southeast Asian Urban Traditions* (Chicago, 1983), 7-8.

31 The question is whether an urban ideology as part of Islamic culture was part of the legacy of pre-Islamic Arabia or was formalized in the aftermath of the conquests. The position adopted here is that further research will confirm the former as the more dominant trait.

32 "The striking feature of the town plan is its disorder and lack of preconceived design ... Umm al-Jimal ... represents the indigenous way of life...," B. De Vries, *Umm el-Jimal, a tour guide* (Amman, 1982), 20.

33 E. A. Knauf, 'Umm al-Jimāl: An Arab town in late antiquity,' *RB* 91 (1984), 579; he uses as his Arabian referent J. Wellhausen, 'Medina vor dem Islam,' *Skizzen und vorarbeiten* 6 (Berlin, 1889), 1-64, 4-6, 17-22. De Vries states that the completed plan of the city represents the occupation of the sixth through eighth centuries in 'Research at Umm el-Jimal, Jordan, 1972-1977,' *ADAJ* 26 (1982), 107, and his summary in 'The Umm el-Jimal project, 1971-77,' *BASOR* 244 (1981), 53-72.

34 B. De Vries, 'Urbanization in the Basalt Region of North Jordan in Late Antiquity: The Case of Umm el-Jimal,' *Studies in the History and Archaeology of Jordan,* II (Amman and London, 1985), 255.

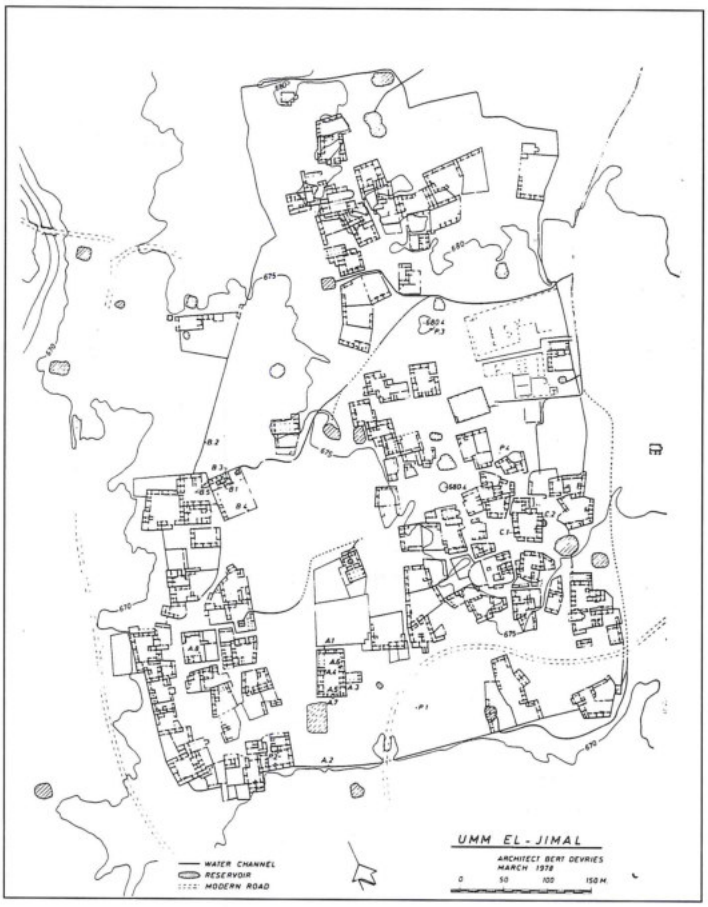
35 A. A. Nasif, 'The Identification of the Wâdi 'l-Qurâ and the Ancient Islamic Site of al-Mibyât,' *Arabian Studies* 5 (1979), 1-19.

36 Al-Muqaddasī, *op. cit.*, 83-84.

37 This is based on close comparisons from Jordan ('Ammān, Mt. Nebo) and Khirbat al-Mafjar, P. J. Parr *et al.*, 'Preliminary Survey in N.W. Arabia, 1968,' *BIA* 8-9 (1968-1969), 201. The excavations in 1984 revealed only a later 10th and 11th century occupation; M. Gilmore *et al.*, 'A Preliminary Report on the First Season of Excavations at al-Mabiyat, an early Islamic site in the northern Hijaz,' *Atlal* 9 (1985), 109-125, TABLE 4.

38 D. Whitcomb, 'Umayyads,' 'Mahesh;' see note 10.

39 J. Sauvaget, *La mosquée omeyyade de Medine* (Paris, 1947), and G. Bisheh, *The Mosque of the Prophet at Madinah Throughout the First-Century A.H. with Special Emphasis on the Umayyad Mosque* (Ann Arbor, 1979).




5. Plan of Umm al-Jimāl (after de Vries 1982, FIG. 9).

spread through the oasis ...." This idea is based on the existence of apparently early fortified towers (*'uṭum*, pl. *āṭām*) which reflected the clan-based social structure and potential for intra-communal conflict in these settlements.[40] It is interesting that the residence and mosque of the Prophet was empty land at the time of the hijra (and remained east of the center of the later town; see FIG. 6B). The town was not walled until A.D. 974.

The physical structure of al-Madīna may have a further significance. Bisheh notes that, "...in many cities the mosque and the administrative center, Dār al-Imāra, stood in a physical relationship which reproduced that of the Prophet's mosque and his private quarters in Madinah." Just as the mosques of the *amṣār* may have had a general prototype,[41] the town plan of Madīnat an-Nabī may have influenced the search for ideas on Islamic urbanization.

The city of Najrān was an important urban center for southwestern Arabia spanning the pre-Islamic and early Islamic periods. The eastern part of the site is the walled citadel of Ukhdūd (with a pre-fourth century "South Arabian" date) which featured a prominent church (not yet securely identified). Occupation in the sixth and seventh centuries seems to show a gradual shift of location to the northwest.[42] The plan of the ruins of Najrān exhibits the strangely irregular form (FIG. 6C), noted above at al-Mābiyāt and apparently typical of other southwestern Arabian towns.[43] It may be suggested that the eventual growth of town limits (and functionally a wall) grew out of the coalescence of individual structures. These buildings (or better, building complexes) may have been similar to the *āṭām* of al-Madīna. This pattern of isolated buildings, gradually infilled and transformed, may also be seen at the site of ar-Rabadha (c. 170km east of al-Madīna).[44] The transformation of settlement clusters into an urban entity has been advanced as a model for the process of early urbanism.[45] The hypothesis of a cluster pattern in Arabian urbanization may be a phenomenon which spread from South Arabia into al-Ḥijāz during the pre-Islamic period.

Mez has defined one of the urban traditions contributing to the early Islamic city as "the [south] Arabian city such as Ṣan'ā', to which type Mekka and Fusṭāṭ belonged."[46] Amplification of this urban system will depend on study of the socio-cultural background; Dostal has proposed two urban types based on social organization. The first is called the Ṣan'ā'–formation, developed from a market center and inhabited by groups of the same tribe with social differentiation based on his "farmer-craftsman" technological specializations. The second urban type is the Tarīm-formation, in which quarter organization reflects the social structure of a multi-tribal settlement (FIG. 6D).[47] This latter ethnographic type might have approximated the social organization, and hence the physical structure, of the *amṣār*.

[40] G. R. D. King, 'Settlement in Western and Central Arabia and the Gulf in the 6th-8th Centuries A.D.' Paper for the 'Settlement Patterns in the Byzantine an Early Islamic Near East,' an unpublished paper read at the Late Antiquity and Early Islam Workshop (London, 1991), 15-17. Two of the āṭām, believed to be pre-Islamic in date, are briefly described in A. Ansari, *Athar al-Madina al-Munawwara* (Madina, 1378), 43-53; see G. Bisheh, 81-82.

[41] G. Bisheh, *op. cit.*, p. 154-155.

[42] Survey and preliminary excavations have resulted in a ceramic typology, discussed but not presented in J. Zarins *et al.*, 'Preliminary Report on the Najrān/Ukhdūd Survey and Excavations 1982/1402 AH,' *Atlal* 7 (1983), 22-40.

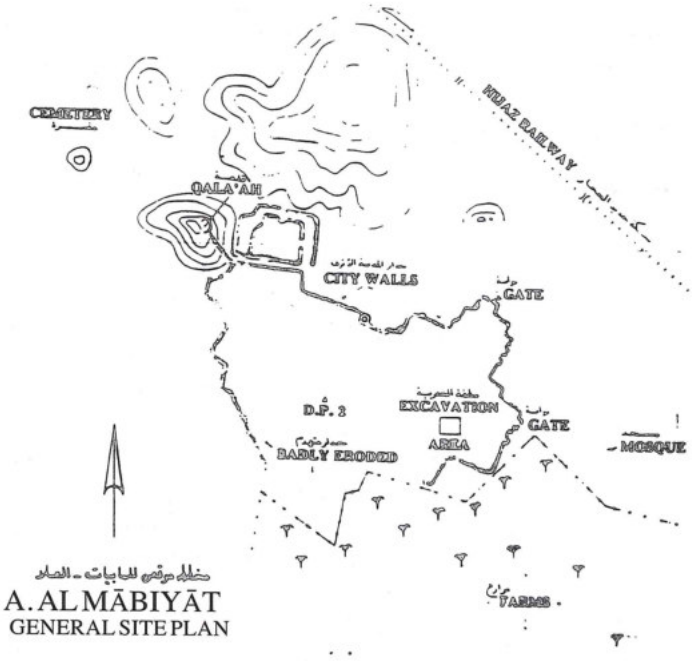
[43] An impression of town plans may be gathered from air photographs published by P. M. Costa, 'Aspetti dell'insediamento urbano antico nella penisola araba,' *Studi in onore di Francesco Gabrieli nel suo ottantesimo compleanno* (R. Traini, ed.) (Rome, 1984), vol. 1, 253-260. The Islamic city of Baraqish seems particularly promising. One may expect further structural comparanda as such sites come to be excavated.

[44] S. A. al-Rashid, *al-Rabadhah: Portrait of Early Islamic Civilisation in Saudi Arabia* (Harlow, 1986).

[45] A recent exploration of this cluster model is found in R. J. McIntosh, 'Early Urban Clusters in China and Africa: The Arbitration of Social Ambiguity,' *Journal of Field Archaeology* 18 (1991), 199-212, which relies heavily on the ideas in P. Wheatley, *The Pivot of the Four Quarters* (Chicago, 1971).

[46] A. Mez, *Die Renaissance des Islams* (Heidelberg 1922), 389; this seminal idea is presented without documentation or further discussion.

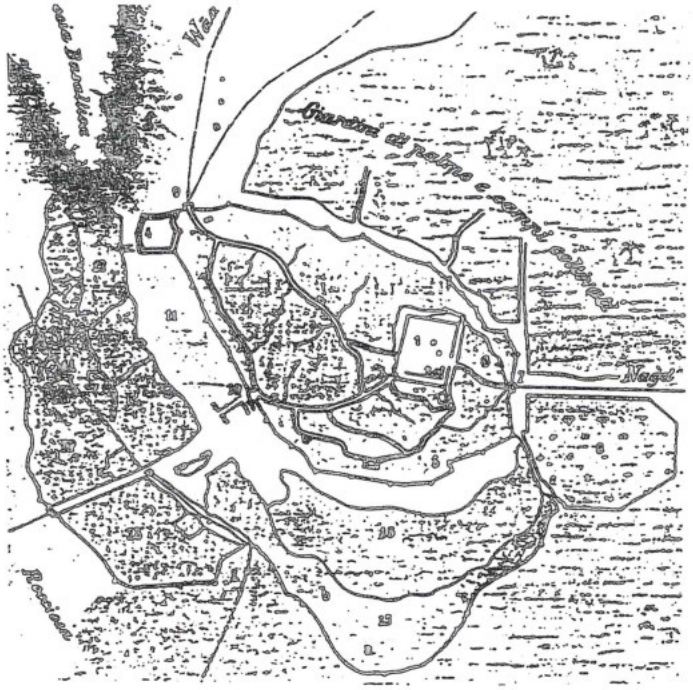
[47] W. Dostal, 'Towards a Model of Cultural Evolution in Arabia,' *Studies in the History of Arabia,* vol. 2: *Pre-Islamic Arabia* (Riyadh, 1984), 188-189. See also his 'Zum Problem der Stadt- und Hochkultur im vorderen Orient: Ethnologische Marginalien,' *Anthropos* 63 (1968), 238-240.



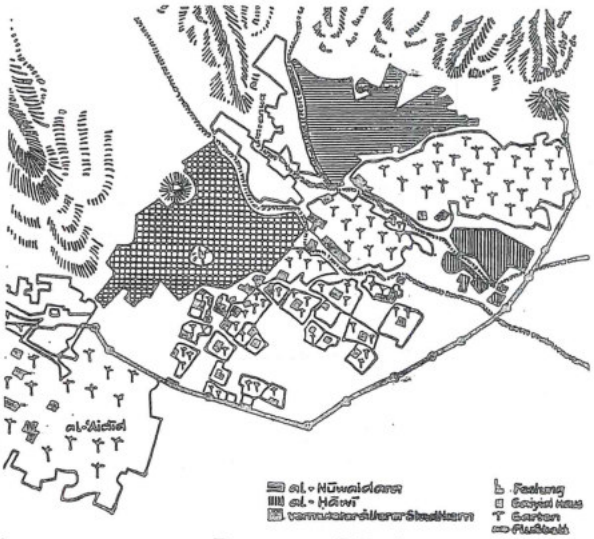

A. AL MĀBIYĀT
GENERAL SITE PLAN



C. Najran

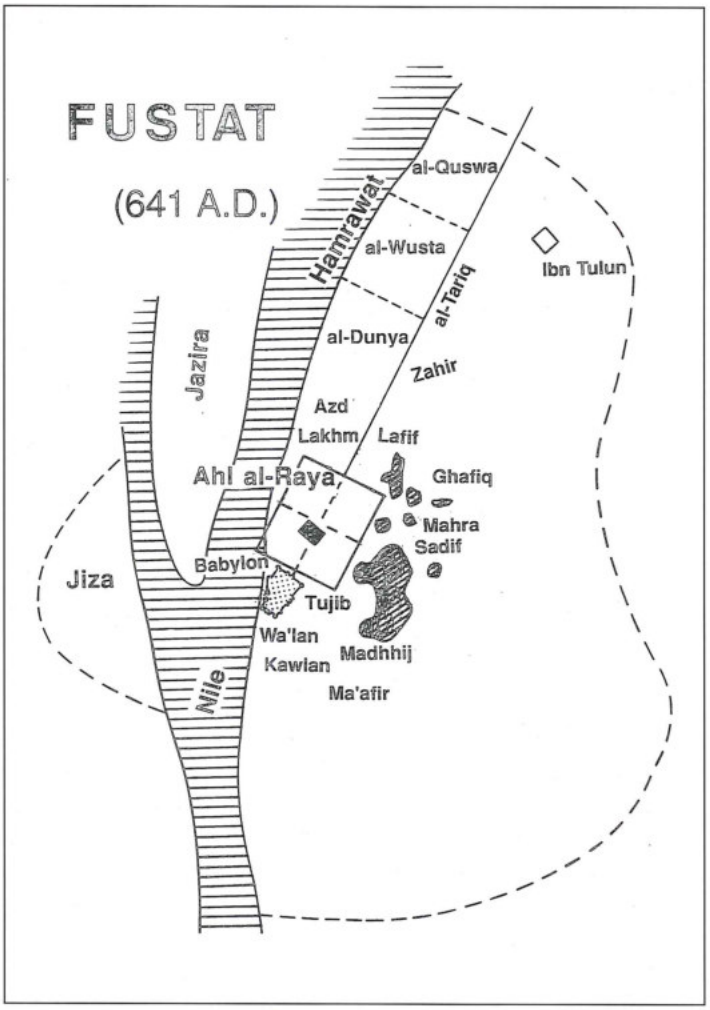


B. al-Madina



D. town of Tarim

6. A. Plan of al-Mābiyāt (after Gilmore 1985: PL. 97); B. Plan of al-Madīna (after L. C. Caetani, *Annali dell'Islam*, vol. 2 [Milan, 1907], opp. p. 71); C. Plan of Najrān (Ukhdūd; after Zarins *et al.* 1983: PL. 16); D. Plan of the modern town of Tarīm in Ḥaḍramaut (after Dostal 1968: Abb. 3).




7. Reconstruction of al-Fusṭāṭ (based, in part, on Kubiak 1982: plan 1).

## D. Al-Fusṭāṭ: An Arabian or Orthogonal City?

Al-Fusṭāṭ enables us to examine the hypothetical effects of the dual urban traditions on the most important of the *amṣār*.[48] Perhaps more than any other *miṣr*, the development of this capital has been discussed in terms of the *khiṭaṭ*. The methodology has resulted in the reconstruction of tribal settlements across the plain south of Cairo (al-Qāhira).[49] The settlement of al-Fusṭāṭ was placed next to the older Roman and Byzantine legionary fort of Babylon (or Qaṣr ash-Sham').[50] In the center of the city was the mosque of 'Amr and, to the northeast, the house of 'Amr (identical in original size).

These structures (or better, institutions) were located in the *khiṭṭa* of Ahl ar-Rāya, "the people of the banner;" this focus of the city (estimated at 400-500 men) was composed of prominent individuals from a variety of tribes.[51] According to Kubiak, the "larger clans..., in addition to what they held within the Ahl al-Rāya, were given parcels for settlement in other parts of the site."[52] It follows that the lists of *khiṭaṭ* which have been recorded for al-Fusṭāṭ may represent a conflation of both "types" of *khiṭaṭ*, those within the urban center (inside the Ahl ar-Rāya) and those dispersed across the plain (the suburban *khiṭaṭ*).

What was the Ahl ar-Rāya? One may reasonably suggest a planned urban center of square or rectangular shape, taking its orientation from the original mosque of 'Amr (see below). Such a plan challenges the prevalent assumption that, as expressed most recently by Kubiak, "...it would have been unimaginable to set up an Arab camp-city on the regular lines of a typical Roman camp or garrison-town, with straight streets and a checkerboard pattern..."[53] Certainly the archaeological investigations at al-Fusṭāṭ tend to confirm Kubiak's impression, an urban plan with a marked neglect for the right angle.[54] While early Islamic artifacts have been found, the excavations have not demonstrated pre-Tulunid occupation in the areas investigated.[55] However, an examination of the distribution of published excavations indicates a distance from the mosque of 'Amr and the fort of Babylon (see FIG. 7; hatched areas are excavations). In other words, no excavations have been undertaken inside the Ahl ar-Rāya.

The mosque of al-Fusṭāṭ has been subjected to constant rebuildings; it is likely that the orientation of the city plan was taken from the earliest *qibla*, that of the

48 An earlier version of this paper, presented to the Late Antiquity and Early Islam Workshop, London 1991, also considered details for an orthogonal hypothesis derived from data on al-Baṣra and al-Kūfa. This evidence, while of fundamental importance, is omitted here.

49 Notable examples of such studies are: P. Casanova, *Essai de reconstitution topographique de la ville d'al Foustat ou Misr* (Cairo, 1913-19); A. R. Guest, 'The Foundation of Fustat and the Khittahs of the Town,' *JRAS* 1907, 49-83; and now, W. B. Kubiak, *Al-Fustat: Its Foundation and Early Urban Development* (Warsaw, 1982; Cairo, 1987). For an alternative view of *khiiṭaṭ*, see J. Akbar, 'Khatta and the Territorial Structure of Early Muslim Towns,' *Muqarnas* 6 (1989), 22-32.

50 The legionary fort of Babylon has been mentioned above. Kubiak's discussion, *op. cit.*, is based on A. J. Butler, *The Ancient Coptic Churches of Egypt* (Oxford, 1884), 155-181.

51 The Ahl ar-Rāya is often compared to the *khiiṭaṭ*, al-Lafif and the Zahir as non-tribal groupings; these *khiiṭaṭ*, may have been spaced at intervals along aṭ-Tarīq avenue.

52 Kubiak, *op. cit.*, 62.

53 Kubiak, *op. cit.*, 65. He continues, "Notwithstanding diverse cultural traditions and some experience with town life, it is improbable that at this early date the Arabs founding al-Fustat had any clear idea of town planning or understood it in a precise, preconceived way, as the Romans had."

54 The published excavations fall into two campaigns: that of Aly Bahgat and A. Gabriel and that of Scanlon and Kubiak, the latter of which lasted over 14 years and is just now reaching final publication.

55 This interpretation counters that published by Scanlon and Kubiak in various places, perhaps most specifically in T. Bianquis, G. T. Scanlon and A. Watson 'Numismatics and the Dating of Early Islamic Pottery in Egypt,' *Near Eastern Numismatics, Iconography, Epigraphy and History: Studies in Honor of George C. Miles*. (D. K. Kouymjian, ed.) (Beirut, 1974), 163-173. This article claims to depart from "architectural stylistics" for dating purposes but presents limited situations with serious ambiguities (cf. walls and sections on PL. 2). The addition of numismatic evidence does not relieve the methodological flaw which may be characterized as a tyranny of "ceramic stylistics." One must also note that such methodological criticisms are easy in view of the exceptionally difficult archaeological problems inherent in this site.

Ṣaḥāba.[56] Near the mosque should be the *Dār al-Imāra,* for which there is no direct evidence.[57] Al-Fusṭāṭ was situated next to the fortress of Babylon and an older town, possibly identified as Tandunias. Opinion has been divided whether this town was identical to the Byzantine fortress and ar-Rasad to the immediate south or may be identified as Umm Dunayn to the north near al-Maqs. It is also possible that the name of Tandunias may be associated with Ḥamrā' ad-Dunyā.[58] If the late Byzantine town lay in the Ḥamrāwāt to the north, then one may explain the otherwise surprising continued existence of Babylon (Qaṣr ash-Sham') within al-Fusṭāṭ: it may be suggested that this Byzantine fortress, in the southern part of the Ahl ar-Rāya, adopted the functions of the *Dār al-Imāra* .

With the mosque of 'Amr in the center and the Qaṣr ash-Sham' (*Dār al-Imāra*) on the south edge, one may draw a maximal rectangle 740 x 620m (twice the size of 'Anjar) to represent the institutional center of al-Fusṭāṭ (FIG. 7), which encompasses the *qaṭā 'ī* of the Ahl ar-Rāya.[59] Within this urban center were settled elements of various tribes, on analogy with al-Kūfa: Azd, Lakhm, Lafīf, Ghafīq on the north; Mahra, Ṣadīf, Tujīb, Madhhij on the East; and Wa'lān, Kawlān, Ma'afīr on the south. North of the Ahl ar-Rāya stretched the axial street, known as aṭ-Ṭarīq, past the three Ḥamrāwāt.

Each of the tribes settled in the Ahl ar-Rāya also held *khiṭaṭ* farther away from the river; these *khiṭaṭ* (possibly including the Ḥamrāwāt) formed the Arabian element of the *miṣr* of al-Fusṭāṭ. Later descriptions of al-Fusṭāṭ Cairo suggest other characteristics which may reflect on the early *miṣr.* Specifically, this will be in the great houses of the town, which rose some seven stories and made the city appear to be a mountain from a distance. These high residential blocks sound most similar to the *āṭām* of Arabia, placed apparently without reference to cardinal points and not enclosed in a city wall. Finally, the open spaces separating these residential clusters may also have been an Arabian urban feature. Thus, in what must be only a preliminary hypothesis, the *khiṭaṭ* organized around the urban core (the Ahl ar-Rāya) was a city built in the Arabian tradition. Further, the evolution of the early Islamic city is the conjunction of these two traditions into an urban entity, one which reflected the social and cultural needs of the new Islamic community.

## Conclusions

The phenomenon of the *amṣār* may be seen as a new phase in the urbanization, or more precisely, the urban process in the history of the Middle East. Wheatley has proposed that such developmental process is of two types, urban imposition or urban generation.[60] "Urban imposition ... is virtually inseparable from the expansion of empire and is usually accompanied by the establishment of an administrative organization designed to sustain the value system of the colonial power ...." The position adopted in this paper, that the *amṣār* represent a program of urban imposition, implies that early Islamic culture intentionally reconstituted the social organization of the conquered lands. This view presupposes the existence of institutional components of fully urbanized society in pre-Islamic western Arabia.

On the other hand, these cities may be seen as a "generational process" in which cultural traits of the fully urbanized milieu of the Middle East were integrated into a distinctive Islamic urbanism. In other words, one might see the *amṣār* as an imposed form but the internal structure of these new settlements, both social and physical, to be component traits adopted from existing cities. The orthogonal urban core may be viewed as a mechanism for facilitating this interaction.

The phenomenon of the *amṣār* , while rooted in the camps of the Arab conquest and reflecting a militaristic nature, actually describes the great wave of urban foundations which became a major characteristic of early Islamic culture.[61] The hypothesis which best explains the structures and associated materials found in the current excavations at al-'Aqaba is that the Islamic city of Ayla was founded as a *miṣr* under 'Uthmān ibn 'Affān. The *miṣr* was designed on the model of legionary forts, for which al-Lajjūn, Udhruḥ, and (the still to be discovered) Ailana provided ready examples.[62] It follows from the evidence of Ayla and the early Islamic "desert castles" that early Islamic urban foundations were planned or-

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56 The accompanying plan uses this original orientation, the "*qibla* of the ṣaḥāba" or 117° SE. The mosque of 'Amr shows two wall alignments of two later *qibla*, the "*qibla* of the astronomers" (127° SE) and that of the Ibn Tūlūn mosque (141° SE). For a study of qibla in Cairo, see David A. King, 'Architecture and Astronomy: The Ventilators of Medieval Cairo and their Secrets,' *JAOS* 104 (1984), 97-133. It is interesting that the orientation of 127° southeast is the orientation of Ayla.

57 The house of 'Amr, immediately to the north of the mosque, may have been a first *Dār al-Imāra;* on the other hand, when Qurra ibn Sharrik changed the *qibla* in 710, his enlarged mosque encroached on the house of 'Amr and he compensated the descendants of 'Amr. One must conclude that, at that time, the *Dār al-Imāra* or governor's residence was elsewhere; on the apparent lack of a *Dār al-Imāra* at al-Fusṭṭāṭ, see Kubiak, *op. cit.*, 129.

58 See Kubiak, *op. cit.*, 57, 119. The term Ḥamrāwāt apparently referred to the quarters inhabited by non-Arabs ("red" = white skinned, specifically Greeks and Persians); this was an ethnically composite population, with whole bodies of non-Arab *mawālī.*, Banū al-Azraq, Banū Yanna (Syro-Byzantines), Banū Rūbīl (Jews?). At least 13 churches and one monastery were located in the Ḥamrāwāt

59 This square plan is less than completely satisfactory in that about a third of the area would have been in the Nile. The location of al-Jīza at the southwest corner of the square is no doubt coincidental.

60 Wheatley, *op. cit.*, 5.

61 This is exceptionally well stated in E. Reitmeyer, Die *Städtegrundungen der Araber im Islam nach den arabischen Historikern und Geographen* (Munich, 1912).

62 As mentioned in n. 12, this site of Ailana or Aila promises an imminent epiphany.

thogonal structures. The larger and more complex of the *amṣār* combined this urban core with the tradition of the Arabian city, as yet to be fully defined. It must be emphasized that both elements are basic to the new tradition of urbanization from early Islamic times; the chimera of "the Islamic city" needs to recognize this mode of organization, in this and other Islamic periods, rather than concentrating on much later devolution.[63] In the words of Hugh Kennedy,

> Early Muslim society did not deliberately choose to develop towns with narrow winding streets out of any conscious aesthetic or cultural preference, and the idea that there is something in the spirit of Islam which leads to the enclosed, private and secret world of the 'Islamic city' should not be entertained by serious urban historians. The most important evidence for this comes from early Islamic planned towns.[64]

The city is more than just a collection of buildings within massive walls; it is rather a focus of social institutions made viable through an economic system. The development of the Islamic city would continue through the first centuries of Islam and the fruition should not be sought before the ninth and 10th centuries in the great capitals of the Eastern Caliphate. Nevertheless, city foundation had a strong symbolic value in Islam from the beginning, that of *hijra* or settlement (as opposed to wandering) and of cultural claim on new territory.[65] This subject goes far beyond the scope of this paper but clearly indicates the central concern of urbanization to the development of Islamic culture.

**Addendum**

The success, growth, and integration of these smaller *amṣār* into larger cities has left most of these foundations not immediately identifiable. The phenomenon of the "desert castles" must be viewed as a result of preservation (due to remote location) and, in part, a by-product of patterns of archaeological research. The discovery of Ayla was in great part serendipity; nevertheless, the delineation of the site was the direct result of a detailed hypothesis of its plan. There are numerous Islamic sites which would benefit from study based on hypotheses taking them as planned *amṣār* (hypotheses hopefully more developed than the outlines suggested here). Perhaps most significantly, progress in research on early Islamic urbanization is dependent on archaeological research, both new work in the field and re analysis of published resources.

63 An example of this tendency is the article of J. L. Abu-Lughod (n. 1).

64 H. Kennedy, 'From *Polis* to *Madina*: Urban Change in Late Antique and Early Islamic Syria,' *Past and Present* 106 (1985), 16.

65 "The *khiṭaṭ*, of Kufa were ...primarily intended for those who had come from further away. 'Umar's notion was that Kufa should be *dār hijra* for the Muslims, and these settlers were the *muhajirin* of Kufa. Their heterogeneous composition led 'Umar to hope that his Islamic experiment would meet with success among them, ... the fellowship of *hijra* forming the accepted basis of society." M. Hinds, 'Kufan Political Alignments and their Background in the Mid-Seventh Century A.D.,' *IJMES* 2 (1971), 351; cf. the comments on *hijra* by R. B. Serjeant in *San'a', an Arabian Islamic City* (London, 1983), 43.

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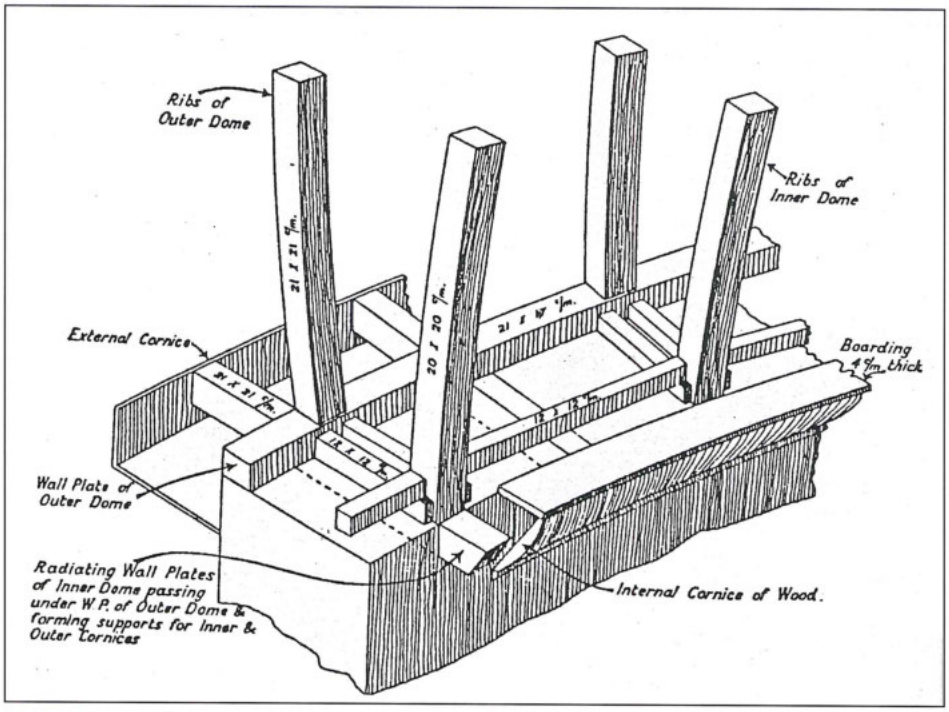
# Woodworking in Early Islamic Palestine

The woodworking industry of the Early Islamic period was highly developed both artistically and technically. Wooden objects from that period include three wooden domes: the domes of the al-Aqṣa Mosque, the Dome of the Rock, and the Dome of the Chain in Jerusalem. In addition, there are the wooden tie-beams placed between the capitals in the al-Aqṣa Mosque, the wooden beams and panels of the al-Aqṣa Mosque roof, the wooden minbar of the Ibrāhīmī Mosque in Hebron, and the three wooden pieces discovered at Qaṣr al-Ḥallābāt in Jordan.

The wooden dome of the Dome of the Rock consists of two domes, one inside the other, and is constructed with converging ribs. The two domes were described by Richmond, who pointed out that the outer dome is constructed with ribs 21 cm square, which spring from a wall-plate formed of wooden pieces scarfed together 21 cm wide and 17 cm high. The wall-plate is laid on the outer edge of the drum. The outer dome is divided on the inside into three sections, one above the other, by horizontal plates. The inner dome is also constructed with ribs 20 cm square. Each rib springs from its own wall-plate, which is laid diagonally across the wall, radiating from the centre of the dome and passing under the outer dome wall-plate. The inner dome, like the outer dome, is built of three sections, and its wooden boards are fixed by iron nails on the inner face of the ribs (Richmond 1924: 11-13; Creswell 1969: I:92-95) (FIG. 1).

The Dome of the al-Aqṣa Mosque, according to my observation, is very similar in its construction to the Dome of the Rock. It also consists of two domes, one inside the other. The outer dome is formed of ribs 21 cm square, which spring from a wooden wall-plate. The outer dome is also divided into three sections by horizontal plates, and between each two ribs there is a third one

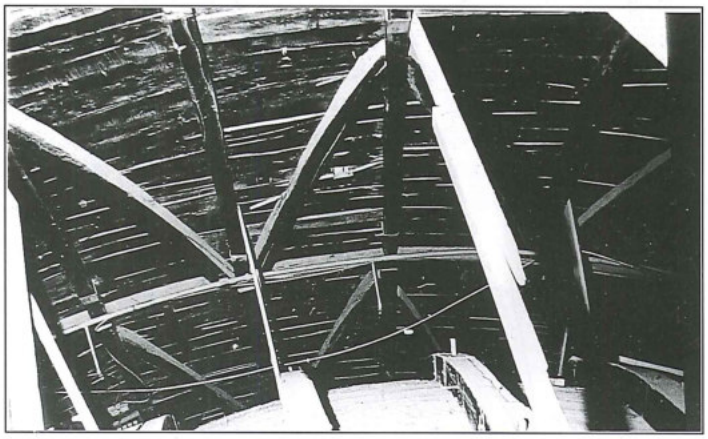



1. Dome of the Rock. Part of the wooden dome structure (after Richmond 1924).

placed diagonally to tighten them (FIG. 2). The inner dome is constructed with long ribs formed by two pieces joined by scarfing and tightened by nailed iron bands. Each rib sits on its own plate, which is laid diagonally across the wall and which passes under the outer dome wall-plate. The wooden boards of the dome are fixed from the inside by iron nails on the ribs.

The Dome of the Chain, as it appeared during the restoration of 1990, consists of a wooden dome on the outside and a concrete dome on the inside. There is no space between the outer and the inner domes. The outer dome is constructed of wooden ribs 20 cm square, each of which sits on its own wooden piece placed diagonally across the wall, projecting about 30 cm from the outside and extending 80 cm along the wall (FIG. 3). The inner dome is constructed with stone and mortar and covered with ceramic tiles on the inside. However, it seems that this inner dome is of a later date and that the original Dome of the Chain had two wooden domes, the same as those of the Dome of the Rock and the al-Aqṣa Mosque.

The wooden tie-beams of the al-Aqṣa Mosque are placed along the arcades and laid end to end on the capitals. Each tie-beam is composed of two beams with a rectangular section 21 cm wide and 15.5 cm high. They are connected by cross-pieces at intervals of about 75 cm. The cross-pieces are inserted 14 cm into the sides of the beams and leave room for 3 cm boards to be nailed to them below. Each board is about 6.75 m in length and is scarfed together above the capitals (Hamilton 1949: 3) (FIG. 4).



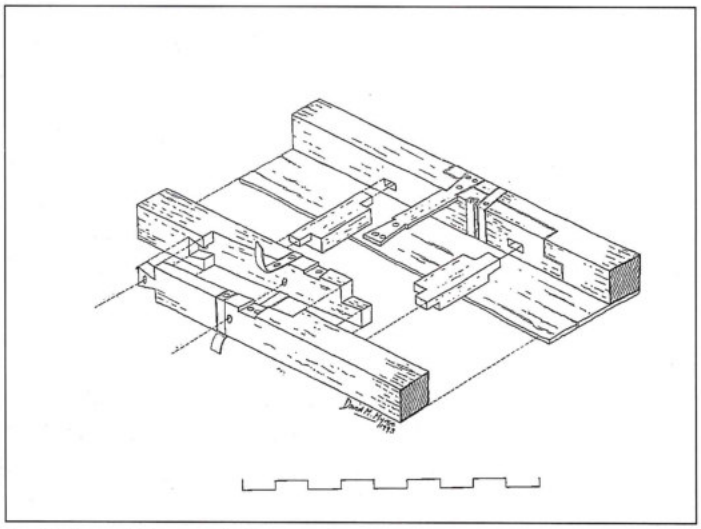
2. al-Aqṣa Mosque. Structure of the outer dome from inside.



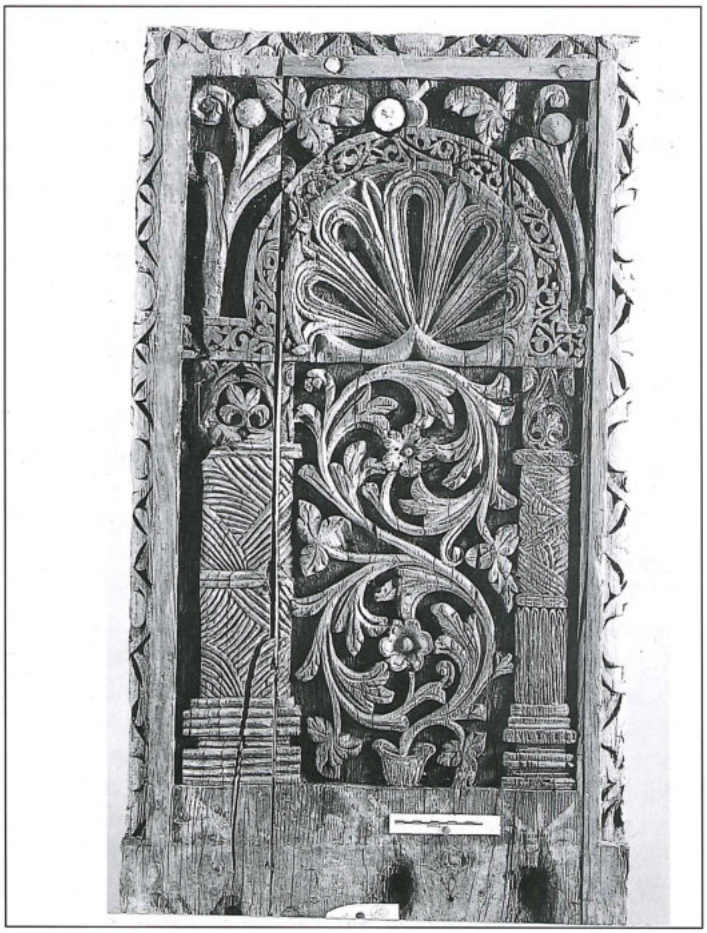
3. Dome of the Chain during the restoration of 1990.

The wooden beams and panels of the al-Aqṣa Mosque were laid across the arcade resting on the east and the west walls, but they were taken down in 1938. Each beam is about 13 m in length and is formed of one or two trunks of cypress wood fastened together and encased with wooden planks, which were nailed either to short vertical and horizontal ribs attached to the trunks or directly to the trunks themselves. Carved panels, also of cypress, were nailed on both extremes of each beam. Those panels are approximately 2 m long, 58-60 cm wide, and 8 cm thick, with a carved part measuring between 90 and 110 cm. Four more identical beams carrying oblong carved panels were fixed in an inclined position at the four corners of the arcade; they have also been taken down. Ten small beams were also taken down that were fixed at the north and south sides of the trusses between the inclined beams at the corners, the beams are 2.5 metres long and each carries smaller-sized carved panels that measure between 30 to 35 cm in length and 20 to 25 cm in width. The carved patterns on those small beams are somewhat similar to those on the larger ones (Hamilton 1949: PLS. 43-71) (FIG. 5).

The Hebron mosque *minbar*, dated to 484 AH/AD 1091-1092, consists of an entrance, staircase, and platform. The entrance is rectangular, formed by decorated beams and cross-beams framing the door, and is surmounted by a panel of Kufic inscriptions that carries a cornice formed of cavities decorated with painted ornamentation on a gilt background. The entrance opens onto the staircase, which is bordered by two balustrades decorated with geometrical *mashrabiya* designs, and which



4. Al-Aqṣa Mosque tie-beam. Isometric drawing showing the construction.



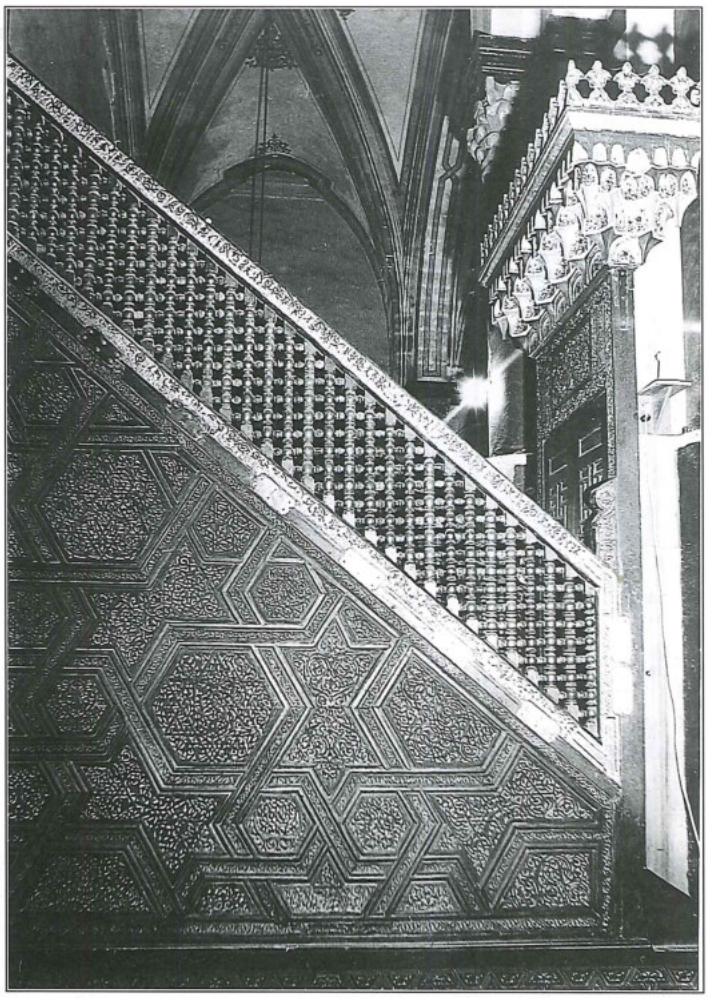
5. Carved wooden panel from the al-Aqṣa Mosque in Jerusalem.

leads to the platform at the top of the *minbar*. The platform is shaped like a pavilion, decorated on the inside and outside with carved panels, and crowned by another cornice of cavities decorated with painted elements similar to those of the entrance cornice (Abu Khalaf 1985: 278, PLS. 135-138) (FIG. 6).

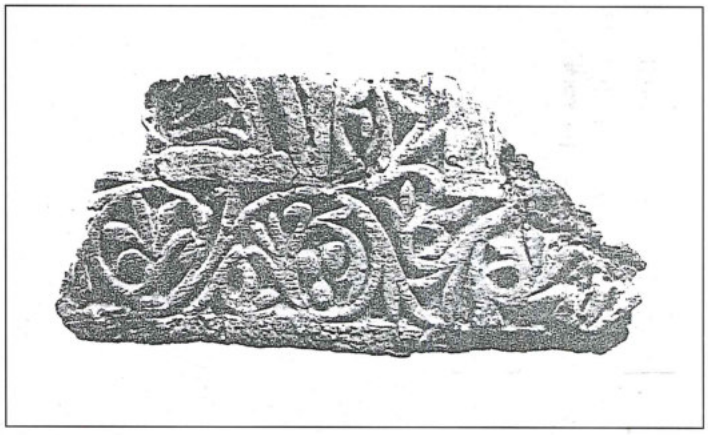
Finally, three wooden panels were discovered during the excavation of Qaṣr al-Ḥallābāt in Jordan (Bisheh 1982: PL. 36). The first panel is covered with vine scrolls, one of which has three grapes attached. The second panel has long acanthus leaves placed vertically (Abu Khalaf 1985: PL. 23a, b) (FIG. 7), similar to those forming the frames of the Mushatta facade (Dimand 1937: 36 N), while the third panel is a turned wooden piece probably used as part of a balustrade (Abu Khalaf 1985: PL. 24) (see FIG. 20 below).

## Tools

A study of those wooden remains shows that several techniques were used to construct and decorate them. The main techniques include shaping, joining, turning, and carving. However, before discussing those techniques it is important to consider the types of tools used at the time.



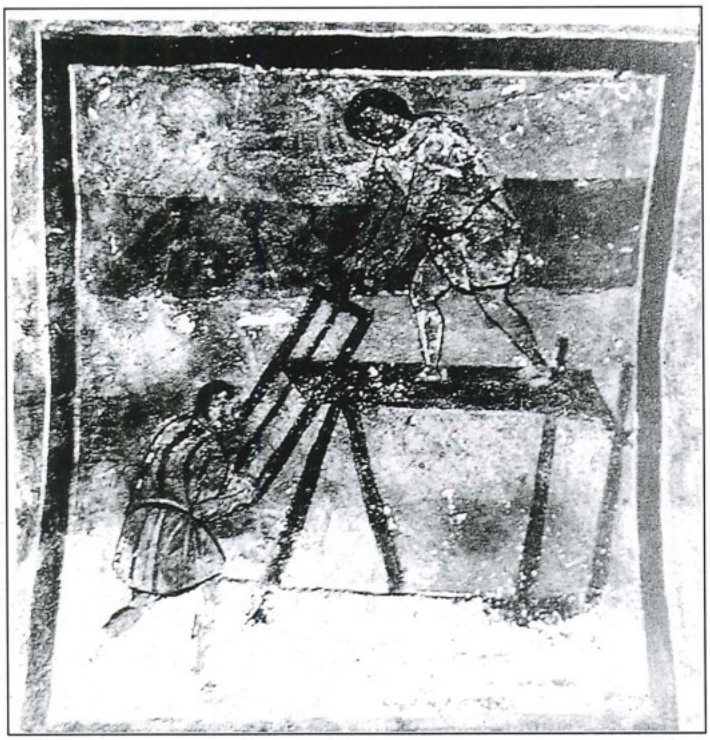
6. Carved wooden *minbar*. Hebron mosque.



7. Carved wooden piece from Qaṣr al-Ḥallābāt.

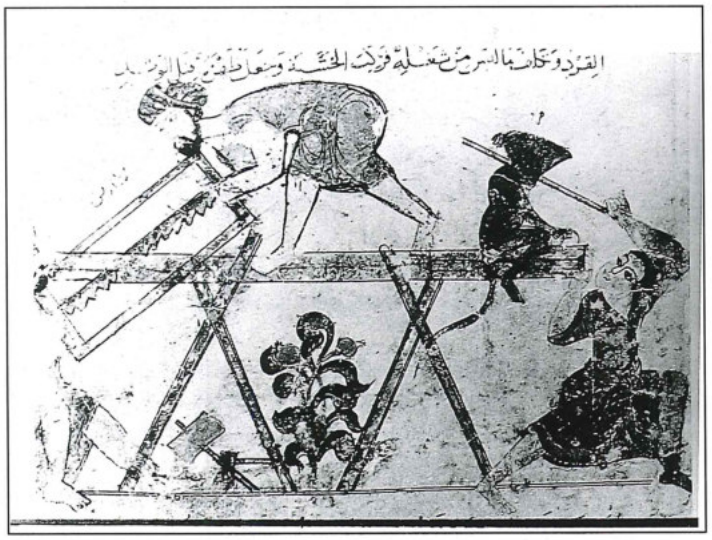
According to literary sources, the carpentry tools in use during the Early Islamic period included saws, drills, planes, adzes, axes, chisels, and gouges (Oughton 1976: 28; Singer 1956: II:230).

The most important tool is the saw, used for cutting wood. It appears in different shapes and sizes – the most common types are the framed saw and the bow saw. The

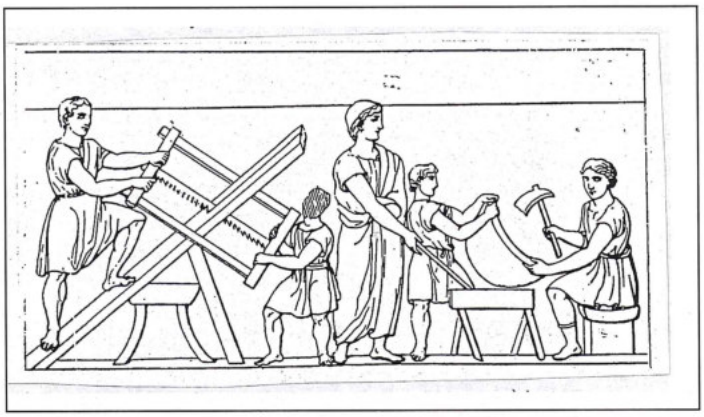


8. Fresco painting from Quṣayr 'Amra in Jordan, showing the early Islamic framed saw (after Almagro *et al.* 1975).

earliest example of an Islamic framed saw – a blade inserted into a crude wooden frame (Goodman 1964: FIG. 122) – can be seen on the fresco paintings of Quṣayr 'Amra dating to the Umayyad period (Almagro *et al.* 1975: PL. 38a) (FIG. 8). Another example of a later date appears in the miniature painting of a *Kalila wa Dimna* manuscript dated to AD 1220 (Rice 1971: FIG. 15) (FIG. 9). That type of saw is also found in the Roman period, where it appears in a relief in Florence (Goodman 1964: FIG. 122) (FIG. 10). That indicates that the framed saw



9. Scene showing the Islamic saw from a *Kalila wa Dimna* manuscript (after Rice 1971).



10. Drawing showing the Roman saw in Florence (after Goodman 1964).

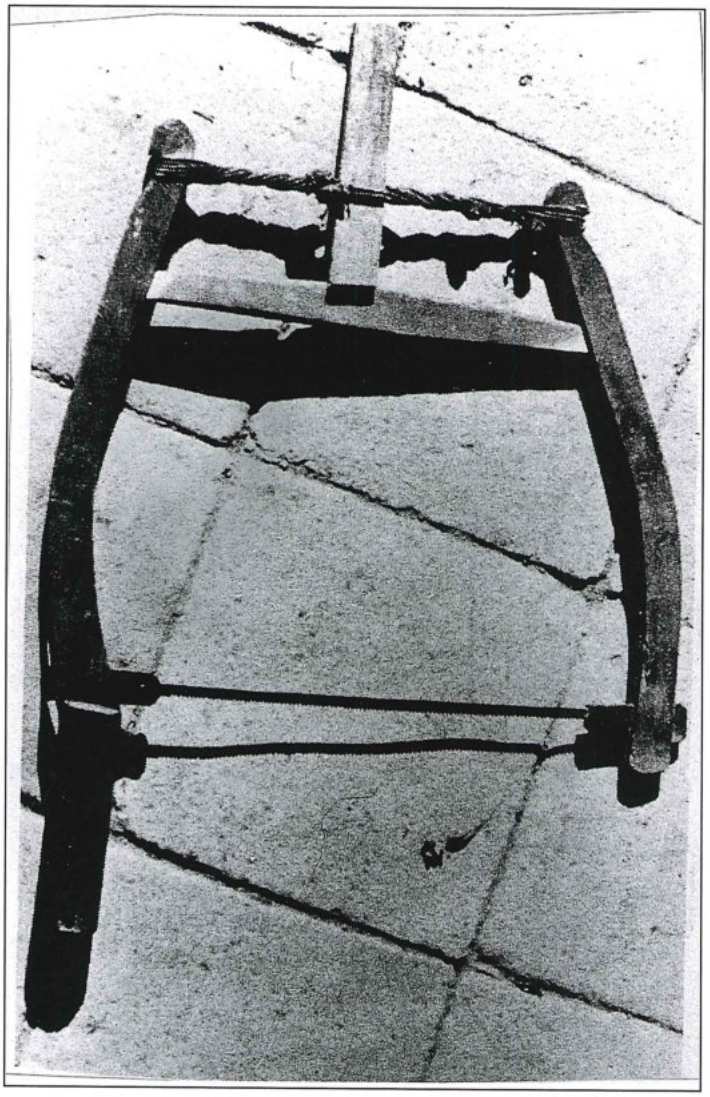
continued in use in the Islamic period without major alterations.

The bow saw, a narrow blade held between wooden uprights connected by a cross bar, also appeared in the Roman period. Above the bar, the upright wooden pieces are linked by a well damped cord tied to each end of the upright wooden pieces (Goodman 1964: 152). There is no evidence for that type of saw in the Islamic period, but a similar saw, very much like the Roman one, is still in use in Iran, which indicates that the bow saw was used during the Islamic period without alteration (Wulff 1976: FIG. 117) (FIG. 11).

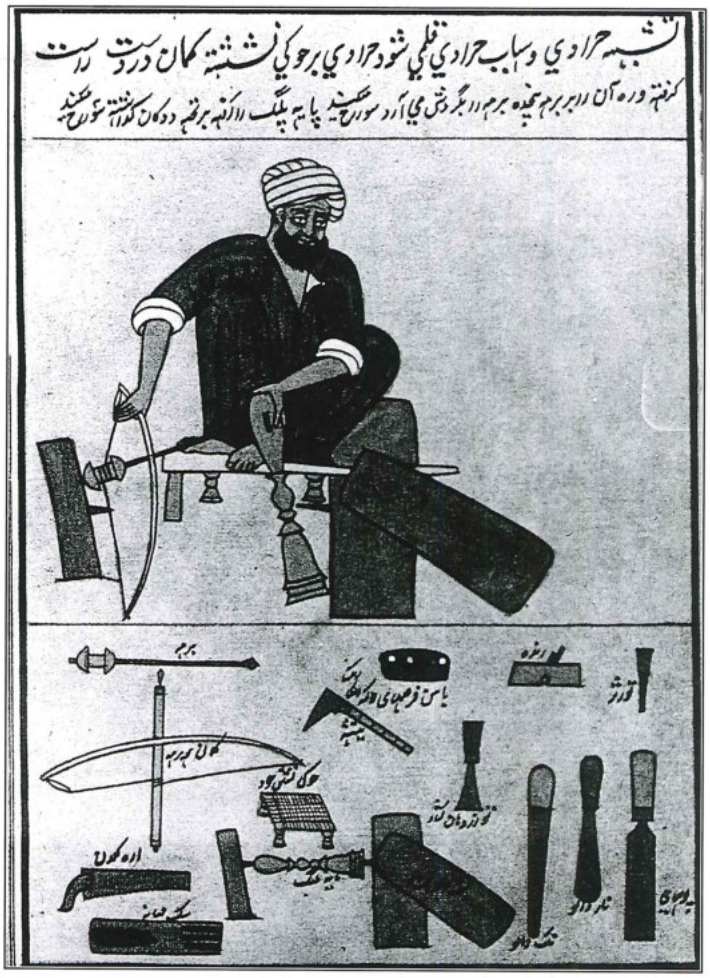
The drill was well known from as early as the third millennium BC. A relief panel in Saqqāra from about 2540 BC depicts a craftsman using it. The same kind of drill was used in Greek and Roman times (Singer 1954-57: II: FIG. 206 "O"), which leads one to assume that a similar tool was used in the Islamic period as well. Examples of a later date show that the drill was indeed in use: one example appears among the tools of the Kashmiri carpenter (Michell 1978: 113) (FIG. 12) in the mid-19th century; the tool is still in use in Iran (Wulff 1976: 124-125). Both of those examples are similar in shape to the drill of the Roman period.

The plane is another carpentry tool. There is no evidence to determine the shape of the Early Islamic plane, although a pre-Islamic example was found in the ruins of Pompeii (Goodman 1964: 43-44). However, the later examples of planes, such as the Persian ones (FIG. 13) and others that appear in the craft records of Kashmir (FIG. 12) resemble the later (16th century) European plane (Wulff 1976: FIGS. 115, 120; Goodman 1964: 87a). That indicates that Early Islamic planes were similar to Roman and Byzantine ones.

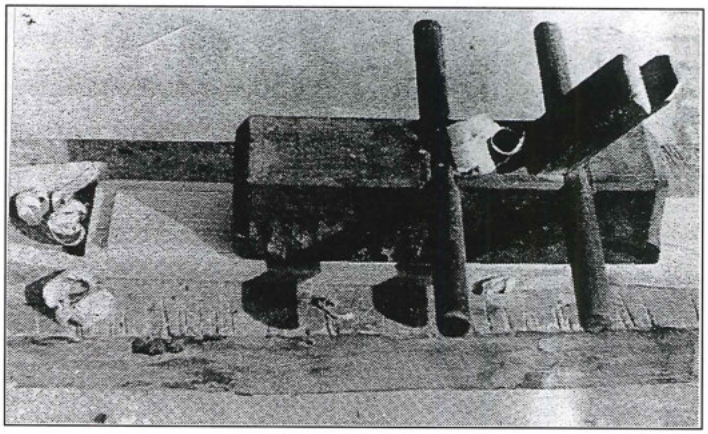
Other important tools used in carpentry were the axe, adze and chisels of various kinds. The axe was the first woodworking tool used by man. Its use for the felling and preparation of timber remains the same as it was in the past. The remains of a variety of axes dated to dif-



11. Bow saw from Iran (after Wulff 1976).



12. Scene showing the wood turning and the carpentry tools used in Kashmir in the 1850s (after Michell 1978).



13. Wooden plane from Iran (after Wulff 1976).

ferent periods indicate that the tool has not undergone fundamental change (Goodman 1964: FIG. 6). There is no evidence for the Islamic axe; however, a late example can be seen on a Kashmir folk painting that dates to the first half of the 19th century (Michell 1978: 113). But we can argue that if Roman and Islamic planes were related, so presumably were Roman and Islamic adzes. The adze was also well known in antiquity, and its main function was for roughing wood. According to Hamilton, adzes were used on the al-Aqṣa Mosque woodwork for squaring the thicker end of the beams (Hamilton 1949: 86). The shape of the adze that was used is not known, nor are we familiar with the shapes of adzes in general in the Early Islamic period; but like the other tools, they presumably were not very different from the Roman ones (Goodman 1964: FIG. 161). Nevertheless, two examples of the medieval Iranian adze were uncovered in the excavations at Nishapur (Allan 1982: 56, nos. 202-203). Some other examples of adzes can be seen in the Kashmiri 19th century folk painting (Michell 1978: 113) and an example from Persia, which is of a type that probably continues in use (Wulff 1976: FIG. 119) (FIG. 14).

Chisels were well known and widely used for different purposes. The mortise chisel is used for cutting and cleaning vertical slots in framing timber. The blade of such a chisel, according to Green (1981: 40) "has no



14. Adze from Iran (after Wulff 1976).

shoulders, and it is often thicker at the handle end than its width, to withstand heavy blows from a mallet and levering action involved in this work. The back of the blade is perfectly flat in line with the handle, to ensure vertical cutting but the top surface generally tapers slightly towards the beveled cutting edge. "A Roman example of that type of chisel appears on the wall of the house of the Vettii in Pompeii, where a young man is seen using a mortise chisel and mallet, and cutting mortises at the edge of a piece of wood (Goodman 1964: FIG. 189).

The shape of the Early Islamic mortise chisel is not known. However, one example appears among contemporary Iranian carpentry tools. That chisel is probably still in use in Iran, and is not very different from the Roman mortise chisel. Thus it is very likely that the Early Islamic mortise chisel was similar to the Roman one (Wulff 1976: FIG. 123). The study of all of the carpentry tools has shown that there was no substantial change in shapes, and that there probably has been no innovation since the Roman period.

**The Shaping Technique**

The first steps after cutting down a tree are to trim the trunk, and then remove the bark and convert it into planks. Three methods for cutting wood probably were known in the Early Islamic period and were certainly used in later periods and are still in use in our time. They are: 1) the cross-cut method in which the trunk is usually cut horizontally across the grain; 2) the square-cut method, in which the trunk is cut on four sides turning the girth of the tree into a square; and 3) the quarter-cut which entails cutting the log radially (Blanford 1979: 7) (FIG. 15).

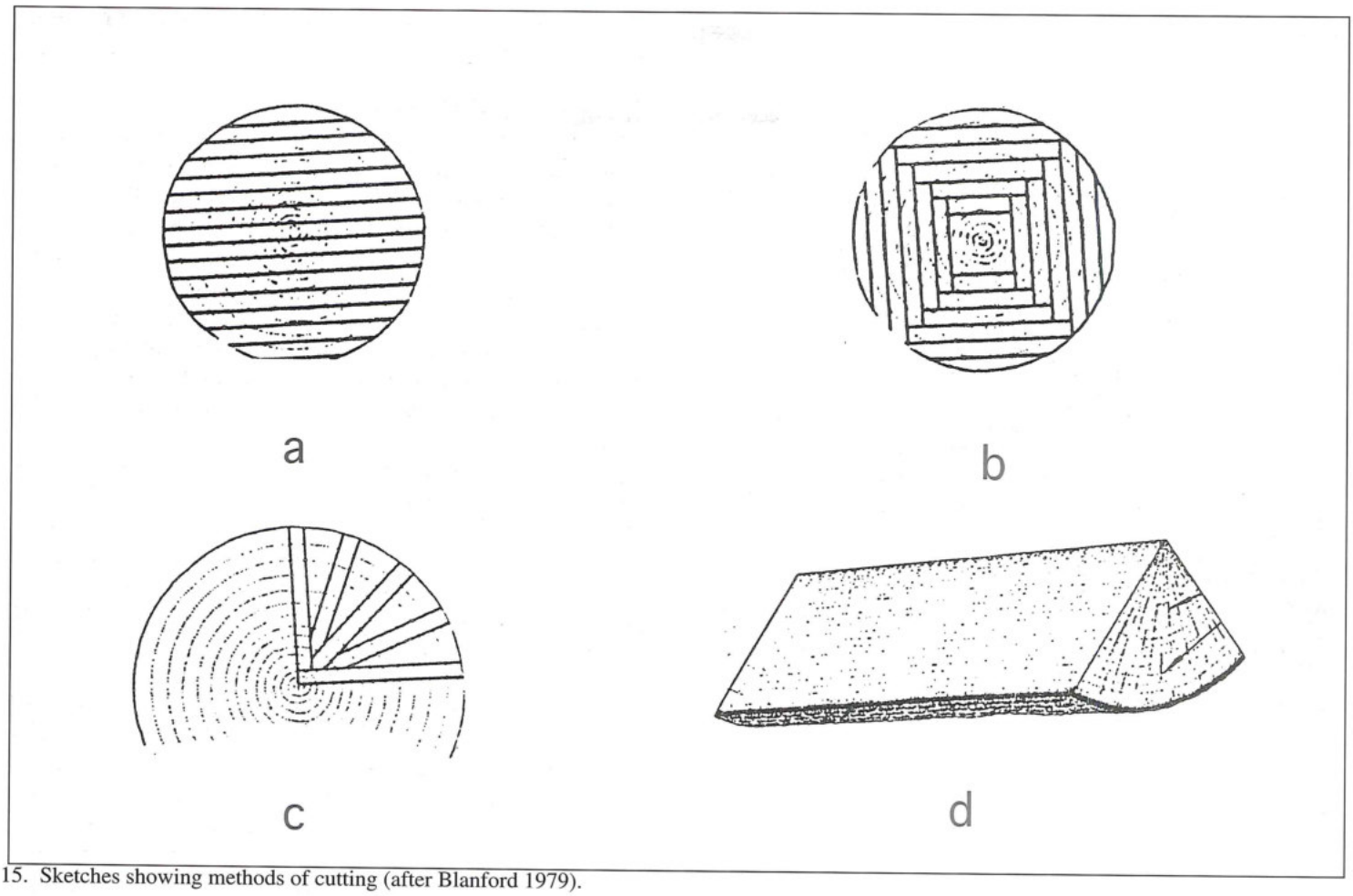
The cutting method can be observed by examining the shape of the grain, because its shape will differ if the panel was cut by the cross-cut, square-cut, or quarter-cut method. A second way to determine the cutting method is by measuring the width of the panel, in order to compare it with the maximum diameter of the tree. The best examples are the al-Aqṣa Mosque panels. Each of those panels is composed of two parts, both of cypress. The maximum width of a 20 to 30 year-old cypress tree is 60 cm. It seems that the diameter of the log used for the panels was less than that size, because the maximum width of their pieces is about 42 cm. It seems clear, however, from the method of cutting that the maximum width of a panel could only be obtained by the cross-cut method. That criterion for determining the method used to cut the wood cannot be used in all cases, because sometimes the panels are small in size, but come from large trees. Nevertheless, the shape of the wooden piece can sometimes indicate the cutting method.

**The Joining Technique**

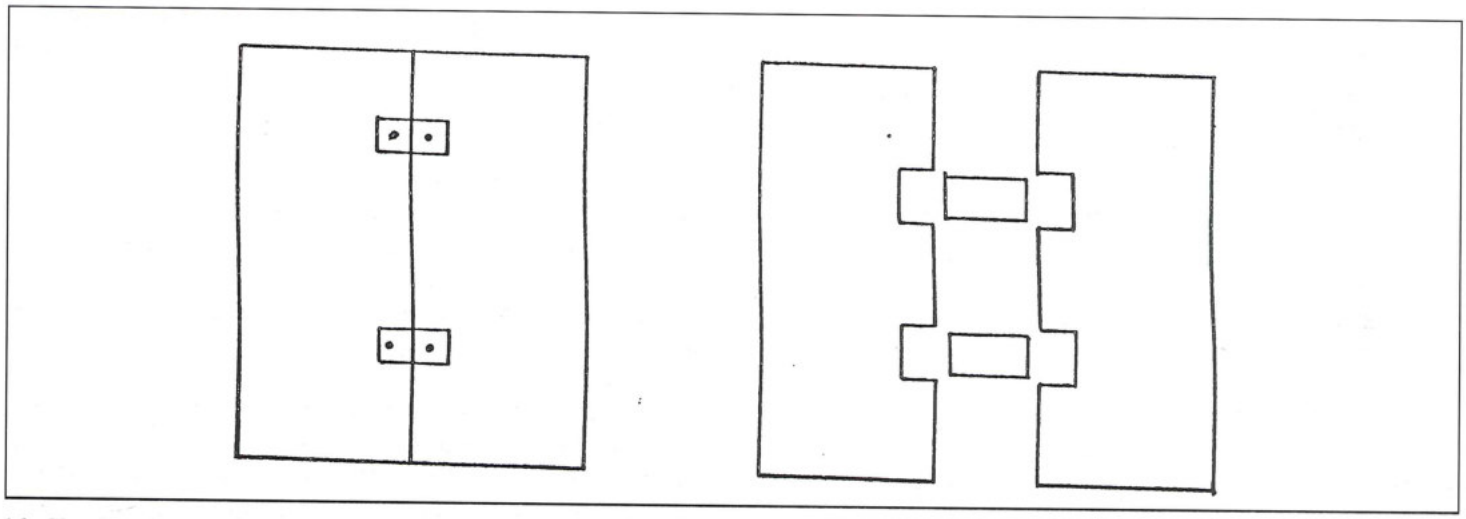
Joining is the most important technique in woodworking and its function is to join wooden pieces together in order to produce the form required. Several methods of joining were used in the pieces described earlier, including 1) tenon and mortise; 2) pinning; 3) scarfing; and 4) dovetailing.

The tenon and mortise method is a process for assembling wooden pieces by fitting a projecting tenon into a rectangular cavity cut into another piece of wood. That method can be seen in the al-Aqṣa Mosque panels in Jerusalem. Each of those panels consists of two pieces that are joined together by a single piece of wood that fits into a cavity on each of the adjoining panel edges and which is then held by wooden dowels (Abu Khalaf 1985: FIG. 6a) (FIG. 16).

A tenon and mortise joint can also be seen on the wooden tie-beams laid end to end on the capitals. The beams are joined by cross-pieces inserted into the sides

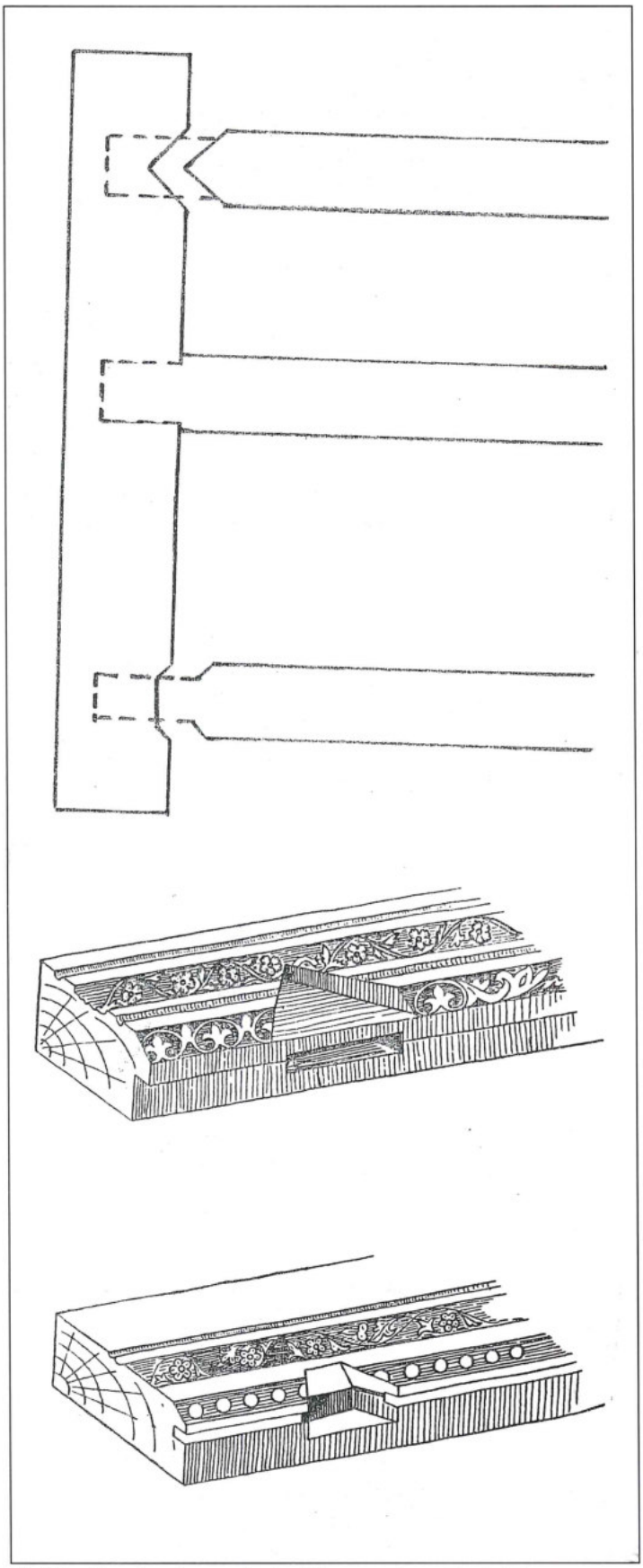



15. Sketches showing methods of cutting (after Blanford 1979).



16. Sketches showing the method of joining of the al-Aqṣa Mosque panels.

of the beams by the tenon and mortise method and then nailed by iron nails (Hamilton 1949: 3). Another type of tenon and mortise is that in which the tenon is not a separate piece of wood, but a projection from one of the wooden pieces with the cavity carved into the other. The general structure is usually built of beams and cross-beams that join each other by having the tenon on both sides of the cross-beams and the cavities cut into the beams themselves. In order to keep the tenon tight in the cavity, they are fixed with wooden dowels. That can be seen clearly on the Hebron Mosque *minbar*, which is constructed of beams and cross-beams joined together by that technique (Abu Khalaf 1985: 246-247). The tenon appears on the outside with either a triangular face, such



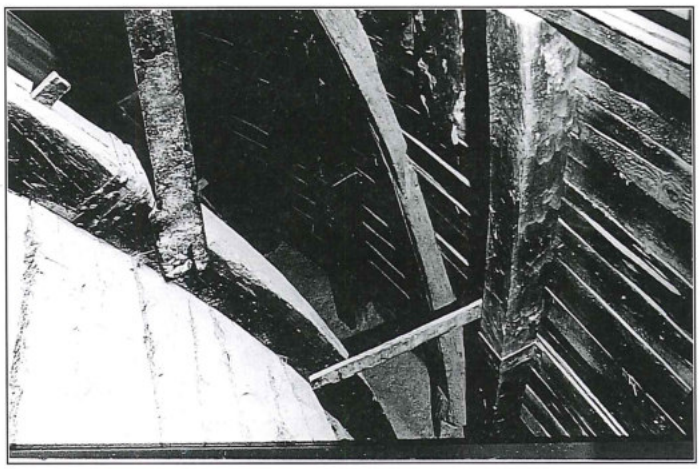
17. Sketches showing methods of tenon and mortise joining.

as on a wooden piece from the al-Aqṣa Mosque (Hamilton 1949: FIG. 47, no. 21), or a truncated triangular face, as appears on another wooden piece from the al-Aqṣa Mosque (Hamilton 1949: FIG. 48, no. 23) (FIG. 17), and sometimes with a straight-edged face, as on the Hebron Mosque *minbar* (Abu Khalaf 1985: PLS. 135-136, FIG. 6b).

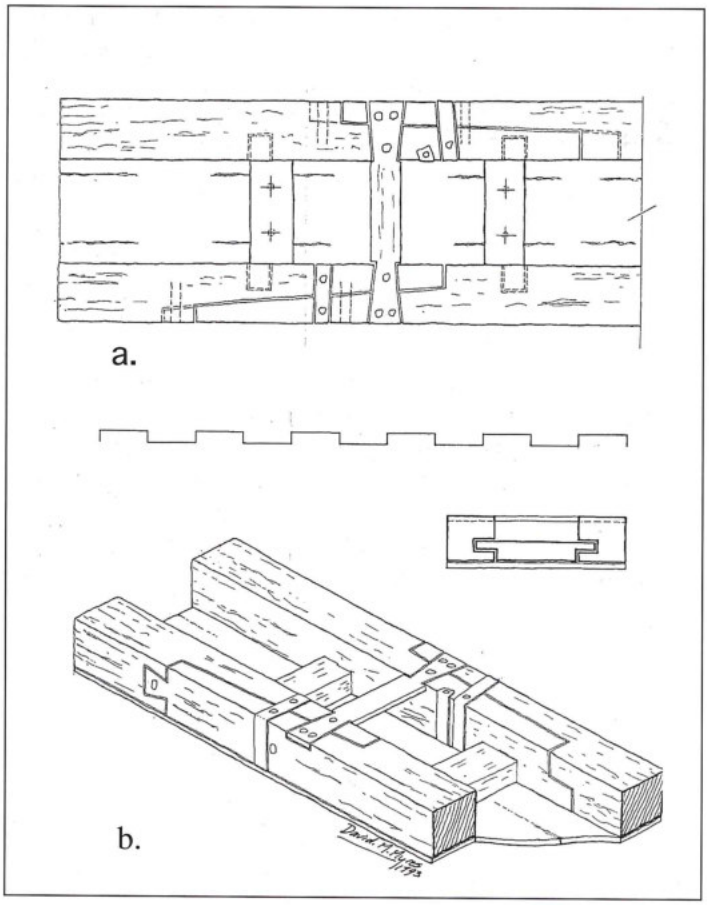
Another joining method is pinning, i.e., joining the wooden pieces by using iron nails or wooden dowels. That method was used on the al-Aqṣa Mosque panels to fix the carved panels on the beams. The trace of the nails is clear on the panels themselves. The nails have rounded heads and the upper part of their shafts are tapered, while their lower parts are elongated and pointed (Hamilton 1949: PLS. 54, 56, 57) (FIG. 5). Another means of nailing is to use wooden dowels. They were used to hold the tenon in the mortise and for other woodworking purposes such as scarfing. That can be seen clearly on the beams of the al-Aqṣa Mosque, where most of the beams are scarfed with a large wooden pin holding the joint (FIG. 18). The pinning method can also be seen on the Hebron Mosque *minbar* to hold the tenon in the mortise (Abu Khalaf 1985: 251-252).

The third method of joining is scarfing, which makes two pieces into a longer piece by joining their ends. The ends of those pieces must be shaped to mesh with each other when placed end to end. To keep the pieces firmly fixed, they are usually joined by wooden pins, which fit through holes in the area of the join (Corkhill 1979: 487). The method can be seen clearly on the al-Aqṣa Mosque beams. According to Hamilton, two trunks of roughly equal size were laid thin to thick and then bound and nailed together (Hamilton 1949: 86, FIG. 43). Beam No. 7 is composed of five separate timbers joined by scarfing. The method can also be seen on the tie-beams placed between the capitals of the central facade of the al-Aqṣa Mosque (Hamilton 1949: 3) (FIG. 19).

Finally, the dovetailed method which is an end to end



18. Al-Aqṣa mosque. Beams of inner dome and scarfing technique.



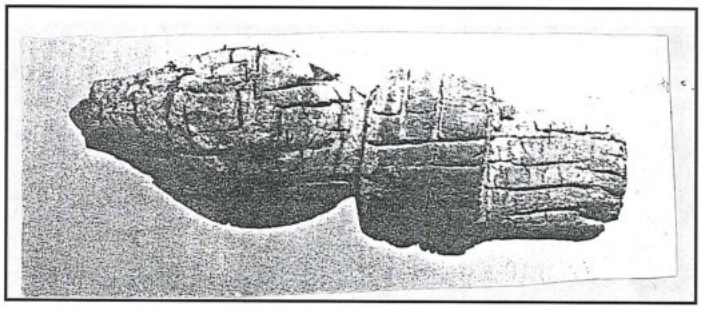

19. Al-Aqṣa Mosque tie-beam: a. plan; b.isometric drawing showing the dovetail and scarfing techniques.

joint for pieces at right angles to each other. In general, they cut the fastening of one piece, which are fan-shaped like a dove's tail. These fastenings usually fit into sockets specially prepared at the end of the other piece, without using any kind of pins or nails (Corkhill 1979: 153). An example of this can be seen on one piece, beam seven of the al-Aqṣa Mosque (Hamilton 1949: FIG. 43) and wooden tie-beams laid on the capitals of the al-Aqṣa Mosque (FIG. 19).

## The Turning Technique

This was a well-known technique in the Early Islamic period. It uses the turning lathe to produce balusters for making balustrades, or making pieces for the *Mashrabiya* system. The shape of the Early Islamic lathe is not known, but probably was similar to the traditional lathe, as still used in Syria, Egypt, Iraq, and Iran. An example of one appears in the miniature painting recording crafts in Kashmir dating back to the mid-19th century (Michell 1978: 113) (FIG. 12).

Examples of turned pieces can be seen around the lower parts of the inner domes of the al-Aqṣa Mosque and the Dome of the Rock, holding the multi-lobed arches and hiding the lower parts of the beams. Other examples are the balusters forming the two balustrades placed on the sides of the staircases of the *minbar* of the Hebron Mosque and a turned wooden piece discovered during the excavations of Qaṣr al-Ḥallābāt (FIG. 20) which was probably used as a baluster. Many turned examples dating to the Coptic period have been found in Egypt (Strzygowski 1904: PL. 9, nos. 7231-7237), which indicate that the turning technique was well known in the pre-Islamic period.



20. Wooden baluster from Qaṣr al-Ḥallābāt in Jordan.

## The Carving Technique

This technique was used for decorating wooden objects from very early Islamic times. To carve a panel, first the piece of wood chosen must have a flat surface. Then the design is transferred on to the chosen piece, being copied from separate sheets. The designs are usually inscribed on the wood with a V-shaped tool, the instrument normally employed for long unbroken lines. The third step is to carve around the motifs and sink the background, so as to raise the motifs clearly from the space around them. The fourth and last step is to trim away around the motifs and finish the carving, so as to clarify the whole surface, which includes the general outlines of the motifs and their background (Abu Khalaf 1985: 257). After this process the carver starts working around the motifs and their surface by decorating and trimming them to the required shape and then finishing the process of carving.

The objects representing this technique are the wooden panels and beams of the al-Aqṣa Mosque and the geometric panels of the Hebron Mosque *minbar*. They are covered with a large variety of decorative elements, of vertical-edge carving. The walls appear more or less at right angle. The carver usually trims the walls around the motifs, where the vertical carving becomes clearer and shows the depth of that carving.

From the study of extant wood objects we conclude that there was a developed woodworking industry in Jordan-Palestine in the Early Islamic period. This is evidenced by the quality of those objects and the techniques used in their production. The study also indicates that Islamic woodworking tools and techniques had not undergone fundamental changes compared to their pre-Islamic counterparts.

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# The Fortification of the Pilgrimage Route During the First Three Centuries of Ottoman Rule (1516-1757)

On 3rd October 1516, after much preparation, Selim the Grim rode into Damascus and proclaimed it part of the Ottoman Empire. For the next 400 years the entire area now comprising the modern countries of Syria, Lebanon, Palestine and Jordan was known as the Ottoman province of Damascus. Historians regard the conquest as the beginning of the modern era. Dr. M. A. Bakhit wrote at the beginning of his history of the province, "The Ottoman period is distinguished from all those that preceded it in the Near East by the great abundance of archival materials provided by the state records... Here, as rarely in the history of Islamic lands, detailed research becomes possible". There have been several important historical studies dealing with the first three centuries of Ottoman rule in the region. Most notable amongst these works are the accounts of Bakhit (1982), Rafeq (1970) and Barbir (1980), all of which devote considerable attention to the Ḥajj.

Between them, these studies give a pretty detailed account of the development of Ottoman rule in the Province. However, there are significant gaps in our knowledge of this crucial period which cannot be dealt with adequately through historical sources. Firstly, there is the problem that the historical information is patchy, thus, for the al-Karak region the period from 1517-1840 is virtually unknown. Secondly, there is the problem that many of the historical sources are either governmental (e.g. tax records) or city based (usually Damascus, i.e. Ibn Ṭūlūn, sixteenth century) both of which provide only a partial and sometimes misleading view of the area.

In this study of the Ḥajj forts, it is proposed to combine historical material with that derived from archaeological survey to gain an accurate perspective of one aspect of Ottoman rule.

The organization and dispatch of the Ḥajj caravan was one of the main priorities of the Ottoman administration. Indeed, Barbir devotes over a third of his book to the Pilgrimage, which is described as the "Centrepiece of Ottoman Rule in Damascus". Although this gives a very full description of how the Ḥajj Caravan was organized and defended, there are two significant aspects not dealt with, which are the design of the forts and their positioning in relation to the Ḥajj route and settled areas. Before discussing either of these in any detail, it may be worth giving a brief summary of the Ḥajj in Ottoman times.

## The Ḥajj in Ottoman Times

The Ḥajj was perhaps the most important annual event in the province of Damascus. Barbir argues that in the eighteenth century, the governors of Damascus were excused from taking part in the Empire's wars so that they could concentrate on the organization of the Ḥajj. In this way the Ḥajj took on the status of an imperial campaign (Barbir 1980: 13). The organization of the Ḥajj caravan was in the hands of officials who after 1571 were chosen from within the province of Damascus (previously they had been sent from Istanbul, Bakhit 1982: 109). The most important post was *amīr al-Ḥajj* who was in charge of all aspects of the pilgrimage caravan and would appoint the other officials. Up to 1708 the *amīr al-Ḥajj* was chosen from amongst the notables of Damascus or one of the great Bedouin chiefs, after that date up until the end of the empire, the governor of Damascus was invariably chosen as the *amīr al-Ḥajj* (Barbir 1980: 51).

Other posts included *mir i akhur-i-Hajj* (official in charge of water supplies), *nāẓir al-Ḥajj* (deputy to the amīr al-Ḥajj) *amīr al-manzil* (in charge of camping places) *imām, mu'adhdhin, sanjaqdar, amīr al-mulāqāh* (in charge of the caravan's reception on its return to Damascus) and an official in charge of Awqāf for Makka and al-Madīna (Bakhit 1982: 112, 114, 137). In addition to these posts directly concerned with the Ḥajj there were many other positions which involved some responsibility for the Ḥajj. Thus the governors of 'Ajlūn and al-Karak/ash-Shawbak, were responsible for the maintenance of facilities in their areas. Because all these posts were fairly prestigious, there was considerable rivalry for them so that the organization and running of the Ḥajj became a subject of local politics. Thus opposition to the Governor of Damascus or Ottoman rule often took the form of an

attack on the pilgrimage (Bakhit 1982: 223).

Damascus was the official starting point of the pilgrimage and it was here that all the arrangements for the caravan were made. In Damascus itself, a huge complex for pilgrims was built. The complex, known as the *Tekkiye*, was commissioned by Suleyman the Magnificent and designed by his master architect Sinan to include a large mosque, kitchen, camping ground, *khān* and *bazaar* (Goodwin 1971: 225-257). The route north of Damascus to Istanbul was provided with a wide range of facilities including *khānāt*, mosques and *ḥammāmāt* (for an account of Ḥajj facilities in Syria, north of Damascus see Sauvaget 1937). Sauvaget makes the point that the Ḥajj route from Istanbul as far as Damascus was similar to other trading routes, whereas south of Damascus the road was subject to constant danger. It was this danger which prompted the construction of the Ḥajj forts (see FIG. 1).

The earliest forts built on the road were all placed within 100km of Damascus during the region of Selim the Grim (1512-1520). These forts were at Ṣanamayn, Muzayrīb and Tall Far'ūn. The earliest forts in the area of present day Jordan were Ma'ān and al-Qaṭrāna whilst further south in al-Ḥijāz forts were built at Dhāt al-Ḥajj, Tabūk, Ukhayḍir and al-'Ulā (Bakhit 1982: 97). During the 1570s forts were built at 'Unayza north of Ma'ān and at Hadiya, 42 hours north of al-Madīna. During the seventeenth century no new forts were built, although extensive repairs were carried out to existing forts (Jaussen and Savignac 1909: 294). In the mid eighteenth century, more forts were built including those at al-Mudawwara, al-Ḥasā and Fāṣū'a (Barbir 1980: 140). The forts were built fairly rapidly thus the fort at Ukhayḍir was built in less than forty days according to the inscription above the gate (Jaussen and Savignac 1909: 294-296).

**Fortification and Design of the Forts**

The basic design of the Ḥajj forts in consistent throughout 1500 kilometres of the Ḥajj road and over the 250 years during which they were built. Essentially the forts are like small *khānāt:* that is square in plan ranged around a central courtyard (see FIG. 2). In the centre of the courtyard there is a cistern, whilst access to the first floor is provided by staircases located either side of the entrance. Outside each fort is one or more reservoirs and a cemetery containing the graves of pilgrims and the garrison.

The basic plan of these forts can be seen reproduced in thousands of *khānāt* throughout the Ottoman empire (for examples see Goodwin 1971; Cezar 1983). Although the forts are considerably smaller than most *khānāt*, they still appear to represent the same generic origins. There are examples of fortified Islamic buildings similar to the Ḥajj forts such as *al-Rabāṭ* of North Africa but these seem to be too remote in time to have directly influenced the design of these forts. The reason for the resemblance of *khān* and fort can partly be explained by the similarity of function. Hütteroth and Abdulfattah (1977: 34) give the following definition of a *khān*:

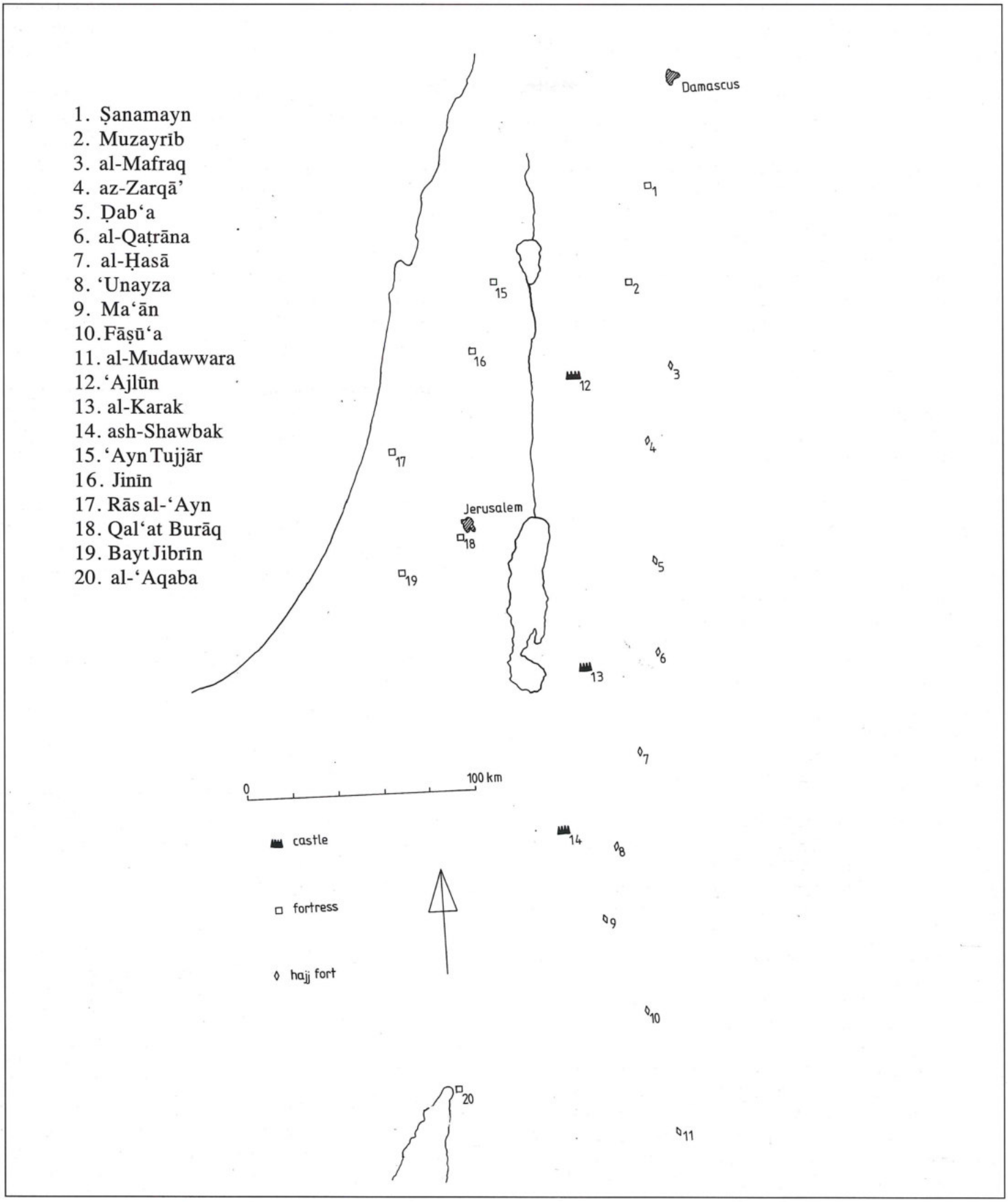
> A khan (caravanserai) is known to be a large building of solid stone, erected for the purpose of providing travellers, merchants and pilgrims, as well as their animals with a resting place. The buildings therefore had to be sited at more or less regular intervals along the main roads ... The khans were usually more or less fortified and sometimes guarded by a small garrison.

The fortified Mamluk *khān* at al-'Aqaba is a good example of a transitionary building, half *khān* and half fort. Despite their similarities it should be remembered that the forts were military buildings designed for the use of troops.

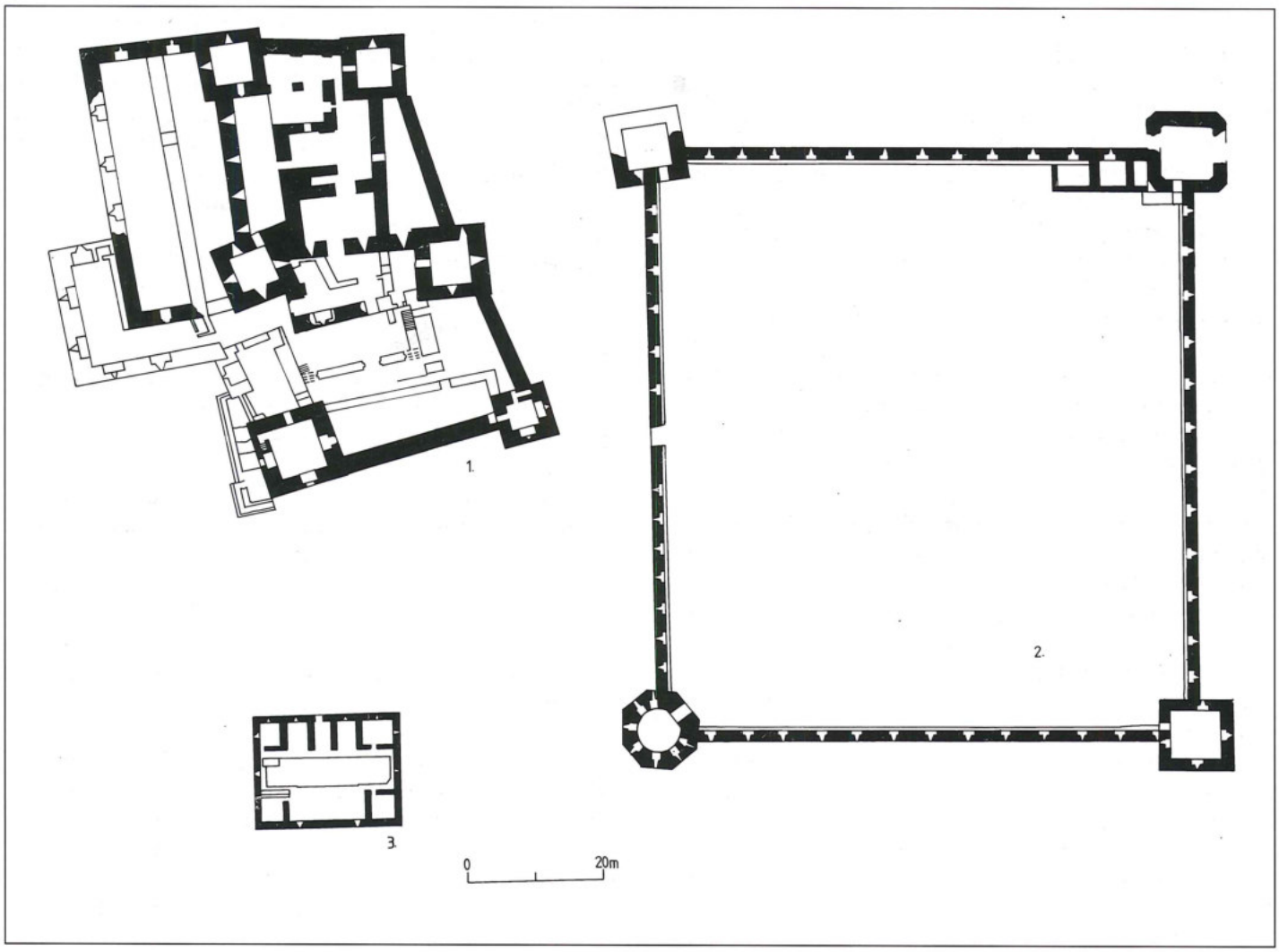
Although the Ottoman victory over the Mamluks was largely a result of their use of firearms (Ayalon 1956: 108-111), the Ottomans were slow to include artillery as a factor in their fortress design. European fortress builders had designed fortifications specifically for the use of artillery as early as the fourteenth century and by the early sixteenth century were producing quite sophisticated designs (see for example Fort Jesus, Kirkman 1974). In contrast Ottoman fortresses of this period tended to have fairly basic designs relying more on the strengths of their garrisons than on sophisticated fortifications. There is however some evidence that the design of the Ḥajj forts was modified in the eighteenth century in response to the increased use of firearms.

The usual modifications employed for firearms such as low thick walls and large bastions were neither practical nor desirable for use in the Ḥajj forts, where the use of heavy artillery was unlikely. Instead the forts had to be adapted to withstand lightning raids by mounted bedouins carrying guns. Two main areas of modification have been identified. These are (i) the openings in the walls (see FIG. 2) and (ii) the development of projecting towers from machicolations.

(i) The earlier forts had arrow-slits or loops generally one metre high and 15cm wide on the outside. The arrow-slits were "V" shaped openings with flat sills through walls about one metre thick. These arrow-slits were sometimes decorated with a carved border and were visible from a considerable distance. At the top of the walls along the parapet there were a number of smaller openings or embrasures (30cm high x 15cm wide) these were also made visible by the use of dressed stone. The top walls of each fort were crowned with distinctive step shaped crenellations. Like many of the other features these can be seen on a grander scale on the city walls of Jerusalem built by Sulayman the Magnificent between




1. The Ottoman fortress network.




2. 1) Ayyubid castle of ʻAjlūn; 2) sixteenth century fortress at Rās al-ʻAyn; 3) sixteenth century Ḥajj fort at al-Qaṭrāna.

1538 and 1541.

In the eighteenth century forts arrow-slits were replaced by more numerous, less visible openings, more suitable for artillery. Because these are less visible from the outside, raiders would not so easily be able to tell where shots were coming from. The increased number of openings provided a greater field of fire, whilst their smaller size provided greater protection for the Ottoman gunners.

(ii) The other features subject to modification, were the projecting machicolations. These structures were located either symmetrically in the middle of each side of a fort. In some of the earlier forts there were also hidden machicolations directly above the entrance (this feature can be found at Ḍabʻa and al-Qaṭrāna and is more characteristic of the Mamluk period, see for example Qaṣr Shabīb in az-Zarqā'). Projecting machicolations usually stand out a distance of 70-30cm from the face of the fort and are supported by two or more sets of corbels, usually two courses high. There are openings between the corbel beams through which missiles and harmful substances may be poured onto an attacker. Like the crenellations, these box machicolations are characteristic of Ottoman architecture in the region and can be seen on the city walls of Jerusalem.

In the later forts there are structures resembling box machicolations which however have no downward openings. In some of the forts such as Qalʻat al-Ḥasā these are still located at the sides of the fort, but in most of these later forts they are located at the corners forming projecting corner towers. The advantages of such features is that the entire area immediately outside the fort was now within the field of fire, whereas before the area directly beneath the walls, particularly the corners, were safe for attackers. This innovation made machicolations redundant particularly as such openings would have exposed the gunner to additional risk.

**The Location of the Forts**

The network of cities, towns and fortresses into which the Ḥajj forts had to fit was extremely complex and had developed over a long period (see FIG. 1).

With the Ottoman conquest Damascus replaced Cairo as the regional centre. Although Cairo continued to operate as a major administrative centre, its influence over Syria declined whilst the importance of Damascus increased in proportion. This shift in emphasis had important effects on the road and defence systems of the area, most notably with the increased importance of the Darb al-Ḥajj ash-Shāmī (Syrian Pilgrimage Route) (Barbir 1980: 109). Another important change after the Ottoman conquest was the eastward shift of the Ḥajj route. Before the Ottoman conquest the Ḥajj had usually taken the highland route via al-Karak and ash-Shawbak. It is said that soon after the conquest a daughter of the Ṣulṭān complained of bandits on the road so that Suleyman ordered that the Ḥajj follow a new route along the edge of the desert. (This is the same route as that later adopted for the Ḥijāz railway and now known as the Desert Highway). This eastward shift is of considerable significance when one considers the position of the Ḥajj forts in the fortress network.

There were three types of fortress (see FIG. 2) in the region during the early Ottoman period which may be characterized as:

(i) Large fortress towns or citadels such as al-Karak, ʻAjlūn, ash-Shawbak and Bayt Jibrīn. These occupy the highland regions.

(ii) Garrison forts located in the low lying regions of Palestine.

(iii) Small roadside or police forts located along desert routes.

(i) The large fortresses were all built before the Ottoman period and most date back to Crusader times. Ottoman work at these castles was mostly limited to repair of damaged fortifications and there were few real modifications. Generally speaking the Ottomans avoided building large castles, preferring instead to re-use previous fortifications. The notable exceptions to this are the large fortresses in Eastern Anatolia build to control communications with Safavid Persia (Barbir 1980: 136; Nicole 1983: 23-24).

(ii) The most notable Ottoman contribution to the fortress network of the region were the large garrison fortresses in Palestine. Important surviving examples of this type are Rās al-ʻAyn, al-Qaṭrāna and ʻAyn Tujjār. These fortresses simply consists of a large stone enclosure wall with corner towers and a gateway with very little in the centre. This was a characteristic feature of Ottoman fortification and can be seen on a grander scale at Rumeli Hisar just outside Istanbul. Here high stone walls run between huge towers overlooking the Bosphorous yet within there is nothing but a large open space (Goodwin 1971: 105). The open spaces in these fortresses would contain wooden barracks and storehouses (Nicole 1983: 23) and possibly a mosque (excavations at Rās al-ʻAyn have uncovered the remains of a stone mosque near the entrance, Kochavi 1975: 35-37). The Turkish traveller Evliya Celebi gives a good description of the fortress of ʻAyn Tujjār which shows how this type of fortress would have functioned:

> This fortress was constructed by Sinan Pasha, the conqueror of Yemen, between 1568 and 1589, in order to ensure the safety of the road between Damascus and Cairo. It is a perfect square fortress built of masonry in the midst of a large verdant meadow. It has a circumference of 600 paces. The garrison consists of a warden and 150 men. It has a double iron gate facing north. Inside the fortress are between forty and fifty rooms for the garrison. It is the seat of the police magistrate, situated on the borders of Safad, being also an administrative sub district (Stephan 1936: 84).

(iii) The philosophy of building the small forts was quite different to that involved in the larger fortifications. Small, often portable forts had been important elements in Ottoman strategy since early times, thus the standard method of taking a fortified town was to ravage the countryside around and impose a blockade with a series of small forts (Nicole 1983: 23). Such forts can be seen depicted in the illustrations of the Suleymanname where they are used in the siege of Belgrade (Atil 1987: 12-13).

Small forts had been used to protect roads in the area before the Ottoman period, important examples on the Ḥajj route include Qaṣr Shabīb at az-Zarqa' and the fort at al-Jīza. Both of these forts are mentioned in the fourteenth century pilgrimage itinerary of Ibn Baṭṭūṭa and continued to be used up until fairly recently (the fort at al-Jīza is still used by the Desert Police). The design of these buildings is considerably different from that of the Ottoman Ḥajj forts, most notably because they are not built around courtyards. In the sources these buildings are referred to as towers (sing. *burj*) as opposed to forts (sing. *qal'a*).

The Ḥajj forts were essentially housing for the garrison and were not designed to provide shelter for the pilgrims themselves who camped in front of the forts. Tresse (1937: 46, 229) gives a schematic plan of the Ḥajj caravan camped around a fort. The size of the garrisons varied but generally consisted of between twenty and thirty men (cf. 150 men at ʻAyn Tujjār). The troops were mostly jannisaries from the province of Damascus al-

though Ma'ān and al-Qaṭrāna were manned by imperial jannisaries. Many of the Ḥajj fort garrisons were supplied from other forts in the region, either from the garrison fortresses of Palestine or one of the castles on the old Ḥajj route (i.e. King's Highway).

The three types of fort are located in three zones which are, the coastal plain of Palestine, the highland region both sides of the Dead Sea and the desert littoral. The type of fort in each zone reflects the nature of Ottoman interest in the particular area. The large garrison forts (Type ii) such as 'Ayn Tujjār functioned as bases for tax collection and the maintenance of public order in the populous regions of Palestine. The older fortresses east of the Dead Sea served as secure population centres in areas often outside government control. In many ways these older fortresses served as a back-up for the Ḥajj forts both in terms of supply of manpower and as an alternative route when there were problems on the Ḥajj road. The Ḥajj forts were located in fairly exposed positions isolated from main population centres, their position on the edge of the desert meant they were exposed to frequent bedouin attacks.

The eastward shift of the Ḥajj route and the position of the Ḥajj forts imply that the Ottomans sought to make the Ḥajj road a physical demarcation between settled lands and the desert. This idea is corroborated by the siting of the Ḥajj forts along the same line as the Roman lines. Sometimes the Ḥajj forts even re-use Roman facilities, thus the forts at al-Jīza and al-Qaṭrāna are sited next to Roman reservoirs. Like the Romans, the Ottomans thought that their empire was capable of indefinite expansion and the desert presented a military dilemma. Whilst the desert was certainly not worth conquering it could not be left as a threat to settled life. The solution was to use the Ḥajj route which had to be defended anyway as a secure border.

In addition to fortification various other methods were adopted to increase security along the route. One of the most important of these was the *cerde* or military escort which accompanied the caravan to Makka and back. The size of the *cerde* varied but at the beginning of the sixteenth century it was composed of 200 jannisaries and one hundred sipahis (feudal cavalry). The armaments of the escort included hand held guns and cannon mounted on camels.

Whilst the *cerde* was capable of coping with isolated attacks it would not have been able to stand up to a full scale tribal raid. For this reason subsidies were paid out to tribes from a central fund (*surre* — literally purse). The distribution of the *surre* took place at Muzayrīb and was given to all tribes who bordered the route. Sometimes the bedouins would cheat by allowing the caravan to pass safely through their own territory and then attack it in the area of another tribe. Failure to make payments from the *surre* could result in serious consequences. Al-Jazīrī (d. 1568) remarked that tribal attacks occurred when allowances had not been paid.

The Ottomans also employed economic sanctions against bedouins, thus in 1567 an order was sent out commanding the governor of Damascus to "collect from markets all large arrows with flat wide iron heads together with bows and daggers used by the bedouin and to distribute them among the various citadels on the route to Mecca." (Bakhit 1982: 220). A similar order made it illegal for merchants to trade with the bedouins (Bakhit 1982: 218).

Apart from sanctions against the bedouins, the Ottomans generally sought to promote trade in order to increase stability in the area. Barbir believes that the wages of the garrison were deliberately kept low as it was known that troops would supplement their incomes by trading with pilgrims and villagers (Barbir 1982: 150). Each fort would specialise in different products depending on its location (see Rafeq 1970: 115 for a table of the products sold at each fort). Generally speaking, the garrisons acted as middlemen selling local products to the pilgrims and imported goods from either Makka or Damascus to the local people. The tax free status of the route further encouraged trade, although merchants using the route were subject to taxation on their return to Damascus.

The effect of the Ḥajj route on trade in the area was probably quite considerable although it would be useful to test this through archaeological excavation. Hütteroth and Abdulfattah (1977: 891) suggest that the effects were less than might be expected when they state "... even the most frequently travelled hajj-route in the Ottoman empire which crossed the country did not initiate the development of market centres along its course." There is, however, some evidence that the Ottomans sought to promote settlement in marginal areas by offering tax exemptions and protection to settlers around the forts (Bakhit 1982: 220-221). Although it is fairly certain that settlements around forts did exist, little is known about their size and composition, their relationship to other settlements or their degree of permanence.

**The Development of Fortification on the Ḥajj Route**

For the moment, our understanding of settlement along the desert border is limited to the fortresses on the Ḥajj route. Two main phases of construction can be discerned, the first taking place in the mid sixteenth century and the second in the eighteenth century (there is no record of forts being built during the seventeenth century although repairs were carried out, Barbir 1980: 137). It is suggested that the first phase was concerned with the establishment of Ottoman rule in the area whilst the second phase was a response to increasingly successful bedouin

raids in the area. This difference is reflected in the appearance of the buildings. The earlier forts tend to be decorated with carved ornament such as the three balls above the gate at al-Qaṭrāna which are an Ottoman design derived from a Buddhist symbol for good fortune. However decoration at the later forts is limited to inscriptions naming the sultan of the time and the officials involved in its construction.

The first forts were built fairly soon after the Ottoman conquest at key positions along the Ḥajj route such as the oasis town of Ma'ān. The construction of these forts can be seen as a product of the same thinking which initiated major building programmes at the recently captured cities of Aleppo, Damascus, Jerusalem and Cairo. Such projects must be regarded as an attempt by the Ottomans to strengthen their claims to be successors to the early Arab caliphs (the titles of the Ottoman sultans included that of caliph). In this context, the forts at al-Qaṭrāna and Ma'ān may be seen as an attempt to advertise Ottoman supremacy to the thousands of pilgrims who passed them each year. It is perhaps significant that one of the other titles taken by the Ottoman sultans was that of "servant of the two sanctuaries". The building and maintenance of facilities on the route was one of the best ways of fulfilling the obligations inherent in such a title.

For the next 150 years such facilities seemed to be sufficient for the successful organization of the Ḥajj caravan. However, at the beginning of the eighteenth century the number of recorded bedouin attacks increased dramatically. Previously over a period of more than a hundred and eighty years from the Ottoman conquest up to 1700, only six major attacks had been recorded. From 1700 to 1757 the number of recorded attacks rose to nineteen, eleven of which were successful. This works out at an eight-fold increase in the frequency of attacks from the sixteenth to eighteenth centuries (Barbir 1980: 170). The building of new Ḥajj forts was an obvious response to provide increased protection for the pilgrims. The new forts were better designed and covered a much larger proportion of the route than the earlier forts. Other measures adopted included the granting of increased powers to the governor of Damascus and the introduction of a rota system for the fortress garrisons (Barbir 1980: 146). None of these measures were sufficient to prevent the catastrophe of 1757 when the entire caravan was destroyed at al-'Ulā, killing 20,000 pilgrims.

The reason for the increased ferocity and frequency of attacks has been the subject of much debate but the increased success of these raids must be attributed to the acquisition of firearms by the bedouins (for support of this idea see Ayalon 1956: 97). Now that the raiders possessed guns which could be fired from horseback, the slow moving Ḥajj caravan was easy prey. The recognition of the changing balance of power can be found in the design of the new forts which had a much greater defensive capability, noticeable in the corner towers and gun openings. The positioning of the forts was now such that most forts were within a day's march of another fort. Generally, however, there was little the Ottomans could do to prevent the westward movement of the bedouins so that the forts became like "ships isolated in the immensity of the desert" rather than potent symbols of Ottoman power.

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# Pour une éthnoarchéologie des cycles d'évolution dans l'habitat rural du Proche-Orient

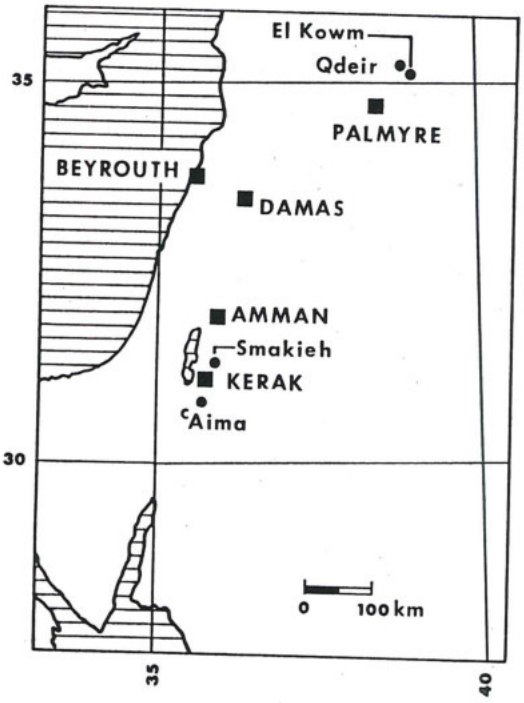
## Principes et méthodes

Entreprise en 1980, l'étude de quatre communautés villageoises en Syrie et en Jordanie a permis de mettre en évidence un certain nombre de constantes dans l'évolution de l'organisation spatiale de chacun de ces villages. A la lumière de ces constantes, on peut faire apparaître des règles qui, avec des rythmes différents, ont présidé à l'histoire du développement de ces villages. Une enquête orale systématique et une attention particulière portée à la manière dont cette histoire s'est traduite concrètement sur le terrain conduit à cartographier les différentes étapes de l'implantation et de la construction des bâtiments. On obtient ainsi, traduite en plans chronologiquement bien établis, une succession d'étapes dans le développement de chacun des villages. Ces documents peuvent alors être confrontés aux plans obtenus dans les fouilles archéologiques, à condition que l'étendue de la surface fouillée et l'attention portée à l'ordre d'apparition des bâtiments le permettent. En comparant ce qui est comparable — en l'occurrence des plans — on est en droit de présenter des hypothèses sur l'organisation spatiale des villages du Proche Orient ancien.

*Présentation des villages actuels* (FIG. 1)

Situés dans des contextes géographiques différents, fondés à des époques différentes, les quatre villages actuels étudiés ont en commun d'avoir été créés par des éleveurs nomades qui se sont progressivement sédentarisés et adonnés à l'agriculture, tout en continuant à pratiquer l'élevage.

Fondé au 18ème siècle, abandonné puis réoccupé à plusieurs reprises (Lewis 1991), al-Kowm se trouve dans la steppe syrienne, à proximité d'une abondante source artésienne, sur un axe de circulation qui relie "l'oasis" de Palmyre à Raqqa, sur l'Euphrate. Le village actuel est au pied d'un très important tell néolithique, principalement occupé au 7ème millénaire. A neuf kilomètres au nord, Qdeir est un village récent, créé en 1958, situé lui aussi à proximité d'un site occupé au paléolithique puis au néolithique (7ème millénaire, cf. Aurenche et Cauvin 1982), et au voisinage d'une source artésienne. A toutes les époques, la présence de l'eau semble avoir joué un rôle décisif dans l'implantation humaine.




1. Carte de localisation des villages actuels étudiés (d'après Noca 1985).

Smakieh, situé sur le plateau transjordanien, à la limite de la steppe, a été fondé en 1909 par deux tribus chrétiennes en voie de sédentarisation. Des vestiges byzantins sont signalés sur le site (Aurenche et Desfarges 1985). Fondé probablement, à la fin du 16ème siècle, 'Ayma a été visité à plusieurs reprises par des voyageurs. Des traces d'une occupation nabatéenne et byzantine ont été repérées sur le site (Biewers, à paraître).

## Les étapes du développement

En confrontant les éléments recueillis lors des enquêtes, on peut mettre en évidence quatre étapes principales dans le processus de développement de chacun des villages, depuis leur origine respective jusqu'à la date des enquêtes (1980-1990).

*Première étape: implantation* (TABLEAU 1)
Ce qui frappe, à Qdeir, c'est l'implantation très lâche des premières maisons. En 1958 le village comptait 10 maisons et 18 tentes (FIG. 2), et occupait, d'emblée, la même surface que l'emprise du village en 1980, qui compte 110 maisons et 33 tentes (FIG. 3). Ce phénomène s'explique par plusieurs raisons: le "nouveau" village, en voie de formation, reproduit au sol l'organisation "normale" d'un campement nomade: maisons et tentes sont espacées et alignées, la maison en dur ne représentant, dans un premier temps, qu'une tente fixe (Jarno 1984). On note qu'en 1958 les tentes sont plus nombreuses que les maisons, mais que ces tentes occupent des emplacements, où seront, plus tard et progressivement, construites des maisons. Les emplacements sont ainsi "préemptés" pour un développement futur. Le plan dressé en 1980 (FIG. 3) conserve des traces de cette situation: même si les tentes tendent à être rejetées vers ce qui devient une périphérie: certaines sont encore dressées à proximité des maisons du "centre" du village, et les maisons construites entre temps conservent les alignements primitifs. Tout se passe donc comme si, en respectant les règles traditionnelles d'espacement d'un campement, on préfigurait, du même coup, le développement du futur village.

La situation est un peu différente à Smakieh, où la planification a été encore plus précise. Dès 1909, le terrain choisi pour le village a été divisé en 46 parcelles concédées aux deux tribus au prorata du nombre de clans. En quelques années 36 maisons sont construites. Mais chaque parcelle n'est pas entièrement occupée. On n'y construit, au départ, qu'une seule pièce, qui d'ailleurs ne sert pas d'emblée à l'habitation, mais au stockage des réserves (Jarno 1984; Aurenche et Desfarges 1985). En effet, comme à Qdeir, le village, au début, n'est pas occupé de manière permanente, mais 3 à 4 mois dans l'année, et l'on continue à vivre sous la tente qui est montée alors à proximité de la pièce en dur. La sédentarisation est donc progressive. En 1980, à Qdeir, par exemple, 3 familles seulement occupent le village de manière permanente. A Smakieh, la sédentarisation ne s'est achevée que vers 1950, soit plus de quarante ans après la fondation du village.

La situation était la même à 'Ayma en 1812: Burckhard y note la présence de "petits groupes de tentes et de bâtiments disséminés sur le replat de site". Mais, là aussi, l'implantation s'est faite selon des règles précises, le "territoire" du village ayant été réparti d'abord entre 3, puis entre 6 tribus (Biewers, à paraître). La situation est moins claire à al-Kowm, car, depuis sa fondation, le village a été abandonné, puis réoccupé. On sait qu'en 1940, le village comptait 10 maisons, que ce chiffre avait doublé en 1935 et qu'en 1980, il y avait 32 maisons (Desfarges 1983).

Il ressort de ces observations qu'au moment de la création de ces villages l'implantation des premières constructions est extrêmement lâche, et que, par voie de conséquence, l'emprise sur le terrain est étendue. Le territoire du futur village se trouve ainsi, dès l'origine, délimité dans des grandes lignes.

*Deuxième étape: densification et extension limitée*
A partir de l'implantation, la première forme de développement consiste à densifier progressivement l'espace

**Tableau 1.**

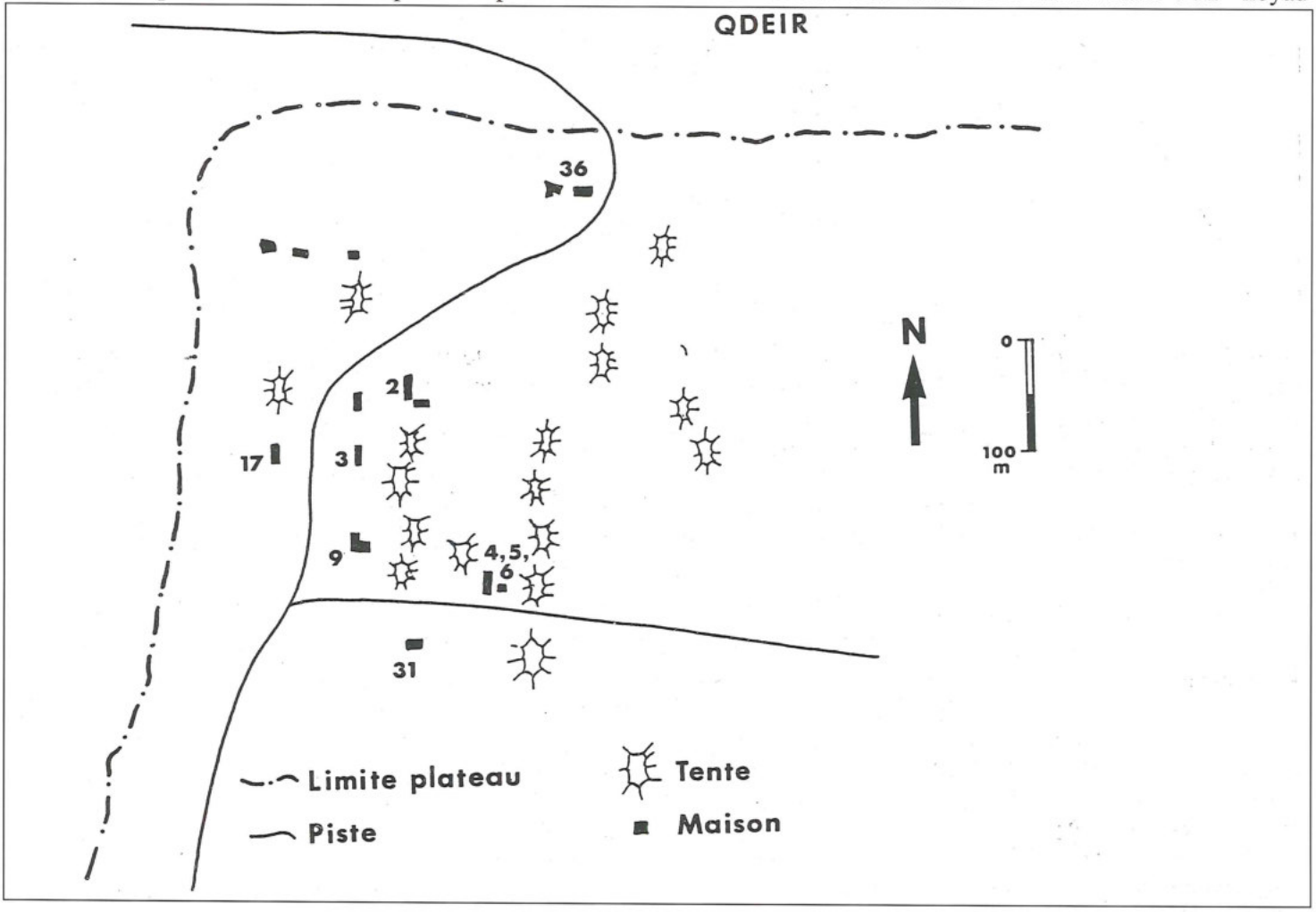
| LES ETAPES DU CYCLE | Smakieh | 'Ayma | al-Kowm | Qdeir |
|---|---|---|---|---|
| 1 **Implantation** | 1909 : 2 tribus - 36 maisons 46 parcelles - 2,12 ha | avant.1812 : 3, puis 6 tribus | 1910 : 10 maisons 1935 : 20 maisons | 1958 : 2 tribus - 10 maisons - 18 tentes |
| 2 **Densification Extension limitée** | 1929 : 50 maisons - 400 personnes - 2,4 ha 1950 : 100 maisons - 700 personnes - 5,8 ha | 1953 : 369 maisons - 9 ha | 1980 : 32 maisons dont 21 occupées - 130 personnes | 1980 : 110 maisons dont 60 occupées - 33 tentes |
| 3 **Saturation** /\ **Déplacement latéral** /\ **Abandon du noyau primitif** | 1950 - 1970 : début du " nouveau village" : abandon du " vieux village" | 1953 - 1986 : début du " nouveau village" : abandon du " vieux village" superficie totale 17 ha | 1960 : création de "fermes satellites" : maintien du "vieux village" | |
| 4 **Redensification Réoccupation partielle du noyau primitif** | 1970 - 1980 : densification du " nouveau village" : réoccupation sporadique du " vieux village" | 1979 : 1016 personnes 1988 : 3155 personnes quelques maisons du " vieux village" occupées | | |

occupé. Le cas est particulièrement clair à Smakieh et à Qdeir, qui sont les villages les plus récemment créés. A Qdeir, le développement est rapide. En 20 ans, on passe de 10 à 110 maisons, dont 60 seulement, soit un peu plus de la moitié, sont occupées au moment de l'enquête. Des tentes, proportionnellement moins nombreuses (33 tentes pour 60 maisons, contre 18 pour 10 maisons en 1958), sont encore visibles dans le village en 1980, ce qui montre que la sédentarisation est loin d'être complète. Le plan (FIG. 3) illustre bien le sens de développement du village: les maisons les plus "achevées", c'est-à-dire celles qui possèdent un mur de clôture, sont, sauf exception, soit celles qui ont été construites les premières (FIG. 3, n°2,3,4,5,5,17,31,36), soit celles qui sont venues s'intercaler dans les espaces laissés libres entre ces premières maisons. L'étape de détail confirme ce schéma de développement: les différentes pièces de la maison ne sont pas nécessairement rajoutées de manière contiguë mais disposées isolément de façon à former progressivement un espace domestique, qui sera, pour finir seulement, matérialisé par un mur de clôture (FIG. 4, n° 31 et 32). Ce processus est facilité par la disposition des lieux, en pente douce du sud vers le nord.

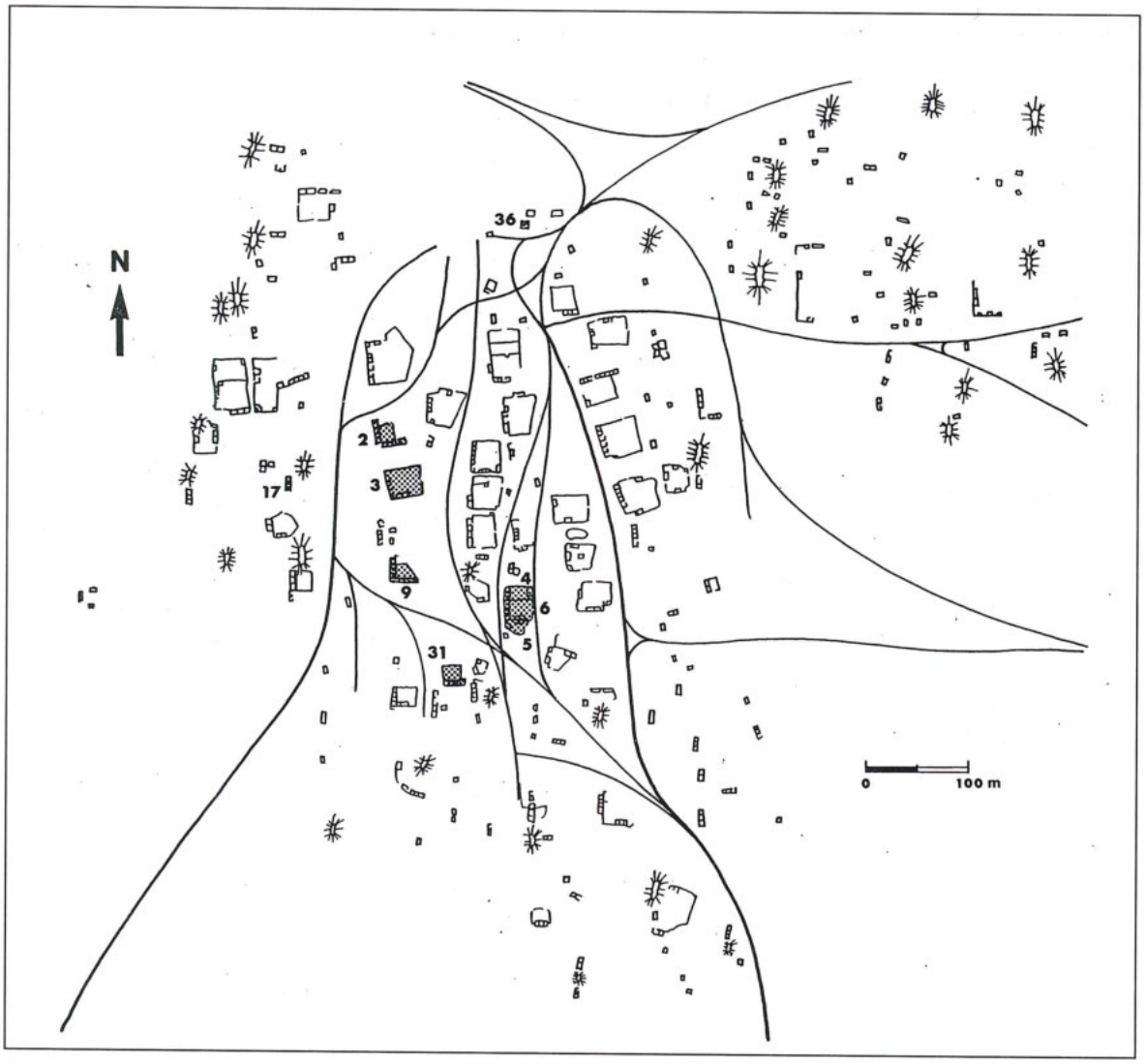
Ce processus de densification progressive est bien observé aussi à Smakieh, où l'on passe, en 20 ans, de 36 maisons construites sur 2,12 ha à 50 maisons construites sur 2,4 ha, et bien illustré par la FIG. 5: les intervalles (parcelles) laissés libres en 1909 sont progressivement comblés en 1929. La densité, beaucoup plus forte qu'à Qdeir, s'explique par la configuration du terrain, qui est plus escarpé.

On voit ainsi se créer progressivement un noyau autour duquel le développement va se poursuivre. C'est le cas à Qdeir où les maisons "nouvelles", sans cour matérialisée et où les tentes sont encore nombreuses, se développent au sud et au nord-est (FIG. 3). A Smakieh, le nombre des maisons double en 20 ans, pour atteindre 100 en 1950, occupant une superficie totale de 5,8 ha, double de la superficie primitive. Le même phénomène s'observe à al-Kowm. L'étude des procédés de construction a montré que les maisons les plus anciennes se trouvaient au centre du village, et que les maisons les plus récentes se trouvaient à la périphérie (FIG. 6).

On assiste donc ainsi à la constitution d'un "noyau




2. Plan du village de Qdeir en 1958 (d'après une photographie aérienne) à une date proche de sa fondation (d'après Desfarges 1983).




3. Plan du village de Qdeir en 1980. Les maisons (ou pièces) déjà construites en 1958 sont hachurées (d'après Desfarges, 1983).

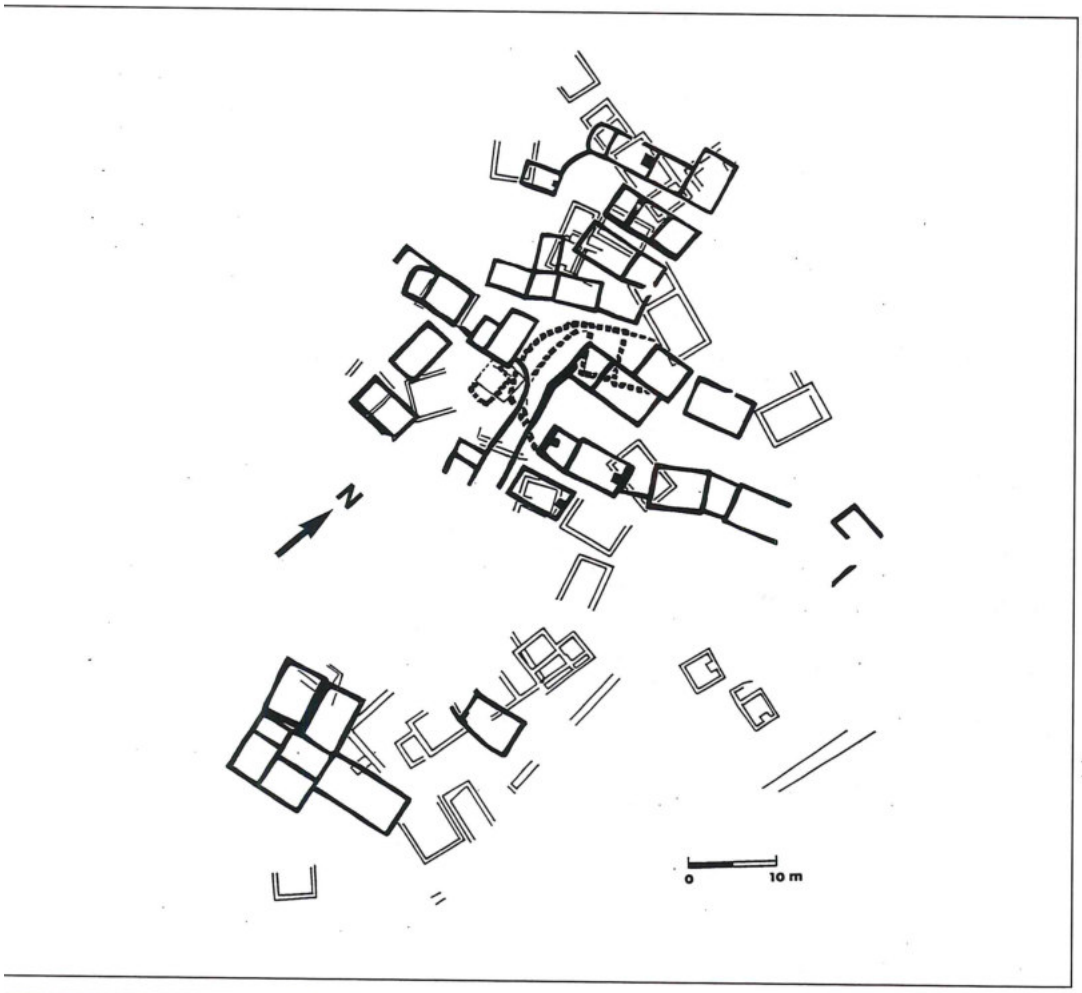
central" qui se densifie progressivement et d'une "périphérie" qui s'ordonne autour. La durée de cette étape est variable. Elle n'est pas achevée, par exemple, à Qdeir, alors que dans les trois autres villages, elle a déjà fait place à l'étape suivante.

*Troisième étape: saturation de l'espace primitif et déplacement de l'habitat*

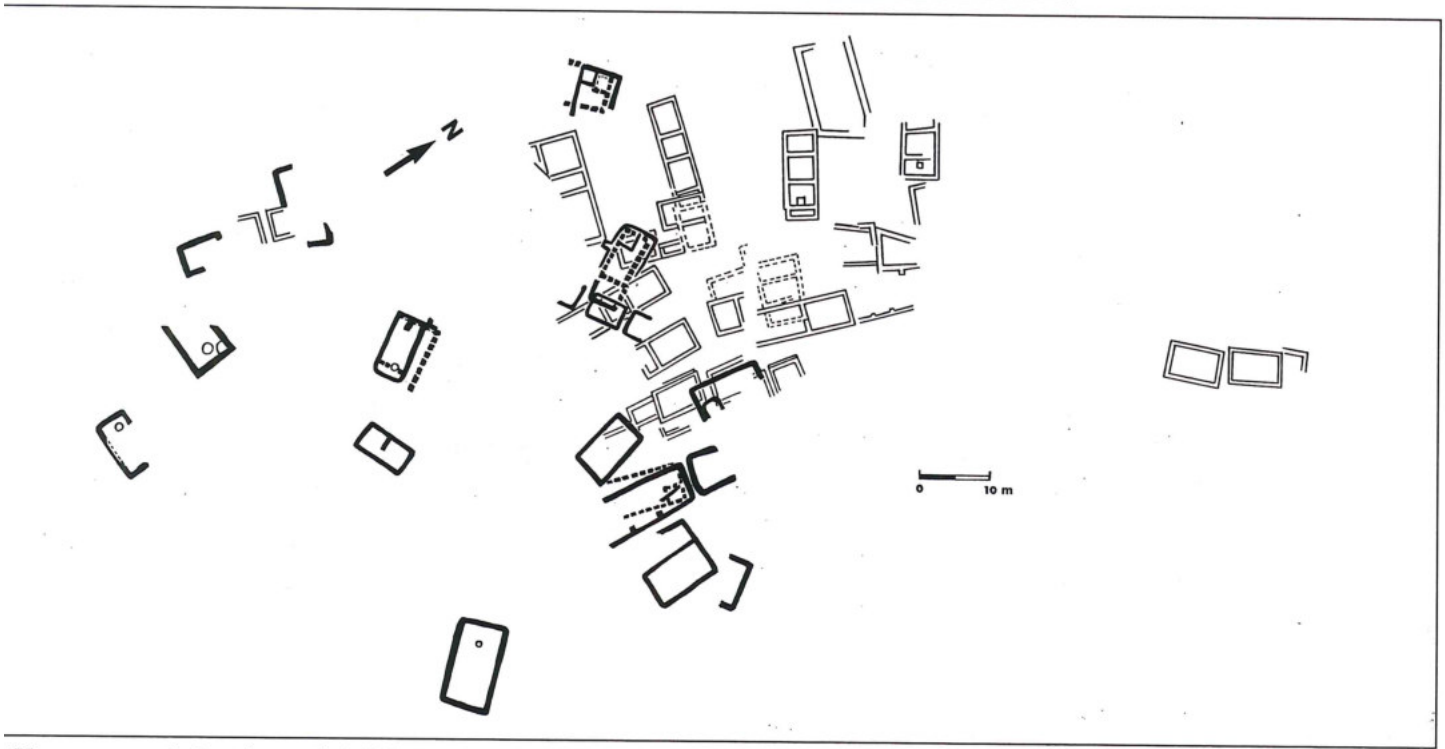
A bout d'un certain temps, l'espace à construire est saturé. Cette saturation est due à des raisons démographiques que l'on pourrait qualifier de "normales". A Smakieh, par exemple, dès 1930, des maisons sont construites à la périphérie du village initial, car certaines parcelles sont déjà saturées (Roux 1984). En Jordanie, le maximum est atteint vers 1950: Smakieh abrite alors 700 personnes réparties dans 100 maisons sur 5,8 ha (Roux 1984), tandis que 'Ayma compte 369 maisons sur environ 9 ha (Biewers, à paraître). La croissance démographique peut être régulée par d'autres facteurs, "externes": c'est à la même époque que commence, surtout en Jordanie, le phénomène d'exode rural, qui attirant vers les villes une partie des populations rurales, diminue la pression démographique. Le phénomène a été mis en évidence à Smakieh, où, par exemple, 59 hommes sur 126 ont quitté le village à la 2ème génération et 75 sur 188 à la 3ème génération (Roux 1984). Cependant, régulée ou non, la pression démographique engendre, tôt ou tard une saturation, particulièrement sensible en Jordanie.

La réponse à cette saturation de l'espace pourrait provoquer, par exemple, un développement en hauteur, par la construction d'étages, techniquement possible sur des toits plats. L'expérience montre cependant que la construction d'étages, rare, mais présente, constitue plus une affirmation de richesse ou de prestige social qu'une réponse à la pression démographique (Aurenche 1992).

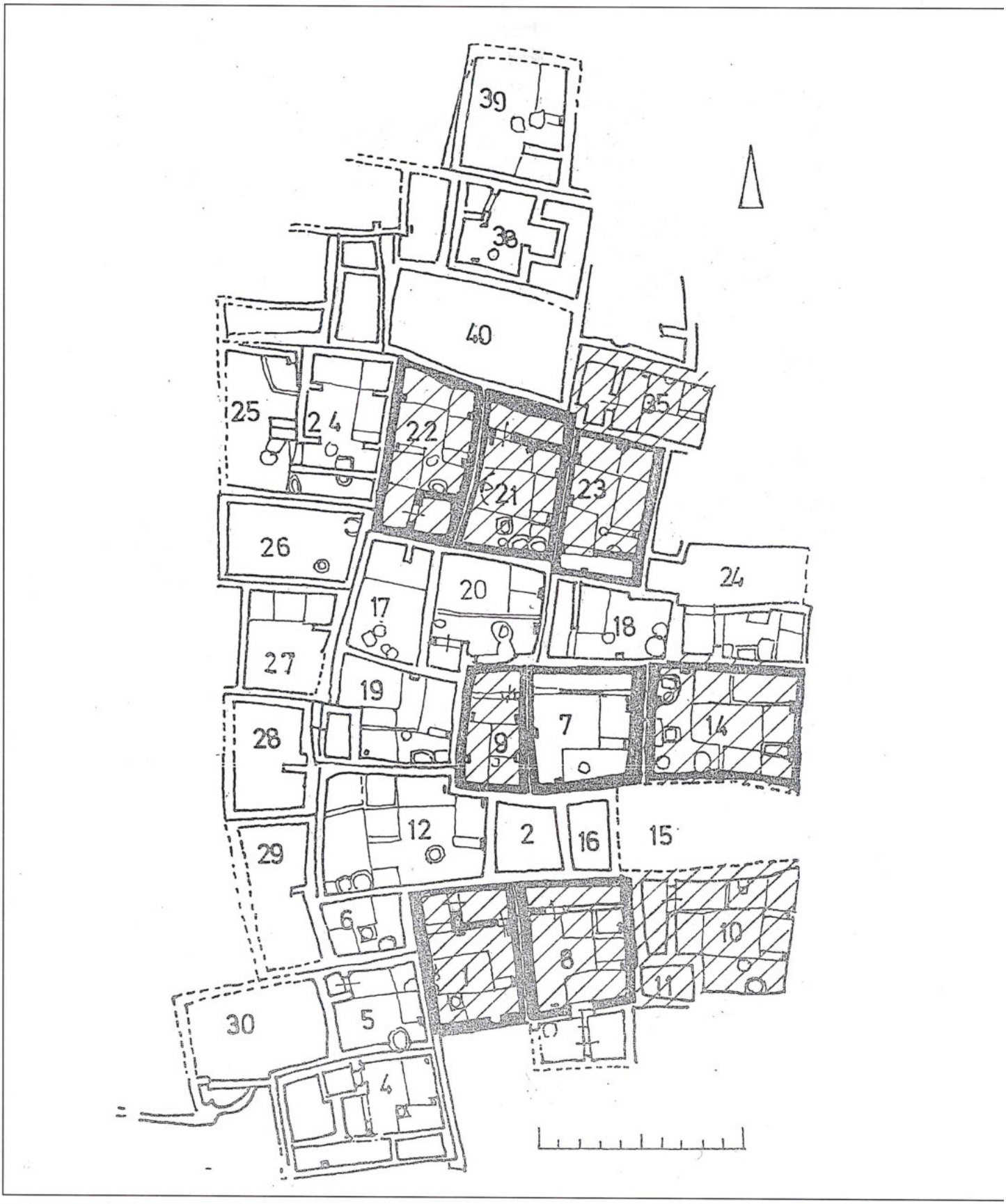
En fait, la solution adoptée dans les trois cas observés a été le déplacement latéral de l'habitat, c'est-à-dire la construction, à proximité du "vieux" village, d'un "nouveau" village qui gagne sur des terres agricoles. Le rythme de cette translation est variable: à Smakieh, le phéno-



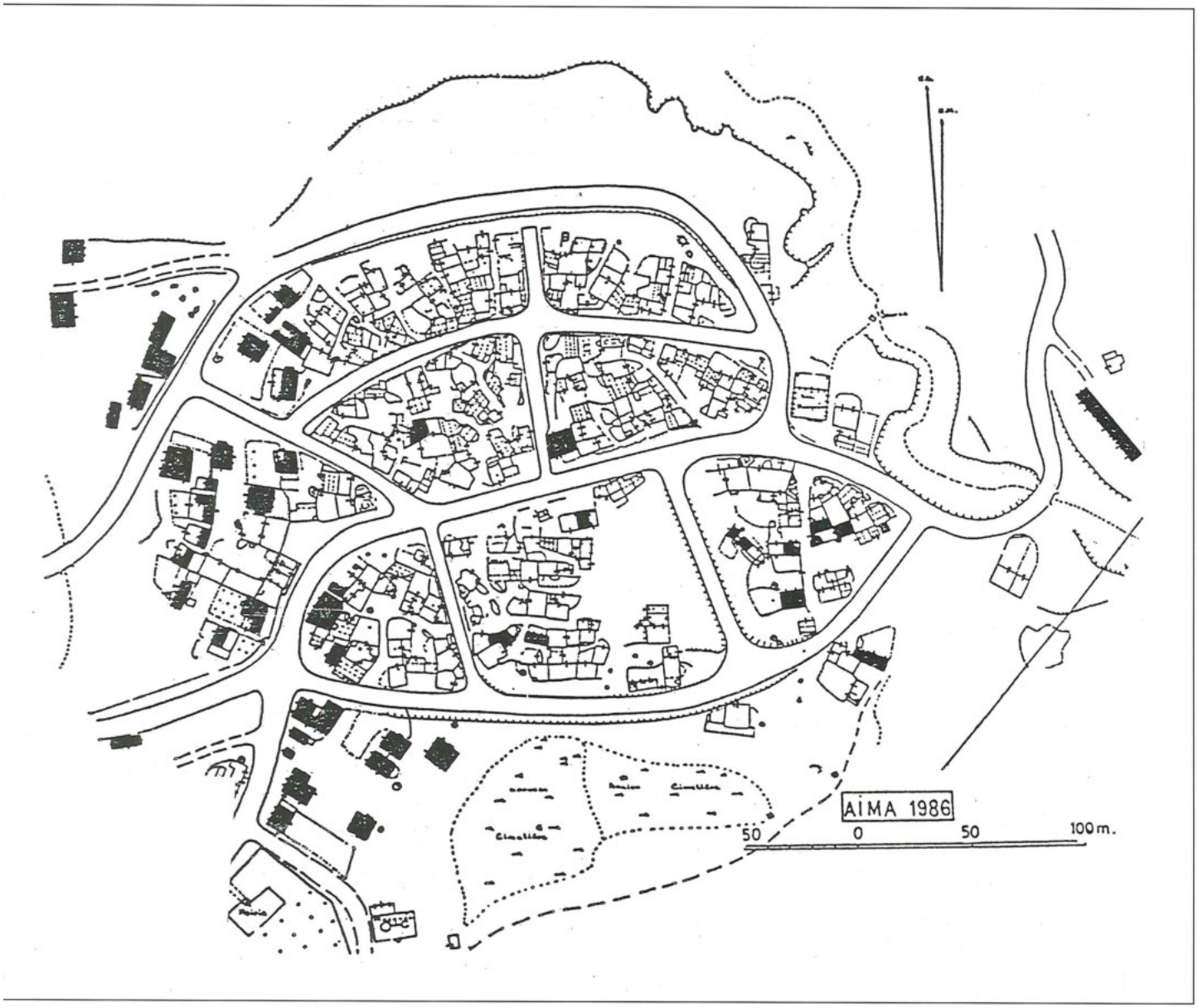

13. Plans superposés des niveaux "néolithique ancien inférieur" et "néolithique ancien supérieur" de Byblos. On mesure la densification progressive de l'espace (d'après Aurenche 1981).




. Plans superposés des niveaux "néolithique récent" et "énéolithique ancien" de Byblos. On note le déplacement latéral de l'habitat (d'après Aurenche 1981).




12. Plan du niveau VII de Çatal Höyük. En noir, les premières maisons construites, en blanc, les constructions postérieures (d'après Heinrich Seidl 1969).




1. Plan du "vieux" village de 'Ayma en 1987. En blanc, les maisons abandonnées, en noir les maisons occupées ou réoccupées (d'après Biewers, à paraître).

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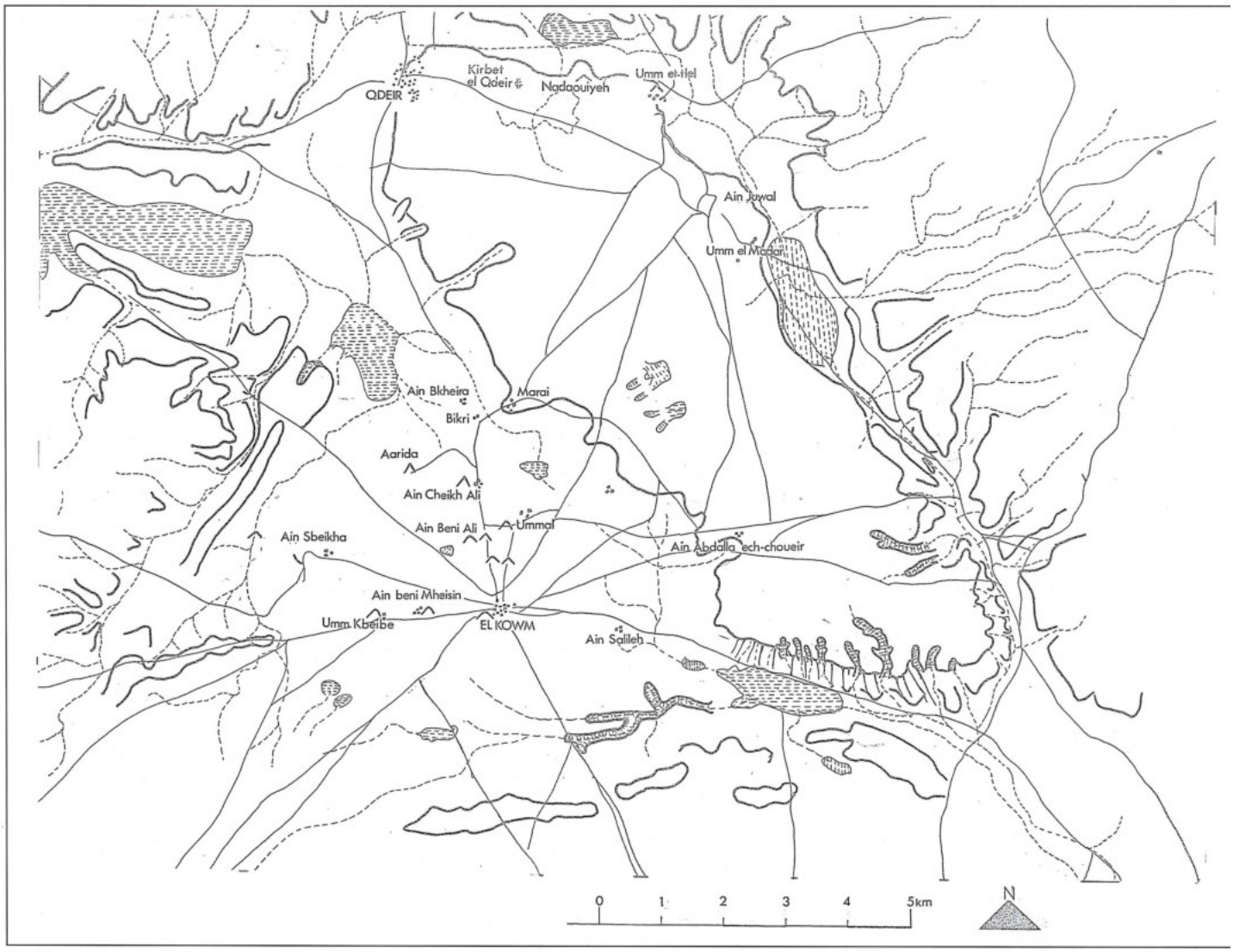


10. Carte d'implantation des "fermes-satellites" créés à partir du village d'al-Kowm (d'après Desfarges, 1983).

phénomène d'exode rural qu'ont connu les campagnes. Peut-on transposer cette durée dans les temps historiques, ou, a fortiori, préhistoriques? C'est peu probable en termes de chronologie absolue, mais ce n'est pas impensable en termes de chronologie *relative*. L'apparition du "phénomène urbain" n'est-elle pas l'une des données majeures de l'histoire du Proche Orient ancien? En quoi les conséquences en seraient-elles moins "visibles" dans les villages néolithiques que dans les villages actuels?

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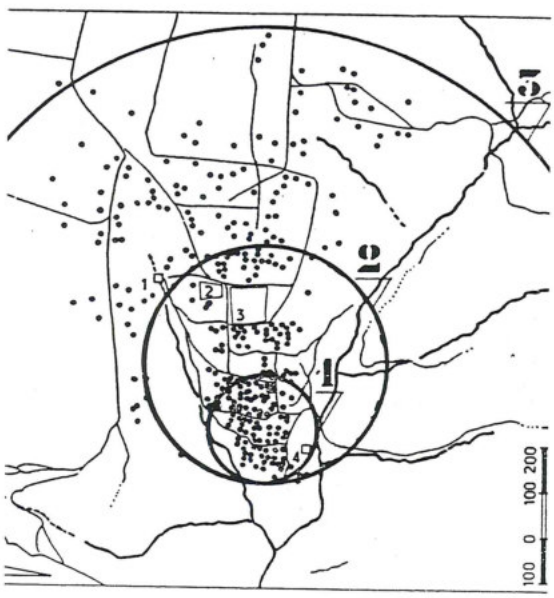
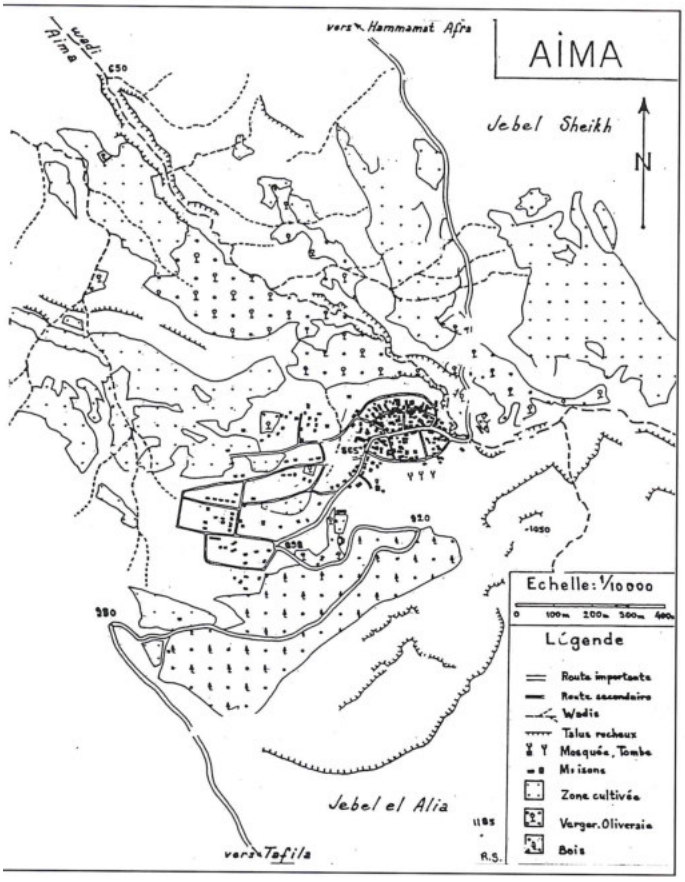



(1) emprise du village en 1929.
(2) emprise du village en 1959
(3) emprise du village en 1982

Schéma de développement du village de *Smakieh* et ses trois étapes principales (d'après Noca 1985).




Plan du village de 'Ayma en 1986. A l'est, le "vieux village" dont le tissu dense a été perturbé par le nouveau système de voierie qui s'étend aussi à l'ouest, et autour duquel s'implante le "nouveau village" (d'après Biewers, à paraître).

## Les implications archéologiques

Il est difficile d'apprécier, en général, le mode d'implantation d'un village ancien, et l'on admettra l'impossibilité de mettre en évidence la première étape. En revanche, on peut reconnaître, sur certains plans publiés, les preuves indéniables de la deuxième étape du processus, c'est-à-dire la densification progressive de l'espace. C'est le cas à Çatal Höyük, niv. II et VII, où Heinrich et Seidl ont fait apparaître l'existence de blocs de maisons, disposés en rangées parallèles, dont les intervalles semblent avoir été progressivement occupés par des constructions postérieures: leur plan et le mode d'agencement des murs montrent qu'ils sont venus s'intercaler entre des constructions préexistantes (FIG. 12; Heinrich et Seidl 1969). Voilà qui peut remettre en question, au moins dans un premier temps, le fonctionnement traditionnel de ce type d'habitat, cité souvent en exemple...

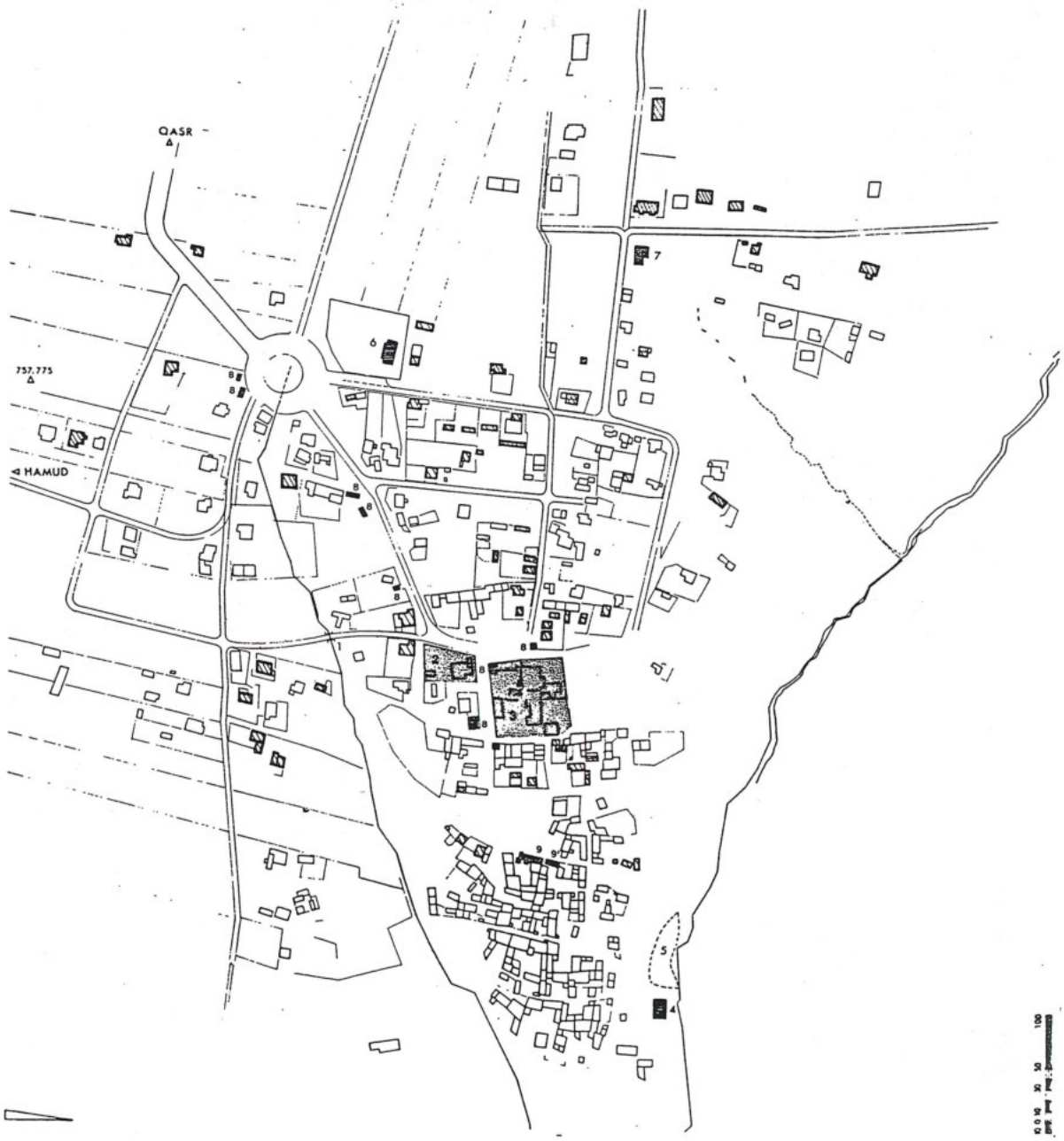
Un cas analogue existe à Byblos. Si l'on superpose le plan des constructions appartenant, selon les indications du fouilleur, au niveau "néolithique ancien supérieur", sur le plan des constructions du néolithique ancien "inférieur", on constate qu'à l'habitat dispersé de la première occupation succède un habitat plus dense qui occupe, au nord en particulier, un vaste espace laissé libre (FIG. 13). Certaines constructions subsistent d'une phase à l'autre, ainsi que l'orientation générale et les axes de circulation (Aurenche 1981: 284). La phase de densification progressive de l'espace serait aussi reconnaissable à Bouqras (Eichmann 1991: 62), mais il faudra attendre la publication définitive du site pour s'en assurer réellement.

On assiste aussi, à Byblos, à la troisième étape du processus, le déplacement latéral de l'habitat, entre le niveau "néolithique récent" et le niveau "énéolithique ancien", sus-jacent (FIG. 14). Une zone d'activités extérieures (aires de battage ?) est lotie et l'habitat se déplace vers le sud. Déjà, au néolithique moyen, selon le fouilleur, le village "ne se superpose... pas au gisement du néolithique ancien, mais lui est juxtaposé, non sans quelques recouvrements à sa limite méridionale et sporadiquement ici et là" (Dunand 1973: 95). Au néolithique récent, "l'installation ne se superpose pas non plus aux précédentes" (Dunand 1973: 126).

## Conclusion

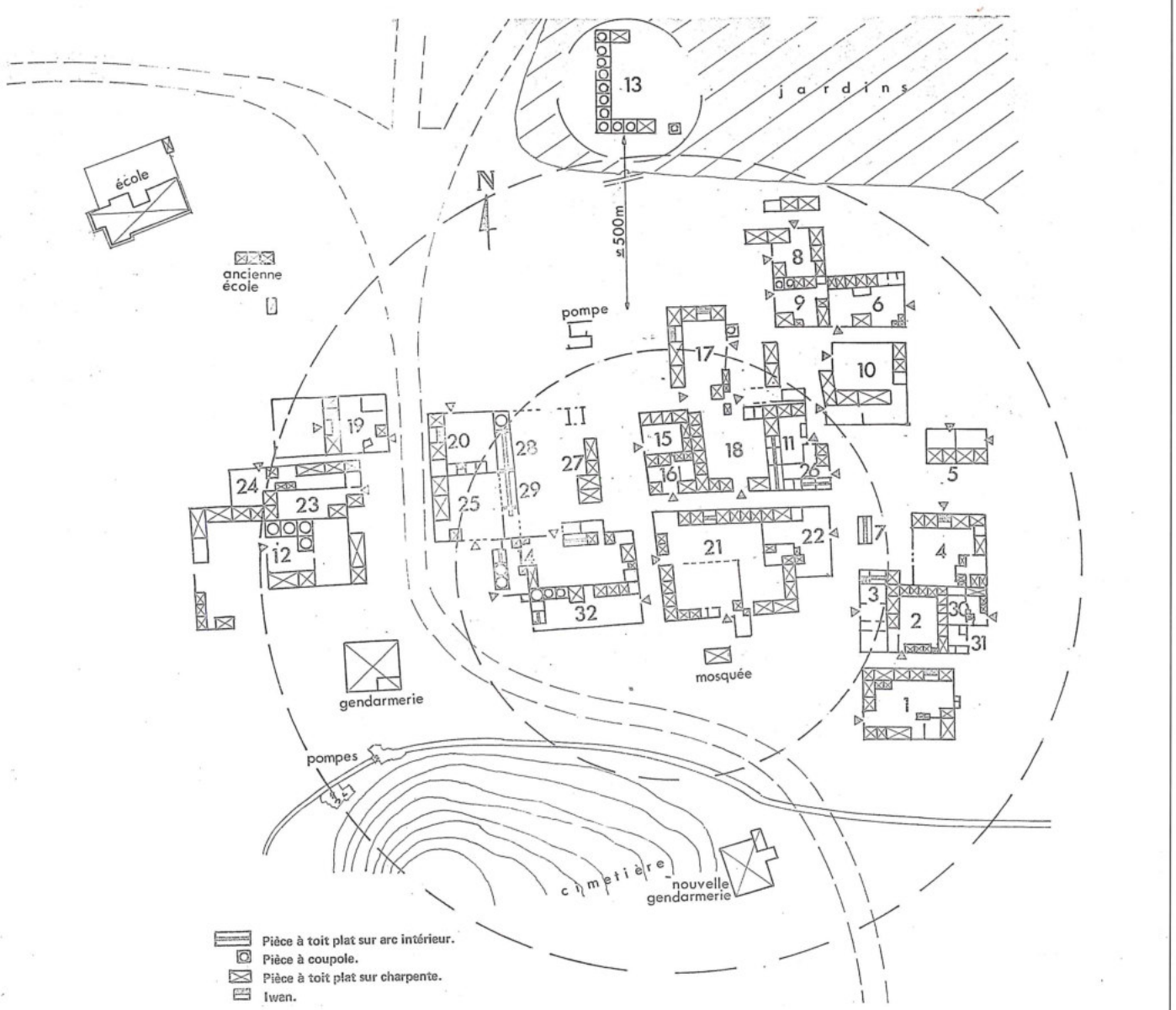
On pourrait multiplier les exemples de ce type. Leurs points communs, quelles que soient les périodes étudiées, renvoient tous, peu ou prou, à l'une ou l'autre étape du processus cyclique qui vient d'être décrit. Seul peut varier, selon l'état où la fouille a "saisi" l'habitat retrouvé, la place dans le cycle.

Une question importante reste en suspens, qui touche au rythme d'évolution du cycle. Les exemples actuels montrent dans ce domaine une assez grande variabilité, qui s'est trouvée accentuée, de plus, par l'accélération du




Habitat créé avant 1970, habitat créé entre 1970 et 1982 (1) pont, (2) église grecque orthodoxe, (3) église romaine, (4) ancien moulin, (5) cimetière, (6) mairie, (7) poste, (8) boutiques, (9) nouveau moulin, (9') nouveau moulin (annexe).

7. Plan du village de Smakieh en 1982. On distingue, à l'est, le village "ancien" (habitat dense) et, à l'ouest, le "nouveau village", avec sa voie préexistante, son habitat encore dispersé et la densification progressive (maisons hachurées) (d'après Noca 1985).



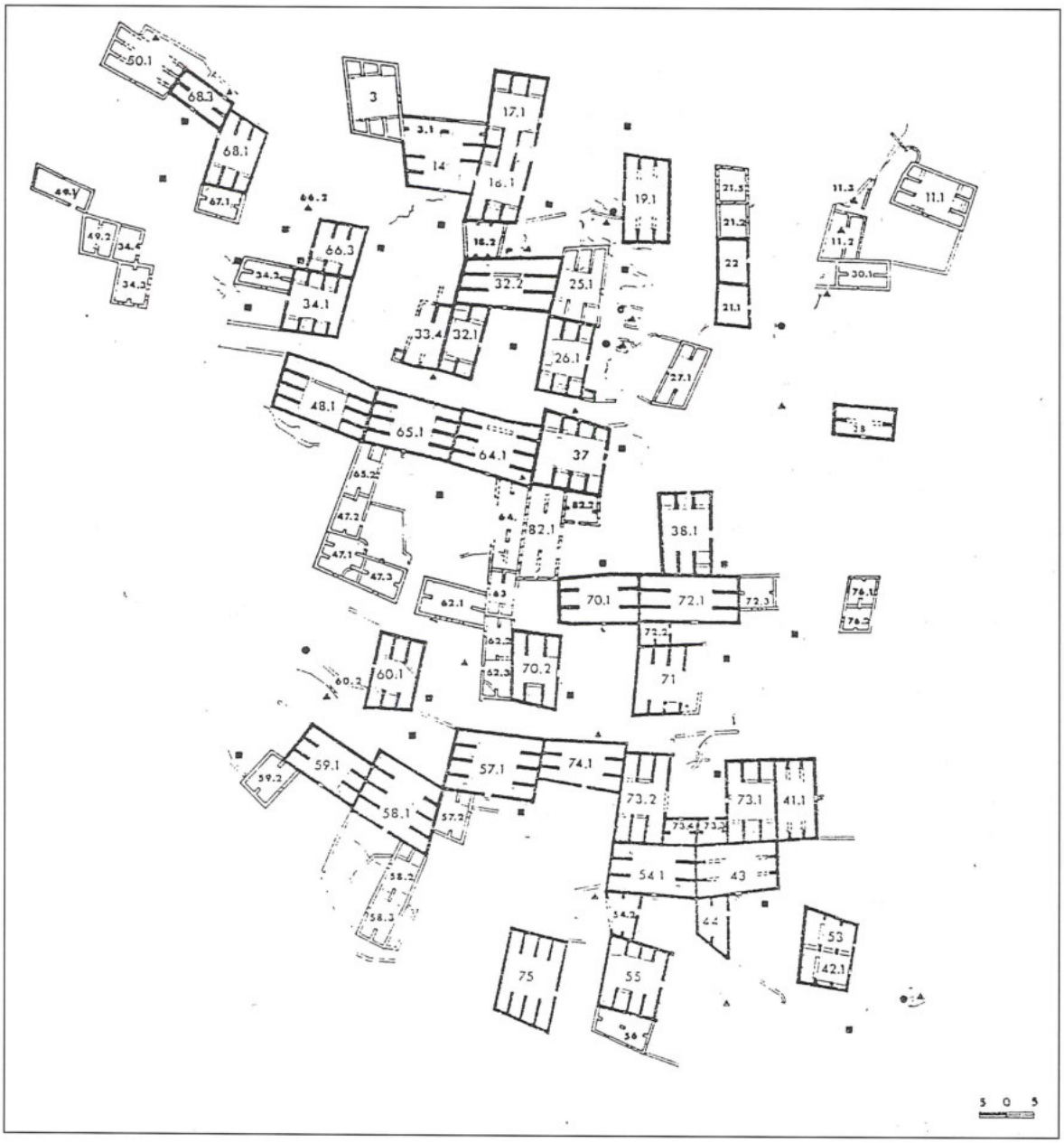

. Plan d'al-Kowm en 1980. Le cercle intérieur contient les maisons les plus anciennes (pièces à toit plat sur arc intérieur), le cercle extérieur marque l'emprise totale du village (d'après Aurenche et Desfarges 1985).

vieux" village, qui n'a pas opéré de transfert latéral mais essaimé" en "fermes-satellites" (observation personnelle, avril 1992).

Plus intéressant encore est le phénomène corollaire bservé à Smakieh et à 'Ayma, qui consiste à réoccuper, rogressivement, de manière sporadique, les maisons bandonnées du vieux village. Les raisons sont principalement économiques: il s'agit de familles, souvent trangères au village, qui souhaitant se fixer mais ne posédant pas les moyens de faire construire une maison euve, s'installent dans des maisons anciennes (Aurenche t Desfarges 1985). Il ne s'agit pas, sauf exception, d'un habitat résiduel, mais du réinvestissement "secondaire" d'un habitat déjà abandonné (FIG. 11). On peut donc là encore, évoquer un cycle d'évolution.

*Conclusion*

Loin d'être linéaire et univoque, le processus d'évolution de l'habitat rural dans le Proche Orient contemporain se présente donc comme un phénomène complexe, en partie cyclique, dont les étapes peuvent être définies avec précision. Il reste à considérer, maintenant, si des traces de processus analogues sont décelables dans les villages du Proche Orient ancien.




5. Plan du village de *S*
*kieh* en 1929. En t
noirs épais, les
structions effect
en 1909, au mon
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maisons du "nouveau" village, construites en béton, adoptent des plans complexes de type urbain, et occidental. Les maisons "traditionnelles", jugées peu confortables et peu conformes aux nouveaux standards, souffrent de la comparaison et sont progressivement abandonnées.

Ainsi, du point de vue de l'organisation spatiale, le développement du "nouveau" village va de pair avec l'abandon du: "vieux" village, selon un principe proche de celui des vases communicants. Il n'y a donc pas accumulation d'un habitat à côté de l'autre, mais substitution d'un habitat à l'autre. Ce double mouvement est particulièrement net à 'Ayma et à Smakieh (Noca 1985; Biewers, à paraître). On est donc loin de l'image traditionnelle, chère aux archéologues, de l'habitat qui s'empilerait indéfiniment sur lui-même...

Ce processus n'est cependant pas totalement abs
mais il apparaît dans une quatrième étape.

*Quatrième étape: densification du nouveau village; ré
cupation partielle du vieux village*

Cette étape tend d'abord à reproduire, dans le "nouve
village, le processus accompli dans le "vieux" villa
(étape 2), c'est-à-dire la densification progressive du n
vel espace conquis. Ce phénomène est particulièrem
net à Smakieh (FIG. 7). On peut donc bien parler ici d
cycle d'évolution, répétant un processus antérieur.

Pour les raisons indiquées plus haut, la situation
différente à al-Kowm où les maisons de type nouveau
béton, ont fait leur apparition dans l'emprise même

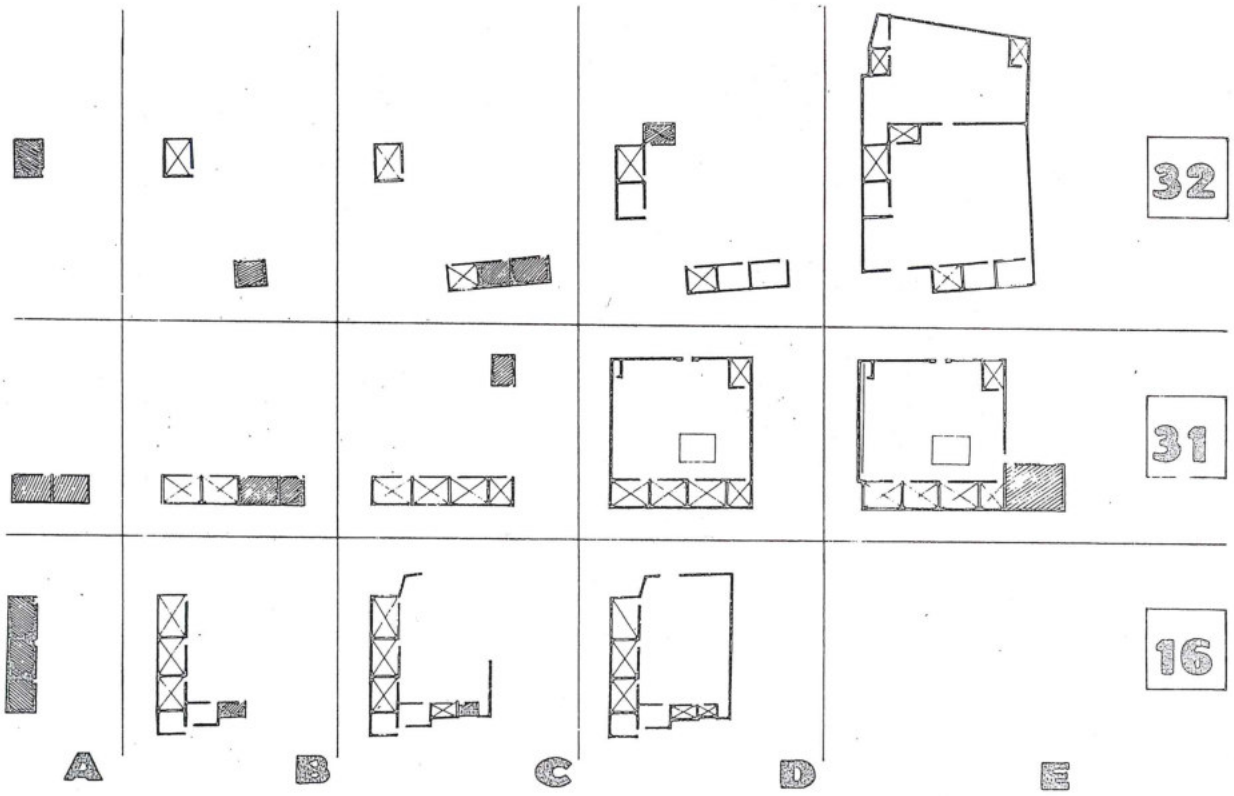


Schéma de développement des maisons de Qdeir. Les pièces successives, attenantes ou non les unes aux autres, sont disposées de manière à délimiter dès que possible un espace domestique qui, dans un deuxième temps seulement, sera matérialisé par un mur de clôture (d'après Desfarges *et al.* 1982)

ène commence vers 1950 et s'accélère dans les années 70 (FIGS. 7-8). A 'Ayma, l'emprise du village passe de ,4 ha en 1983 à 17,6 ha en 1986, et la population de 00 à 3000 habitants (FIG. 9; Biewers, à paraître). Dans deux cas, la topographie et l'environnement, ont permis ce "glissement" de la population.

La situation est un peu différente à al-Kowm où la topographie — le village est construit sur une terrasse au ed d'un tell — et l'environnement — steppe aride — ne rmettaient cette extension directement à proximité du lage primitif: on a assisté à la création de "fermes-tellites" situés à plusieurs centaines de mètres du village primitif (FIG. 10).

Chaque fois, des raisons techniques ont accompagné le phénomène: à al-Kowm, l'apparition de moto — pompes a permis de s'affranchir des contraintes de l'irrigation traditionnelle, par gravité et, en pompant directement dans la nappe phréatique, de mettre en valeur des terres jusque là incultes. Les "fermes" se sont donc installées à proximité des "champs" et non pas l'inverse. A 'Ayma et Smakieh, le développement du réseau routier régional de routes asphaltées a "attiré" le village en direction du nouvel accès et permis la mise en place d'un lotissement délimité par une voirie préétablie le long de laquelle l'habitat vient désormais progressivement s'installer (FIGS. 7 et 9).

L'exode rural et la découverte de la ville ont aussi modifié la construction et la conception de l'habitat: les

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# An Ethnoarchaeological Study on the Technology and Use of Adobe in the Jordan Rift Valley

The oldest use of sun-dried brick, or adobe, is found in the Jordan Rift Valley where the combination of semi-arid climate and abundant alluvial soils make it the most suitable choice for building material. The practice of making adobe structures and seasonally reconditioning them can be traced for 10,000 years in the archaeological record. Such evidence demonstrates the success of earth as a building material. It is also closely linked to the beginnings of agriculture and urbanisation.

The preference for the word 'adobe', rather than 'mud-brick', comes for the word's origin and because 'mud' is an unclear term. Adobe is a Spanish word transliterated from the Arabic 'aṭ-ṭūb' during the Moorish rule of the Iberian Peninsula. This had its origins in the Coptic word 'τωβε' (tobe) which in turn derives from the Egyptian word for brick, 'ḏbt' (Gardiner 1969: 497). All these refer to the sun-dried brick used as a building block, comprised primarily of common earth and usually mixed with some kind of tempering agent such as straw. Metaphorically, it can also be used to describe an entire structure built of this material.

The area in which this research was conducted was restricted to the Jordan Rift Valley, bounded by Lake Tiberias and the Yarmūk River Valley to the north and the Dead Sea to the south. The majority of the sites which were investigated lie on the two levels of the valley floor, the Ghawr and the Zawr. These *tall* sites, which were formed by consecutive layers of abandoned or destroyed adobe-built structures, are the best physical testimony for the importance and long-use of adobes as a basic building material in settlements of the Jordan Rift Valley.

The study of adobe in the Jordan Rift Valley was interdisciplinary, integrating archaeology, pedology, botany and ethnography (Politis 1993). It drew on engineering, architectural and socio-economic analyses in order to compare the ancient technology of adobe-making to the surviving one. The main objective was to trace adobe use through the ages, to quantify variation and attempt to explain the difference.

First, *in situ* adobe structures from recently exposed and on-going archaeological excavations were recorded in detail and sampled. The ancient sites studied include: Tulaylāt al-Ghassūl, Tall Iktanū, Tall al-Ḥammām, Tall as-Sulṭān/Jericho, Tall Umm Ḥammād, Ṭiwāl ash-Sharqī, Tall Dayr 'Allā, Katārat as-Samra, Tall al-Mazār, Tall Abū Ṣarbūṭ, Tall as-Sa'īdiyya, Ṭabaqat Faḥl/Pella, Tall Abū Ḥamid, Tall al-Ḥammah, Gilgal, Netiv Hagdud, Baysān/Scythoupolis and Munḥaṭa.

This fieldwork was done over a period of years during which time a series of mechanical, mineralogical, organic and chemical tests were conducted on the adobe components. These include particle size determination, phosphate testing, calcium carbonate testing, X-ray diffraction, grain shape analysis and Munsel colour charting. Similar analyses were applied to the natural soils and sediments surrounding the archaeological sites sampled in an effort to identify the sources for adobe production and help establish preference of soils. The results of these tests have also contributed to the reconstructing of the ancient landscapes in the Jordan Rift Valley.

The identification of tempering agents such as straw or dung is an important part of understanding adobe technology. A number of hypotheses can be made on the type of temper used or its total absence, which may reflect customary practices (as is described in the Old Testament), or economic factors (barley straw as opposed to wheat straw). The use of dung, which was evident in adobes from prehistoric as well as later periods, may also show a conscious choice of technologically better tempering agents. Furthermore, identifying impressions of organic tissues in adobe fabric has introduced a new technique to archaeology.

Finally, a catalogue was made which can be used as a reference on all future excavations in the Jordan Rift Valley. Recording adobe structures properly is of utmost importance, considering that they cannot be preserved once excavated and therefore information about them is lost forever.

The main soil groups in the Jordan Rift Valley are red

Mediterranean soils on old alluvium in the north; yellow Mediterranean soils on old alluvium in the middle part; Solonchaks on old and recent alluvium in the southern part; Regosols on eroded lacustrine sediments *(katār)* and on slope colluvium; and lurigated soils spread throughout the valley with profiles which are difficult to define but which partly belong to groundwater (grey soils) and 'Black Habitation' soils (Moorman 1959: 44). It is important to note that lacustrine sediments which are found in the basin of the Dead Sea and of the old Lake Lisan, have erroneously been named 'marls'. The strata consist mainly of fine textured sediments interbedded with numerous thin sand, clay and gravel layers. This is one of the most common sources of earth for adobe-making in the valley.

The basic component of adobe brick is earth. Although all soil types can be used for adobe production, the ideal soil should contain four elements: coarse sand, or aggregate, fine sand, silt and clay. The aggregate provides strength, the fine sand is a filler to lock the grains of aggregate, and the silt and clay act as a binder and plastic medium to glue the other ingredients together. Adobe structures are more vulnerable to erosion from rain. Adobe structures high in clay may be much more resistant to water and erosion, but less strong.

Clay may be the most important component of adobe make-up, but too much of it can be detrimental. Clay tends to expand when wet and contract when dry, causing cracks. Therefore, clayey loams or sandy clays are the most suitable soil types for adobe brick-making (Agarwal 1981: 140; Hughes 1988: 2). It must also be noted that clay minerals have different bonding properties and that the calcium carbonate ($CaCO_3$) content as well as the organic content will affect the physical properties of soil (Rapp 1978: 227). Kaolinite, which has traditionally been chosen for adobe-making in the Jordan Rift Valley, is an inert clay type which does not expand with water and therefore does not cause cracking (McHenry 1984: 55). In contrast, montomovillinite, mica and vermiculite clays do not bond with water and have a negative effect on adobe brick strength.

An example of a good soil particle proportion is 60% sand, 20% silt and 20% clay.

A variety of other ingredients have been used traditionally in adobe brick composition, which may or may not be beneficial to adobe strength and durability. The most common is fibrous vegetable matter as a tempering agent and soil stabilisers such as calcium carbonates or asphalt. Other additives whose properties and attributes have not yet been clearly determined include urine, animal and human hair, sap, animal blood, animal milk and various plant juices (Hughes 1983: 179; McHenry 1984: 75).

Finally, adobe bricks are often composed of some coarse material which may not be intentionally added to the mixture. Fragments of bone, pottery sherds, flints and larger gravels may be found accidentally inside adobe bricks, but only as impurities which existed in the soil at the time when the earth was quarried for brick production. The coarser impurities in the earth do, however, sometimes contribute towards the building strength of the adobe blocks, especially when the natural soil has a high clay content.

Stabilising soil to be used for adobe brick-making can be achieved by one or more of the following ways: a) by increasing the strength and cohesion of the soil; b) by reducing the moisture content of the soil; or c) by making the soil waterproof (Tukan 1989: 14). By mechanically compacting soil (i.e. rammed earth) it is possible to change its density, mechanical strength, compressibility, permeability and porosity.

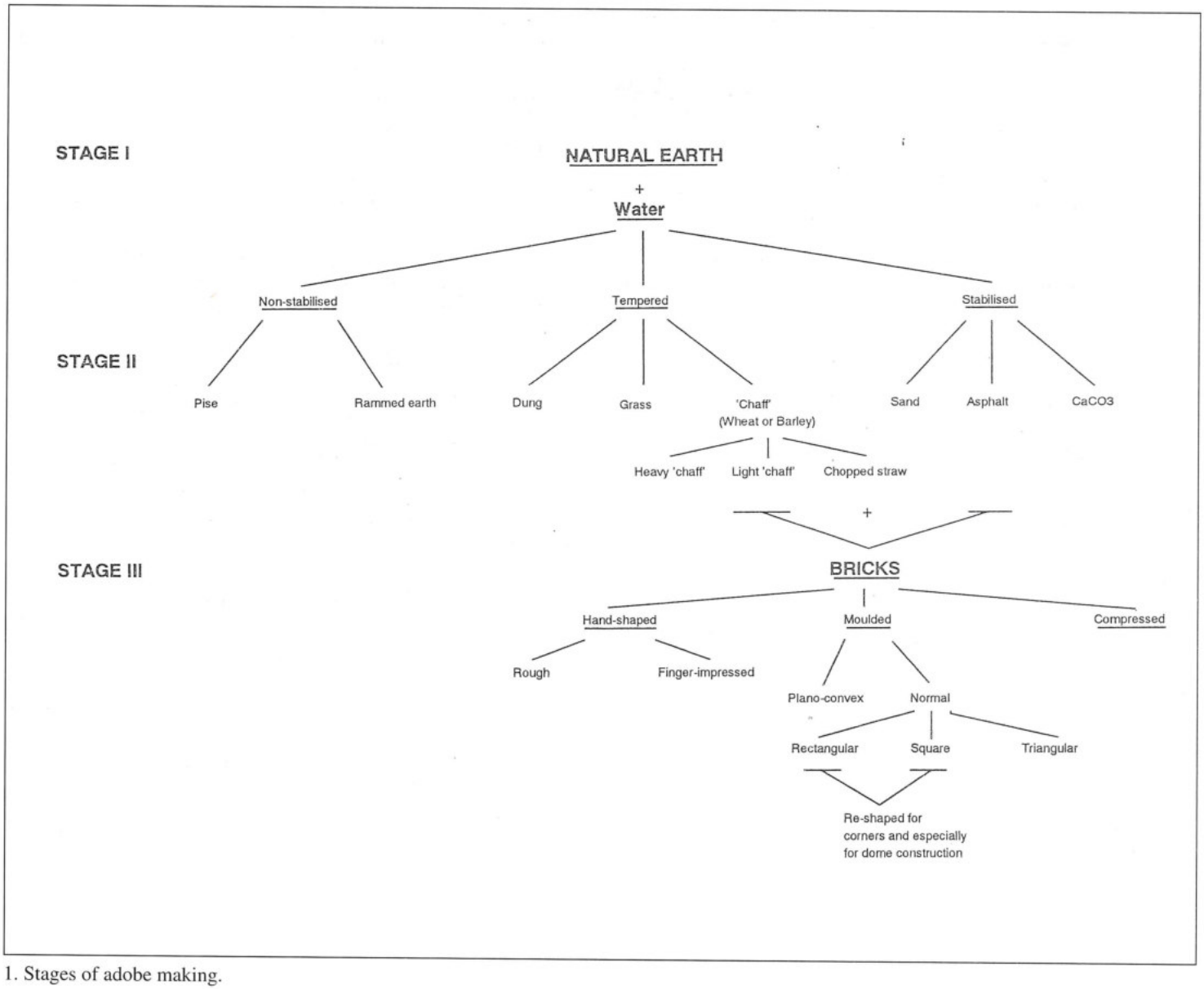
Physically, the properties of soil can also be modified by acting on its texture through, for example, the controlled mixing of different particle fractions (i.e. the addition of sand to clayey soils). Finally, materials or chemicals (i.e. asphalt) can be added to the soil to modify its properties either by a physical and chemical reaction between the particles and the additive, or by creating an impermeable layer which binds or coats the particles (Habitat 1988: 158).

Calcium carbonates ($CaCO_3$), which are naturally present in high percentages in the soils of the Jordan Rift Valley, can dramatically strengthen adobe bricks by reacting chemically with clay particles. The inclusion of ash in the soil mixture may also have the same effect. At the late Chalcolithic settlement of Tall Abū Ḥamid, hand-shaped bricks were uncovered which had a high percentage of ash mixed with calcareous soil. Another adobe brick wall was excavated in the Iron Age levels of Tall Iktanū which was comprised virtually completely of ash.

Tempering soil with fibrous vegetable matter such as grass, straw or even dung serves as an adhesive, binding adobe bricks together, distributing cracking more evenly or even preventing it altogether, and assist in the evaporation of moisture from the interior (Davey 1961: 19). The fermentation of these organic materials induce certain microbial products like extravacellular polysaccharides which are known to bind soils together (Hughes 1983: 179).

The production of adobe bricks is labour-intensive, depending largely on the skill of the brick-maker. It is characterised by a low technology and is not capital intensive. The basic tools needed include shovels, trowels and moulds (optional). The main stages are shown in FIG. 1.

After having selected the raw materials and bringing them to the site of production, the first step of adobe




1. Stages of adobe making.

manufacturing is pugging the earth. Because of the cohesive nature of soil, especially that with high clay content, the pugging process can sometimes be a long and tedious operation. The earth is piled up in a small mound, often with a depression at the centre. Water is then poured onto the mound a little at a time, and kneaded with bare feet until a consistent mixture is obtained and all the clumps of earth are broken and larger gravel inclusions are removed. Mixing is the key operation in the production process of adobes, especially if the earth used requires an admixture such as sandy soil, temper or stabilising agents. In the case of fibrous tempers such as chopped straw or dung, the process may be delayed for two to three days to allow the tempering material to rot and achieve the sought after gluey attribute.

The manual production of adobe bricks can be made either with or without a mould. When bricks are hand-shaped they tend to be more irregular and their size varies. They often have thumb or finger impressions on their surfaces which are intended for better mortar adhesion. The Neolithic "hogback" and "cigar-shaped" bricks from Tall as-Sulṭān/Jericho are of this type. The main problem with the hand-shaped adobes is that they are more labour-intensive and take longer to make than mould-made bricks.

When moulds are used, the earth is prepared to a semi-soft paste and the mixture is slopped into the mould on a level ground surface (which may be covered by straw, reeds or sand). When the mould is filled the earth mixture is levelled off. In between mouldings the mould is kept soaking in water in order to prevent the wet earth mixture from adhering to the wooden surface of the mould when it is being lifted. Mould dimensions vary. The basic rule is that a brick should have a size and

weight which can be easily handled by one man without the danger of it breaking.

The 'plano-convex' brick, first used in Mesopotamia in the third millenium BC, is similar to the normal moulded type except that one surface is rounded or convex.

The curing of adobe bricks is the final step before their use in building. The bricks should dry out as slowly as possible to avoid cracking or even disintegration due to shrinkage. It is during this time when the proportions and mixture of earth, water and tempers and/or stabilisers will be tested. The bricks are then left to cure for at least several days in the sun. This is one of the main reasons why adobe brick-making traditionally takes place in the summer months after harvest (when straw is also more readily available). Dried bricks are then put up right on their sides or stacked in such a way that air can circulate in between them. This dry storage should last at least two weeks but can often be kept for over a year.

Although adobe is characterised by a low technology, its constant widespread use as a building material in the Jordan Rift Valley from the earliest agricultural settlements to the twentieth century town is proof of it own success. Not only was earth as cheap and readily available as it is today, but its practical qualities made it the obvious choice for over 10,000 years.

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# The Historical Development of the Jordanian Rural House and its Effects on Traditional and Modern Buildings

## 1. INTRODUCTION

Modern changes in life style and new construction, particularly new roads, have resulted in the disappearance of a large part of the traditional built environment. For this reason, many historians, archaeologists and architects are trying to save what remains. Except for a few attempts at preservation, most of their work has been descriptive documentation of the existing buildings. Analysis and synthesis are required to find historical roots and relationships in the built environment.

The research presented here covers various stages of history, starting with the town of Umm al-Jimāl (third to eighth centuries AD) and continuing to the present. A comprehensive perspective is required to see how the rural Jordanian house was formed, where its roots are, how its parts are composed, and what effects it has on modern buildings.

## 2. EXAMPLES OF BUILDINGS FOR STUDY AND REASONS FOR THEIR SELECTION

All buildings chosen for this study have similar characteristics of an empirical nature, and layout patterns similar to that of the rural house. They are selected from different areas of Jordan in order to achieve broad coverage.

### 2.1. Umm al-Jimāl

This settlement is located in the southern Ḥawrān. Its buildings represent the oldest known historical development of a vernacular nature similar to that of the rural houses found in Jordanian villages.

#### *2.1.1. The Nature of the Early Settlements*

The first historical reference to the Nabataeans in this region was during the third century BC, later they established their settlements in the Ḥawrān, such as Bostra, Umm al-Jimāl, Umm Surāb, etc., with Petra as the capital of their kingdom.

The Nabataean built environment reflects a distinctive nature that shows creative ability in utilizing natural conditions and available sources. In Petra, they used the natural site for defense and the caves for storage and living. They covered the caves with false facades in a decorative manner suitable to the environment. In the Ḥawrān they devised construction techniques suitable to the locally available basalt stone (see FIGS. 1, 2, 3, 6).

The Nabataeans created complete water irrigation systems in all their settlements. They used the topography of the surrounding lands to control water flow through networks of dams, channels and reservoirs. This achievement influenced later patterns and forms of settlements.

#### *2.1.2. The Use of the Arch*

Butler's work at Umm al-Jimāl in the early 20th century described its building characteristics as native or at least of Oriental origin (Butler 1913: 153-155).

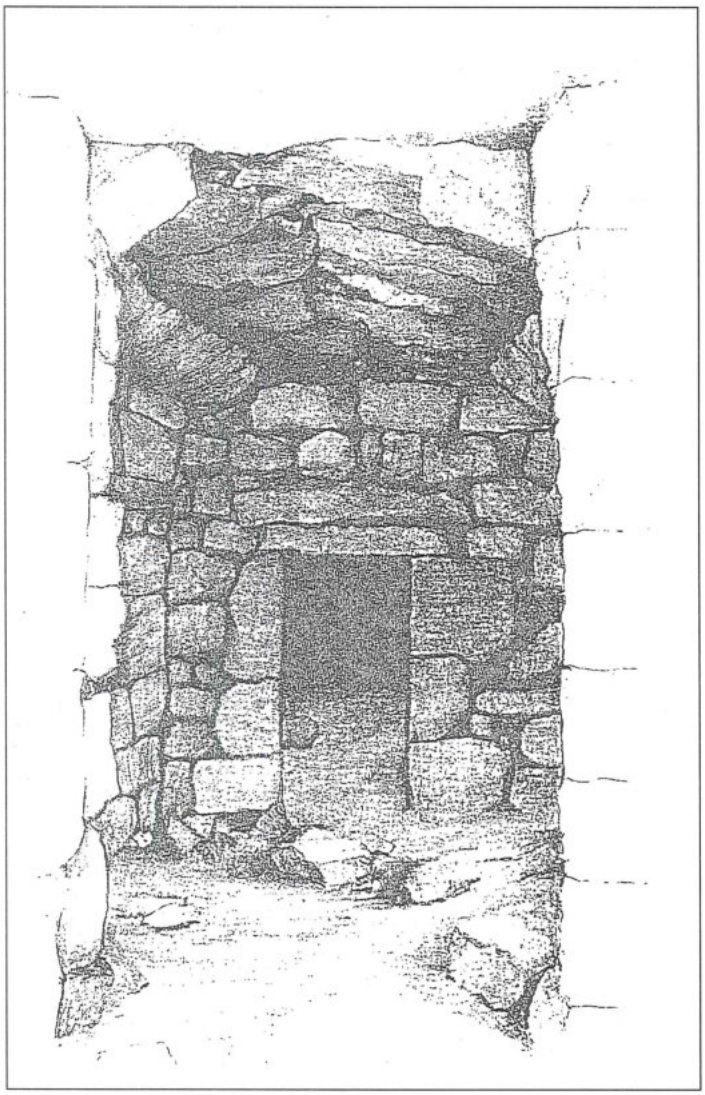
The dark gray-black basalt stone, thick walls, small windows, roofing method, and irregular clusters of buildings and courtyards are common features of the buildings.

The details of the roofing method is a major distinguishable feature for understanding the buildings and how they are formed. The earliest method was corbel courses projecting from walls and supporting horizontal slabs of stone for roof spans less than 3m (FIG. 1). Later the arch was introduced for wider spans and the typical roofing and flooring method then consisted of one or more arches supporting courses of corbels and slabs (see FIGS. 2, 4, 5).

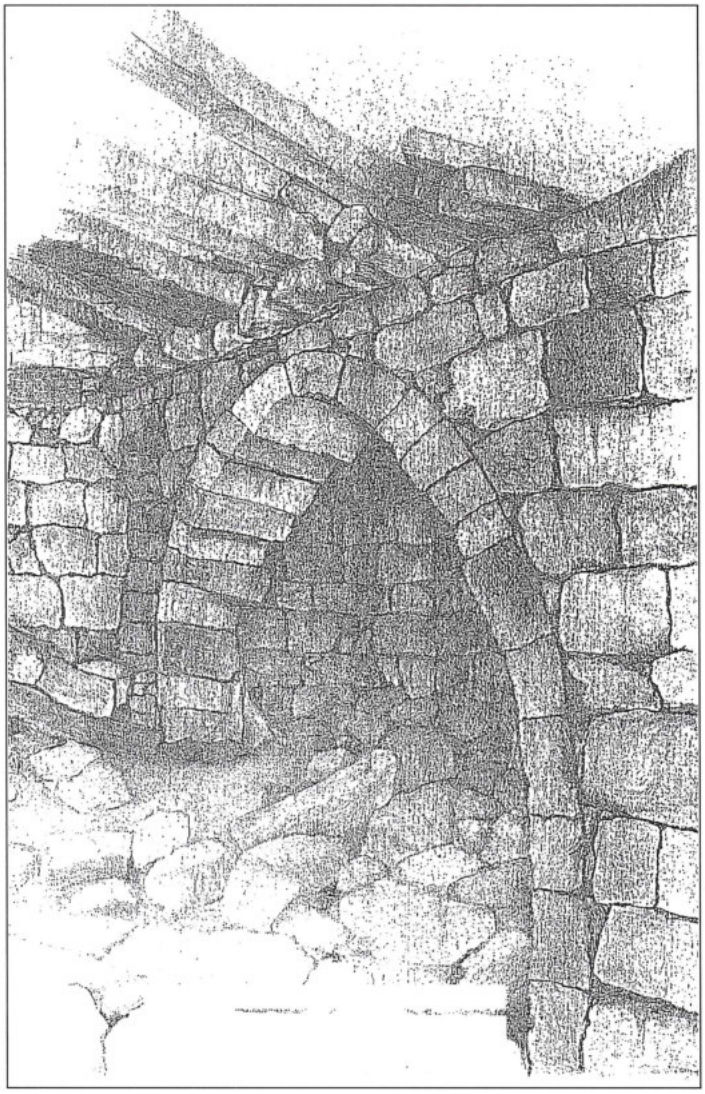
Many archaeologists regard the development of the Ḥawrān arch to be the most important single development in the formation of what has been called Ḥawrān Architecture. If the creative ability of the Nabataeans as masters of the art of construction is taken into consideration, then the development of the arch is one of their own native contributions. This theory of arch development is very much in line with the achievements of the Nabataeans in all fields of their built environment (FIG. 3).

#### *2.1.3. Analyses of Private Houses*

Bert De Vries (1982: 20) described the private houses of Umm al-Jimāl (FIG. 4):



1. Corbel courses for roofing, Umm al-Jimāl.

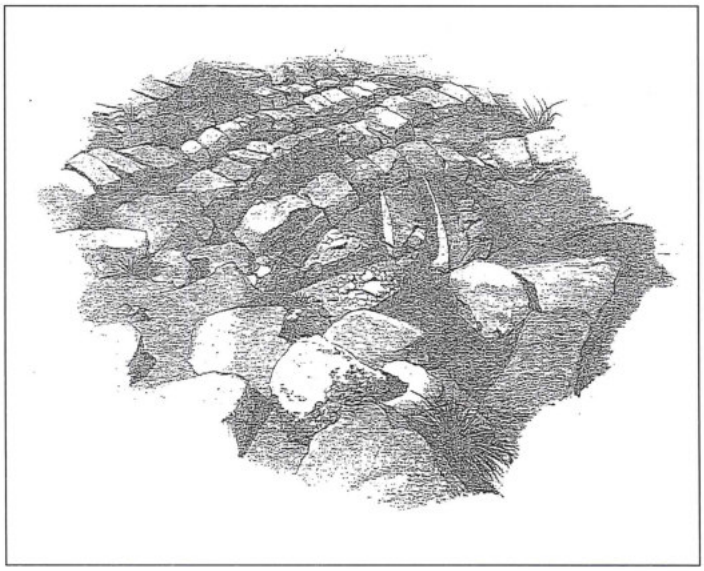


2. Arch supporting corbel courses, Umm al-Jimāl.

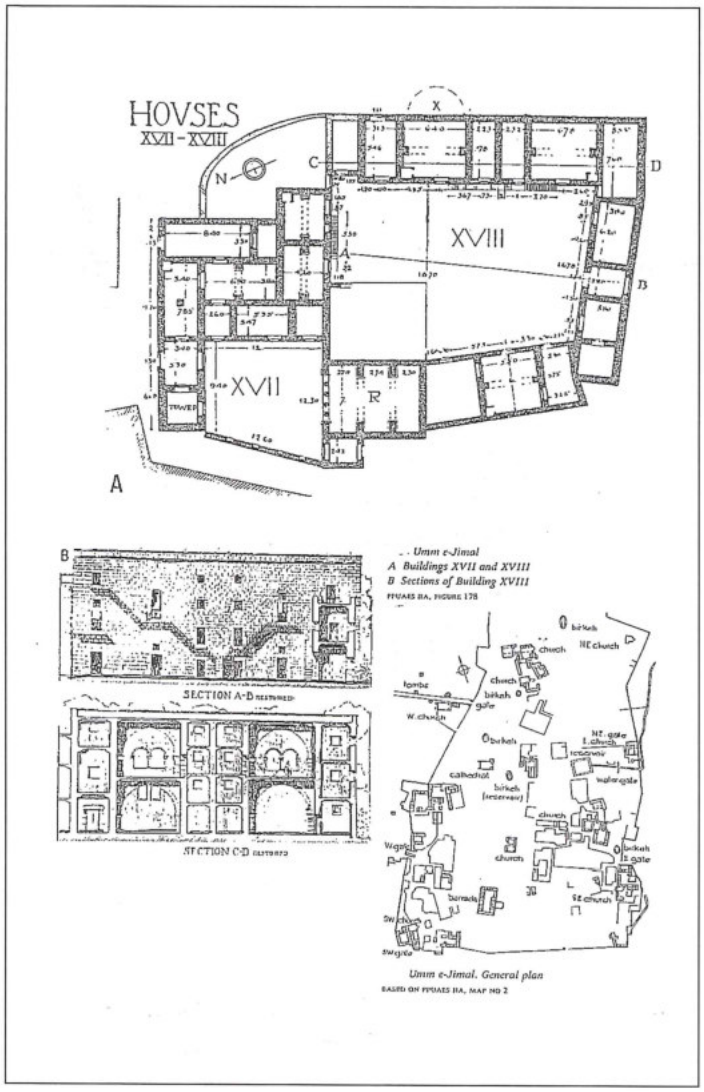
The houses are all of traditional Middle Eastern type: a single entry opens onto a central enclosure or courtyard surrounded by a multi-storied complex of rooms, accessible from the enclosure via doorways and stairways. While the whole complex is closed off from the outside human and natural environment, daily domestic and family activities focus on the sheltered and protected courtyard where family members and animals intermix with intimate familiarity. The houses range in complexity from a relatively small number of rooms arranged on one side of a barnyard to a large number of rooms on four sides of an enclosure (e.g. Houses XVIII and XIII).

The last two houses that De Vries describes as large houses were surveyed by Butler. Both represent good examples for study; they contain most of the major features of the houses of Umm al-Jimāl.

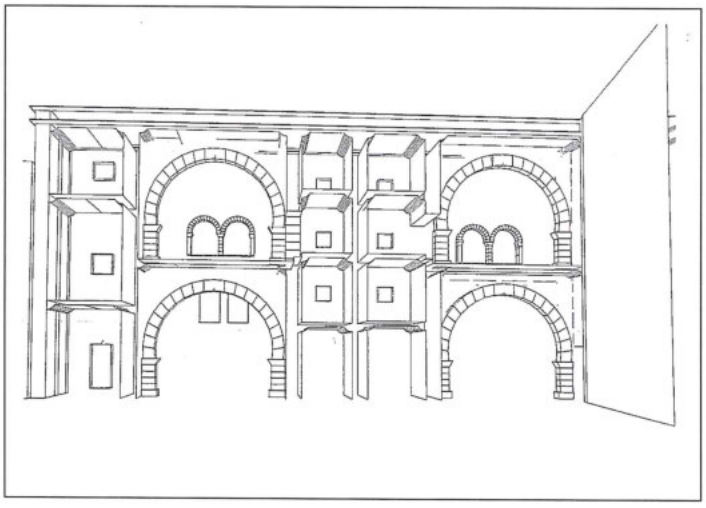
Computer graphic analysis (FIG. 5) shows the fol-



3. Arches for roof of water reservoir, Umm al-Jimāl.




4. Houses XVII-XVIII, plan, elevation, and section, Umm al-Jimāl (after Golany 1980: 24, based on Butler 1913).



5. Section through House XVIII, Umm al-Jimāl.

lowing features:

A. Walls are very thick with almost no window openings on the outside walls; the building complex is a defensible unit. Most openings, of limited area, are located on the inside walls enclosing the courtyard space. Wall construction and window treatment are the vernacular response to the conditions of an arid climate.

B. Entry is through space with lockable doors. Directly above this space, there is another storey with a small opening overlooking the outside space in front of the entrance. The axis of orientation of the entrance space is north-south.

C. Smaller rooms with short spans are roofed with corbel courses. The larger spans (5.5m - 6.78m) of the larger rooms are roofed with arches supporting corbel courses.

D. The two spaces (arched two-storey height) on top of one another have up to four storeys on both sides.
The section shows that the builders knew two facts very well. First, they knew how to handle different volumes and integrate them in one building composition, and second they knew how to handle structural stresses resulting from the large arches by the mass on both sides.

E. Basalt was the universal building material. The builders knew the structural properties of this material and used types appropriate to their location in a building, i.e., dense stone was used for the stairway cantilevered on the east wall (FIGS. 4 and 6).

F. The double arched space located on the south side of the courtyard of house no. XVIII is an example of the triple bay layout frequently found in Umm al-Jimāl. It served as an open space for various functions, such as a private dwelling in its simplest form.

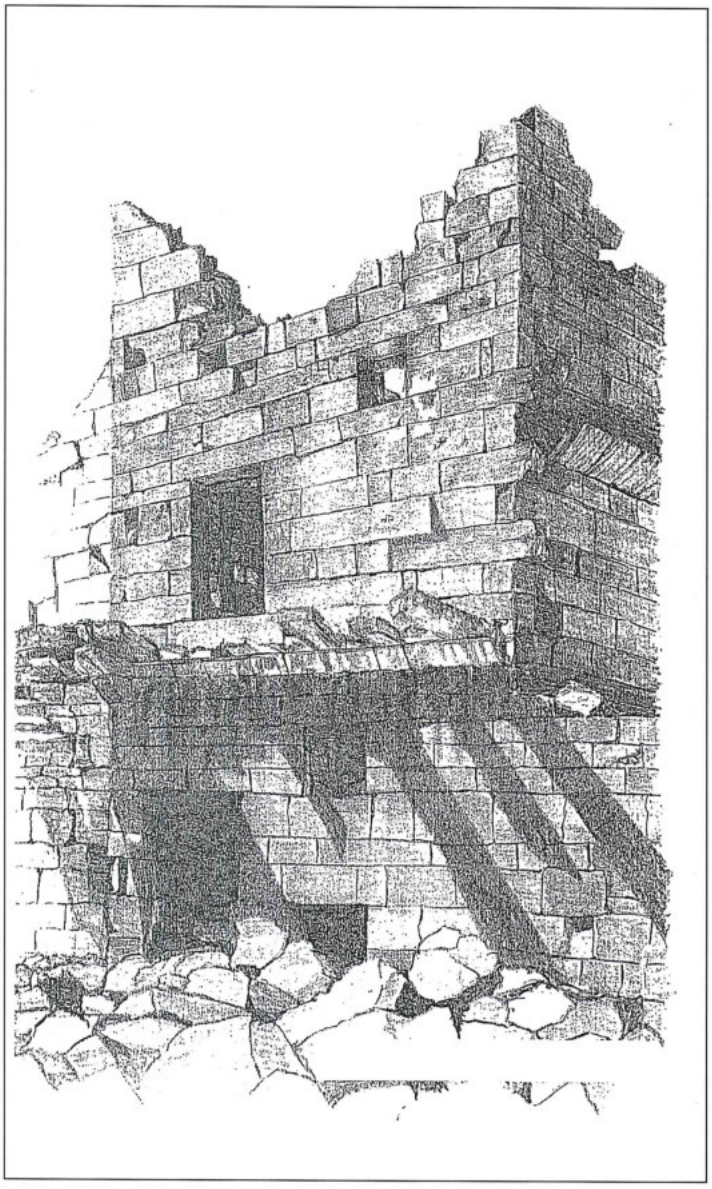
G. The shape of the courtyard is an irregular square, resulting from the skewing of walls on one or two sides. The informal shape of the courtyard contrasts with the rigid basalt blocks. Courtyards are formed by blocks and walls, or by the interlocking blocks of neighbouring houses.

### 2.2. Quṣayr ʻAmra

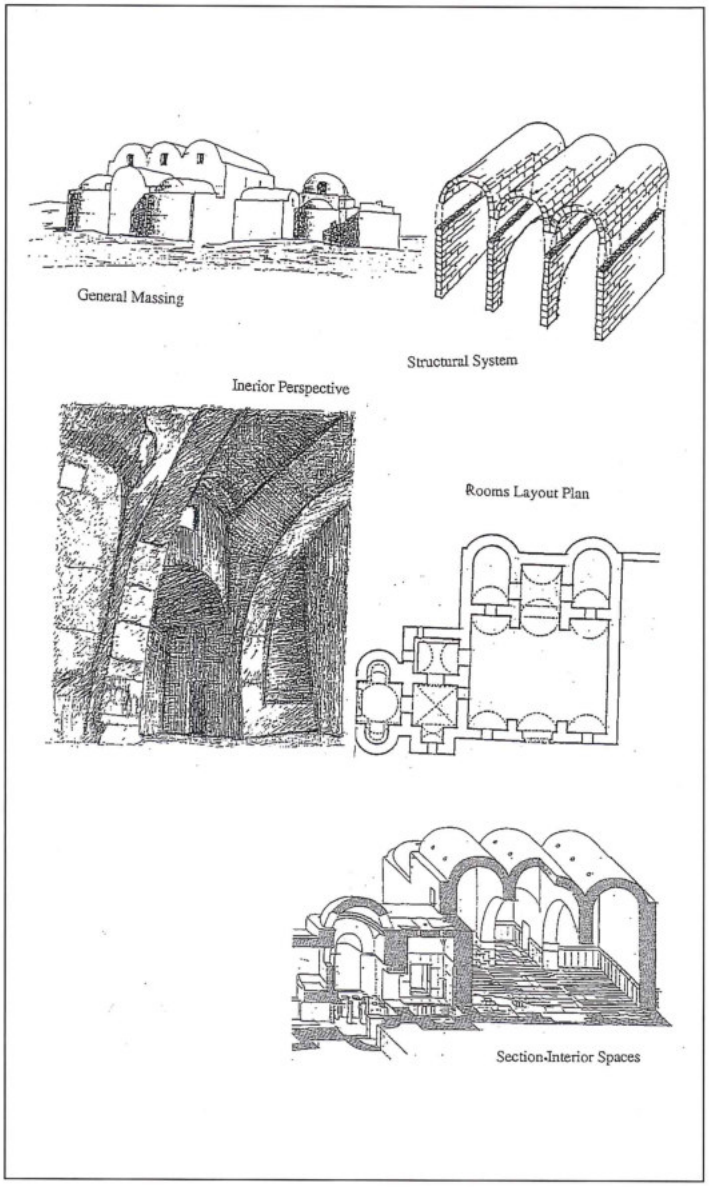
The building is a fine sample of the eighth century AD Umayyad period (Almagro *et al.*1975). The main part of the building contains the throne hall; its plan and structural method are similar to those found in Umm al-Jimāl (FIGS. 7 and 8). Two great arches supporting three barrel vaults span the roof. The barrels are a new development of the roofing system from that known in Umm al-Jimāl.

## 3. RURAL AND URBAN TYPES

All buildings of the late 19th and early 20th centuries used arches and barrel vaults for the floor or roof structures.



6. Basalt cantilevered stairway, Umm al-Jimāl.




7. Structural method of the throne hall, Quṣayr ʻAmra (based on Almagro *et al.* 1975).

### 3.1. Al-Ḥuṣn Near Irbid

The houses there are characterized by a simple cubic mass with a triple bay layout forming an open space with two arches (FIG. 8).

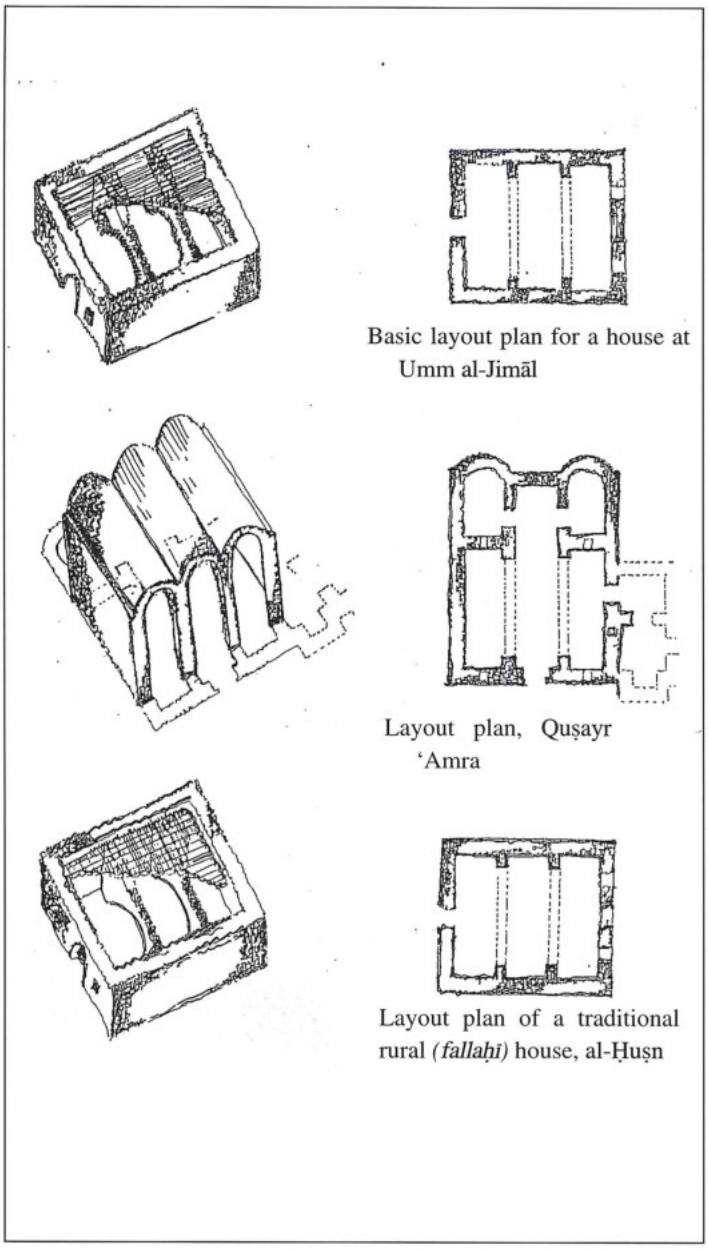
### 3.2. As-Salṭ Houses

Examples built before 1900 are of three kinds according to the nature of the middle bay space:

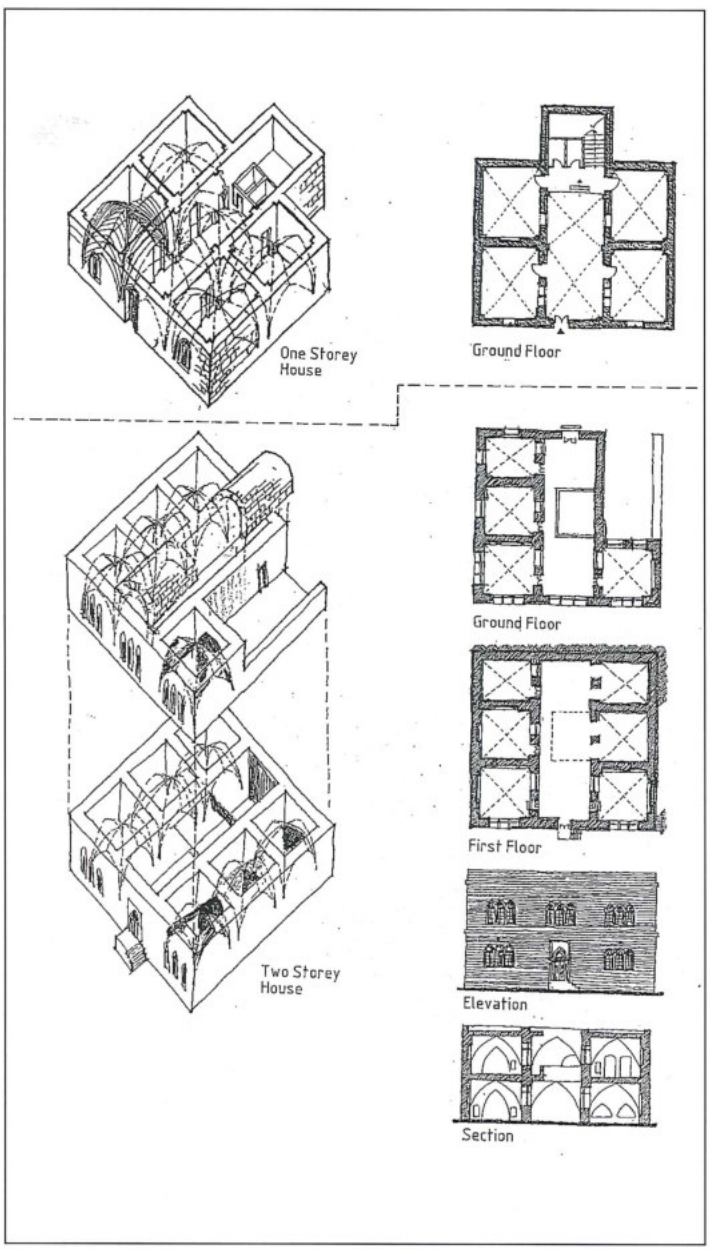
A. Open space formed by building blocks on both sides (FIG. 9).

B. Open space formed by building blocks on four sides. This type may have one or two stories. On the axis of the front entrance space/central open space/īwān space at the back of the house, the entrance and īwān spaces are covered with crossed pointed barrel vaults and both spaces are open to the central space of the court. The same layout of the ground level is repeated at the upper level except for the entry point from the back of the house through the space above the īwān at ground level. The stairway is located within the open courtyard, thus it becomes the transition space between the ground level at the front of the house and the upper level at the back of the house. This type of house can be considered a true courtyard house in terms of spatial and visual relationships, and circulation flows (FIG. 9).

C. Covered Middle Space, a type that inherited all the characteristics of the first two types of houses with the middle bay or central space covered to protect the house from the cool rainy winter of the as-Salṭ region.




8. Traditional house, al-Ḥuṣn, Irbid showing the relationship of plan and structural method between it, Quṣayr 'Amra, and a typical house from Umm al-Jimāl.




9. House at as-Salṭ — relationship of plan and structural method (after the Building Research Centre 1990).

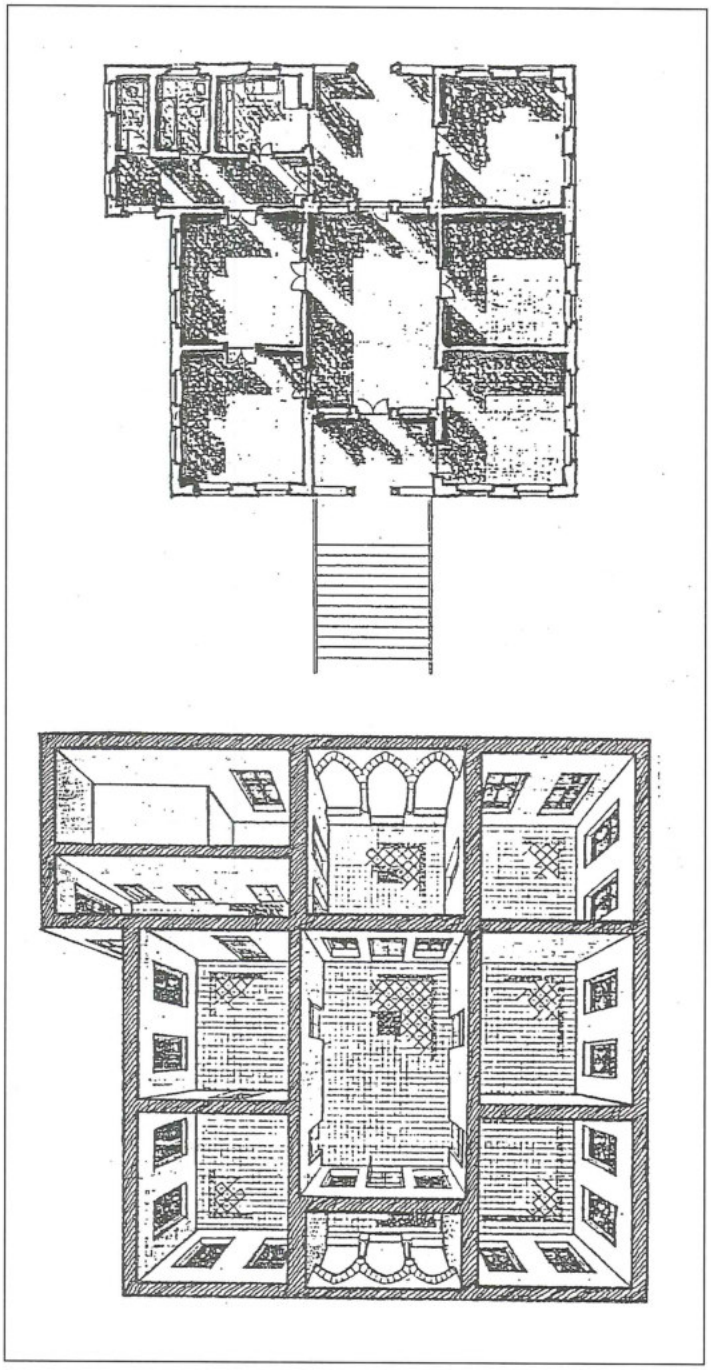
## 4. INFLUENCES ON MODERN ARCHITECTURE

### 4.1. Influences on Houses During the 1920s

*Qusoos House - 'Ammān 1929* (FIG. 10). The triple bay layout of the house is similar to the basic spatial organization of earlier types found in as-Salṭ (FIG. 9). Entry to the house is through a covered verandah or terrace in front of the middle bay, which becomes a hall for living and circulation. The house is situated as an individual building in an independent plot of land. As a consequence spaces are oriented to the outside open space. As the middle bay replaced the open courtyard space, the relationship with the outside open space is maintained through the covered terraces on the front/back axis of the middle bay.

The simple and pure mass treatment of the house recalls the roots of architectural solutions in Umm al-Jimāl several centuries earlier. The fine proportions and details also recall some of the typical as-Salṭ treatments, such as the triple pointed arches on the front and back terraces.

Steel and concrete are used for construction instead of arches or barrel vaults.



10. Qusoos House, 'Ammān, 1929 — plan and organisation of space (after Rifa'i and Kana'an 1987: 84-89).

### 4.2. Influences on Contemporary Architecture

Traditional architecture has influenced the proposed design of the National Archaeological Museum - The Citadel, 'Ammān by Michael Brawne and Associates (1979) in the following features (FIGS. 11 and 12):

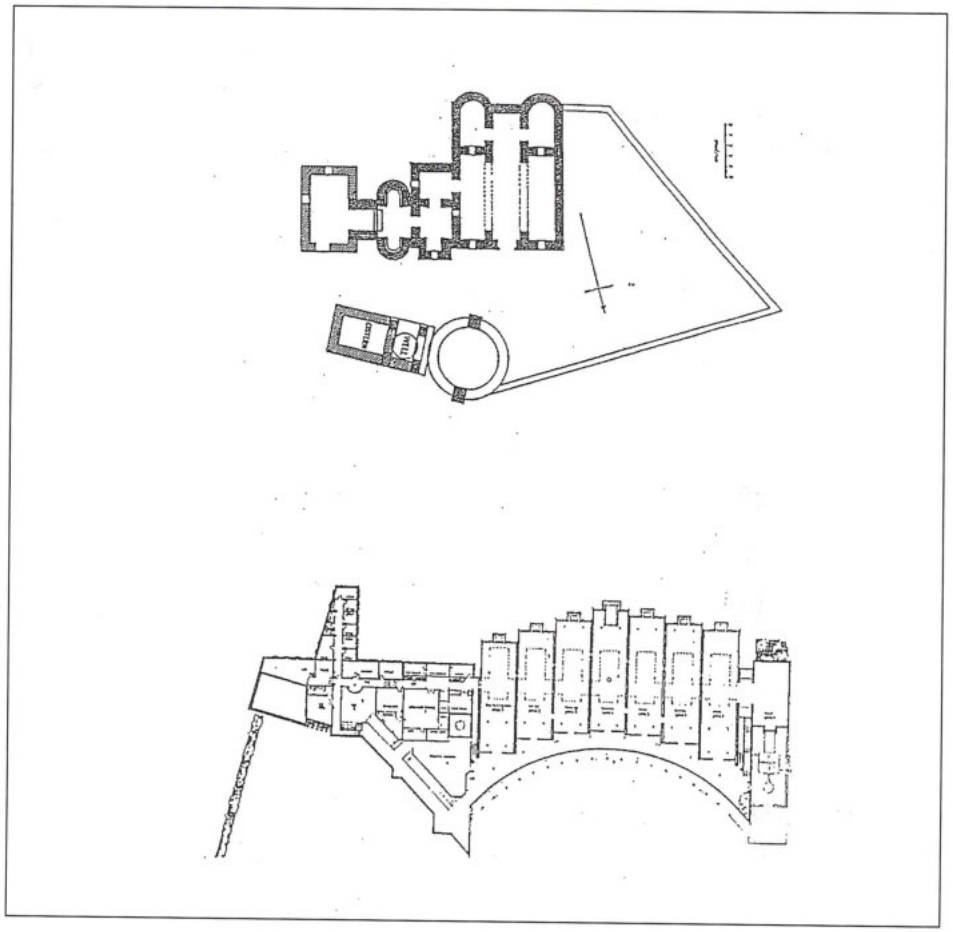
A. The use of the basic bay unit for articulation of space and structural standardization.
B. The gallery on the upper floor within each bay, which recalls the open space and covered iwans on the upper levels of the as-Salṭ houses.
C. The plan similar is to that of Quṣayr 'Amra in a number of details: the multi-bay plan, the proportions of the rooms, the projection and staggered masses, curved and skewed lines, etc.
D. The use of semi-barrel vaults in the roof adapted for directed natural light.
E. Composition and proportions of masses, details, and openings.

## 5. FINDINGS

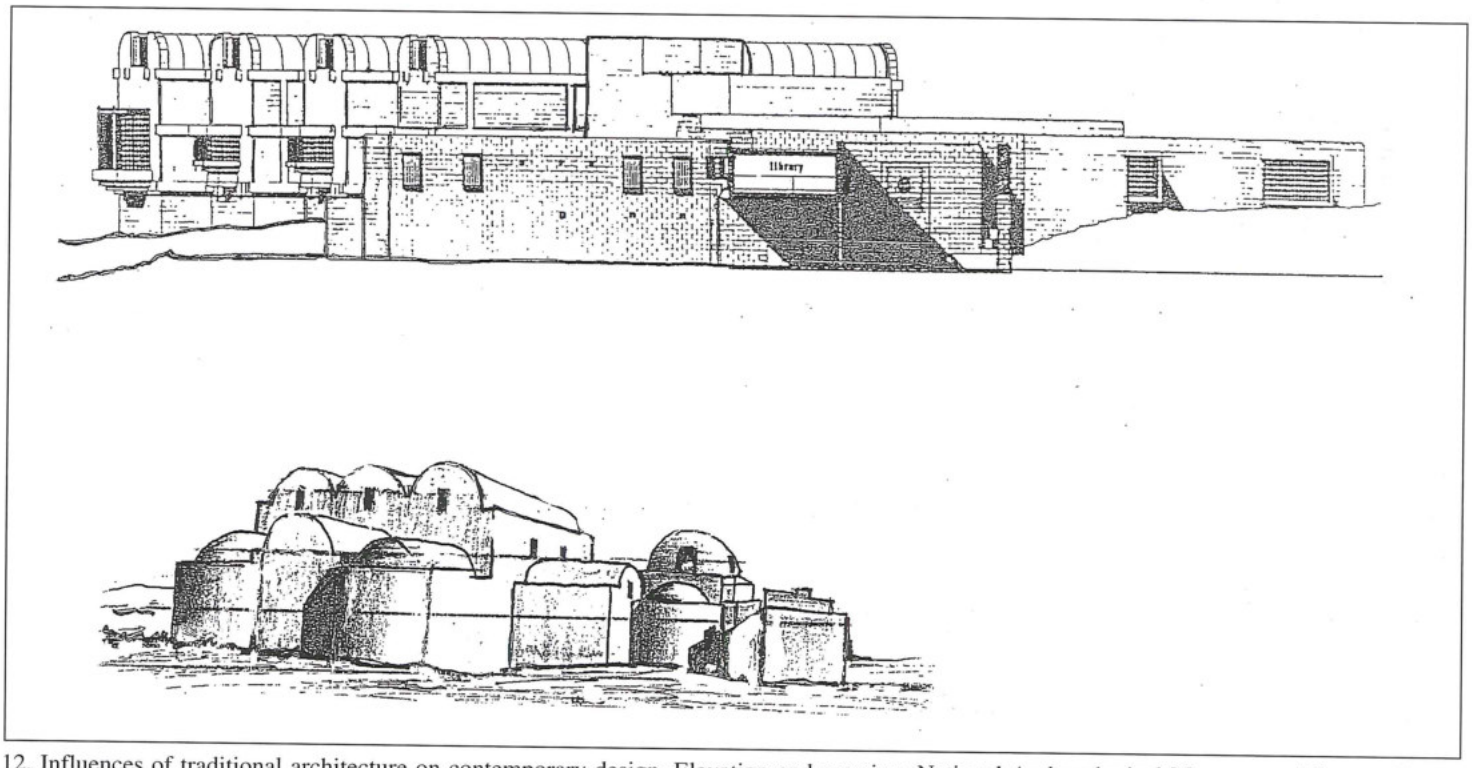
5.1. The rural house in its basic triple bay layout presents a feature and pattern that appear throughout the different stages of Jordanian village architecture from Umm al-Jimāl up to the present, covering a time span of nearly 20 centuries (FIG. 13).
5.2. Materials and construction methods, in particular the roofing system of arches or barrel vaults, have predetermined the sizes of the bays and layout plans, and consequently articulated the outcome of the overall spaces and massing of the house.
5.3. Plan type and structure are organically linked and integrated, by knowing one the other can be defined. They both provide vital information for understanding vernacular architecture.
5.4. Two types of house plans have emerged from this study. The first is the simple multi-functional open space, the second is the courtyard space. They are linked very strongly, the first became a cell in the development formation of the second through structural discipline and mass articulation.
5.5. Spaces with different roof structures have been used for the needs of everyday life, but the crossed barrel vaults (with an effect like a dome) have been used for buildings with important social status or prestige like gathering places (*maḍāfah*), religious places, etc. The barrel vaults have been used in *Maḍāfat* al-Tell and al-Hindawi, etc. The open space plan of the *maḍāfah* is very similar to the open space plan of traditional houses.
5.6. Modern houses built in the 1920s inherited many features of traditional Jordanian houses. The fully enclosed triple houses with different zones of privacy were suitable for the full range of day and night activities.

## 6. CONCLUSIONS

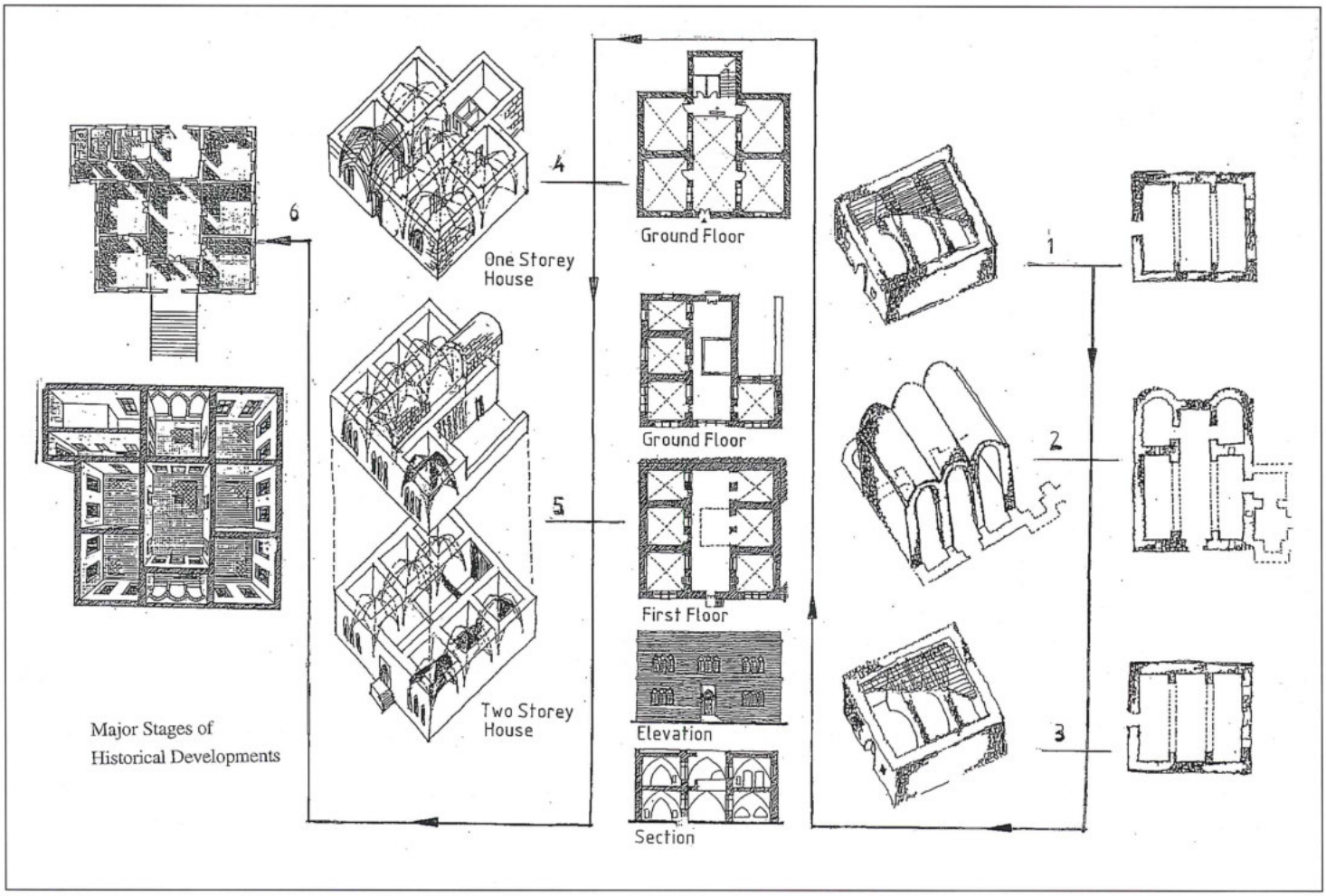
6.1. The integration between forms and structure, the discipline of space and mass through structural articulation, and the expression of human scale are very useful principles for contemporary design.
6.2. The architectural heritage should be treated with care, it is the cultural wealth of the nation. Rural houses are practical solutions to the problems of providing a living environment with very limited re-



11. Influences of traditional architecture on contemporary design. Plans of Quṣayr ʻAmra and the proposed design of the National Archaeological Museum, ʻAmmān (after Brawne and Associates 1979: Phases I+II).




12. Influences of traditional architecture on contemporary design. Elevation and massing, National Archaeological Museum and Quṣayr ʻAmra (after Brawne and Associates 1979: Phases I+II).




13. Summary of relationships in the historical development of houses in Jordan.

sources. They are the recorded lessons and experiences of the past from which one day we may need to learn.

6.3. The traditional environment, including houses, has been used as an inspiration for contemporary design to create and express an image of identity and region.

**Acknowledgments**

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# The Orientation System in Jordanian Settlements

## 1. Introduction

Settlements which evolved and developed to human behavioural needs are vivid environments with a strong association with their inhabitants. The built environment is provided with elements or features through which people will understand and communicate with their living surroundings. These elements are cultural, social, physical etc., forming images for an orientation system that will help people to perceive and use the environment efficiently. People will interact and circulate in their environment, finding their direction and location with minimum effort and with self satisfaction in the traditional Jordanian towns and villages. Modern settlements lack this orientation system, consequently people do not identify themselves with their living environment.

## 2. Research Methodology

2.1. Samples of towns and villages were selected from different locations, regions and time periods to cover a wide scope of study.

2.2. Three traditional settlements and three modern ones were selected for comparison and analyses, these are: Umm al-Jimāl versus Mafraq, Ramthā old town versus the new expansion area, Umm Qays old village versus the new housing area. An-Nu'ayma and Sūf were also included to explain relative features.

2.3. Image elements and devices contributing to the orientation system are identified on their frequent or long duration of existence in the settlements.

2.4. Elements of images were compared with other known theories of images and behavior for the evaluation of the findings.

## 3. Findings Related to Traditional Settlements

*3.1. Physical Patterns*

Forms are similarly informal, composed of different groups of building enclosures as clusters (FIGS. 1-12). The pattern structure expresses functional features or image elements on three levels. The first is the overall shape of the village or town which reflects the original purpose of the settlement, e.g. defense, government centre, etc. The second is the shape of major spaces for social activities like religious gathering etc. The third is the shape of spaces within the building clusters or housing areas, for safe pedestrian movement, children's play, neighbours' interactions, etc. (FIGS. 1-3).

*3.2. Building Enclosures*

Building enclosures are mainly irregular in shape, locations of building complexes, outside spaces, etc. This irregularity is a constant feature which is done in two ways (FIGS. 4, 8, 10, 11):

A- Rotating/skewing the location of one building/ building complex to another. The building or complex may be a regular square but the resultant outside space is irregular in shape (FIGS. 5, 6, 7, 9).

B- Rotating/skewing one wall/building or more to form an irregular inside space (courtyard) and outside space. The result of irregularity in the layout pattern is a (volumetric variation) in the outside space (FIGS. 9-12).

*3.3. Social Context*

3.3.1. External space represents norms of human behaviour, they indicate important acts and events in the cultural life of the people. The memories associated with them create cognitive images for the comprehension of spatial identity (FIGS. 5, 6, 10, 13).

3.3.2. Each housing cluster or group of clusters represent a social context of family/tribe ownership of land. The external spaces have distinguished territorial boundaries with symbolic entry and exist spaces giving social identity, orientation and protection (FIG. 13).

3.3.3. Enclosures of spaces are hierarchically organized in terms of public, semi-public and private zones of functional and social contexts (FIGS. 1, 2).

*3.4. Spatial Flow*

External spaces flow into each other to form links be-

tween all clusters of the settlements. The degree or level of flow openings (passages, roads, etc.) is related to hierarchy of function and privacy (FIGS. 3, 10-12). Special flow results in flow of vision and circulation flows in an enclosed and contained sequential manner.

*3.5. External Spaces*

Spaces have variation in the dimensions of width, length and height. They are composed in volumetric variation in such a way that each space is volumetrically different from other spaces of the same function, in the same built environment (FIGS. 3, 10-12).

*3.6. Landmarks*

Manmade and site natural features forming reference landmarks are integrated with the other elements already stated above to work as a whole system within the settlements. In Umm Qays at the nodes of street intersections, important buildings are located with high mass overlooking the land below (FIG. 4).

*3.7. The General Appearance*

The physical appearance is a very pleasant setting, complete harmony integrated with the natural landscape. The overall impression, whether it is in flat land or in a mountain setting, reflects a massing composition mostly made of small comprehensible units with human scale built of unified natural materials. The size of these units is pre-determined by the traditional construction methods of arches, barrel vaults, etc.

## 4. Findings Related to Modern Settlements

4.1. All plans are similar in layout, there are no enclosures except in the main streets. The vital elements of traditional settlements are lacking here, particularly the social features. New road networks imposed on existing traditional fabrics of towns and villages resulted in deformation in the existing environment (FIG. 8).

4.2. Machine aesthetics lead to obsession by "universal societies" for extreme abstraction and standardization of design and planning components, resulting in a characterless environment. This movement affected Jordanian settlements.

## 5. Comparison with Known Theories of Environmental Images and Behaviour

5.1. Kevin Lynch in his book, *The Image of the City*, stressed the importance of the orientation systems, referring to them as vital to the better use of the environment. His work is limited to the effects of physical perceptible objects, i.e. the physical forms of the built environment. He glossed over social meaning, function, history and other symbolic references.

Lynch defined the elements of the city image as: Paths, Edges, Districts, Nodes and Landmarks. The scope of his work is related to the much larger cities, this may explain the reason for the superficial work done by him on the social influences which are very strong in the relatively small settlements with a long history in our region. The physical form of an-Nu'ayma old village was developed as a result of social influences of the family/tribe who came from the surrounding areas and inhabited the village (FIG. 13).

The five elements of the city image defined by Lynch are all found in traditional settlements, but some of them are missing in the modern ones. Lynch's theory of image elements does not cover in a clear way the volumetric variation in the external space, found as a strong element in the traditional environment.

Lynch wrote, in the same book (p. 20): "At every instant, there is more than the eye can see, more than the ear can hear, a setting or a view waiting to be explored. Nothing is experienced by itself, but always in relation to its surroundings, the sequences of events leading up to it, the memory of the past experiences."

This description is more suitable to the physical environment found in traditional settlements, rather than the open streets of modern settlements or cities.

5.2. The idea of space which can be protected from crime and vandalism was proposed by Oscar Newman in his book *Defensible Space, Crime Prevention Through Urban Design.* He introduced the concept of territoriality in space and four other requirements in its design to be safe. These are:

A- Surveillance by people's presence.
B- Clear private and public zones.
C- Creation of neighbourhood images.
D- Separation of safe and dangerous zones.

These characteristics are naturally part of the traditional environment, as an outcome of family/tribe land ownership and social behavioural patterns.

## 6. Conclusions

The building clusters, functional expressions, sequential visual and circulation flows, hierarchy of informal spatial enclosures, social and behavioural contexts, volumetric variations, natural and manmade landmarks, and mass compositions of small units, are all elements forming the images of the orientation systems found since early times in the traditional settlements. These systems contribute to the people's identification with their own environment – an aspect which is very important to the cultural continuity and quality of the people's life. Therefore it is nec-

essary to introduce this systtem in modern settlements.

**Acknowledgments**

The authors would like to express their gratitude to Mr. K. Musallam, Miss A. Gharaibeh and Mr. T. Hamd of the Department of Architecture, Jordan University of Science and Technology, for their kind help in preparing some of the figures for this paper.

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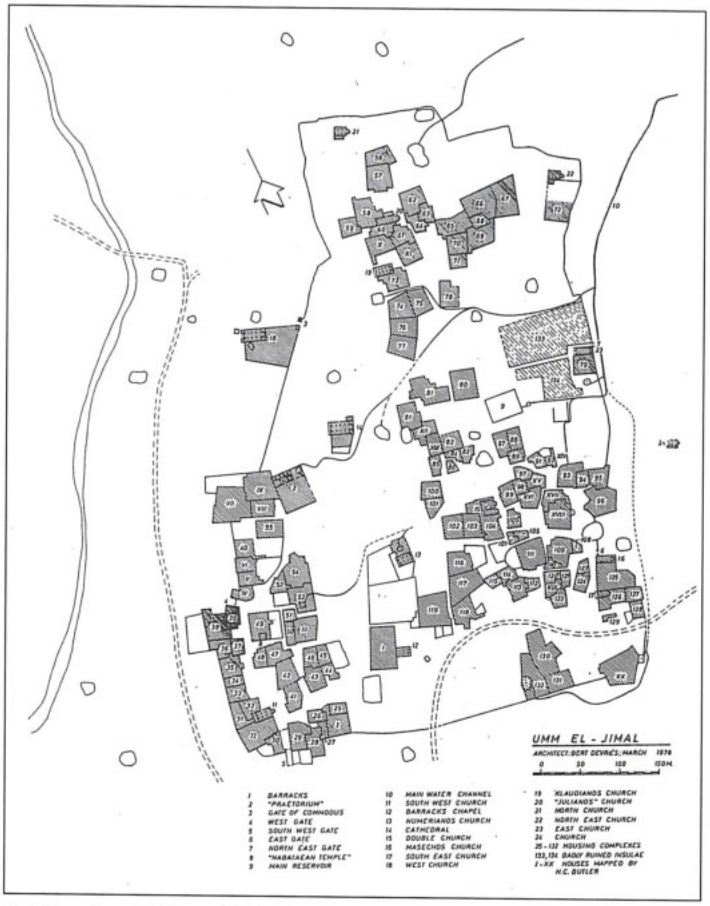
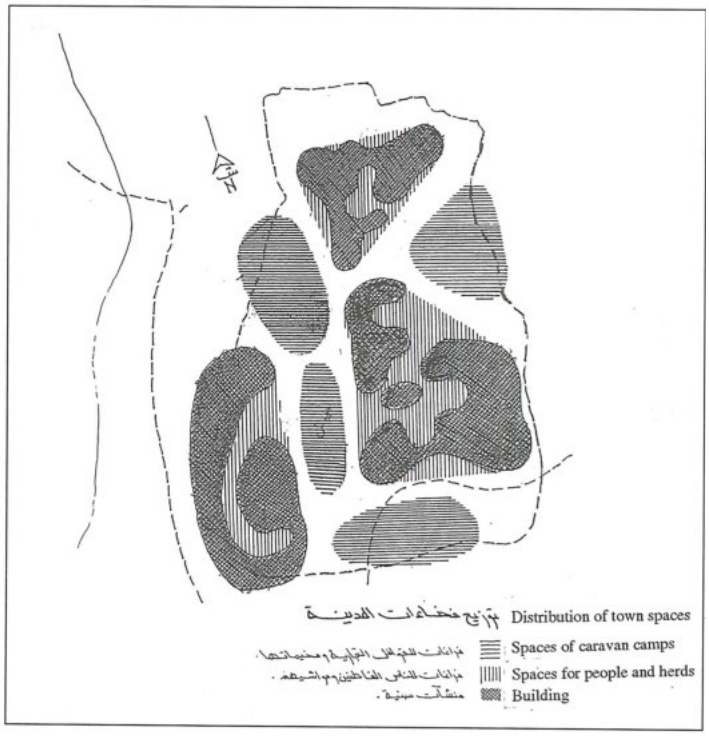
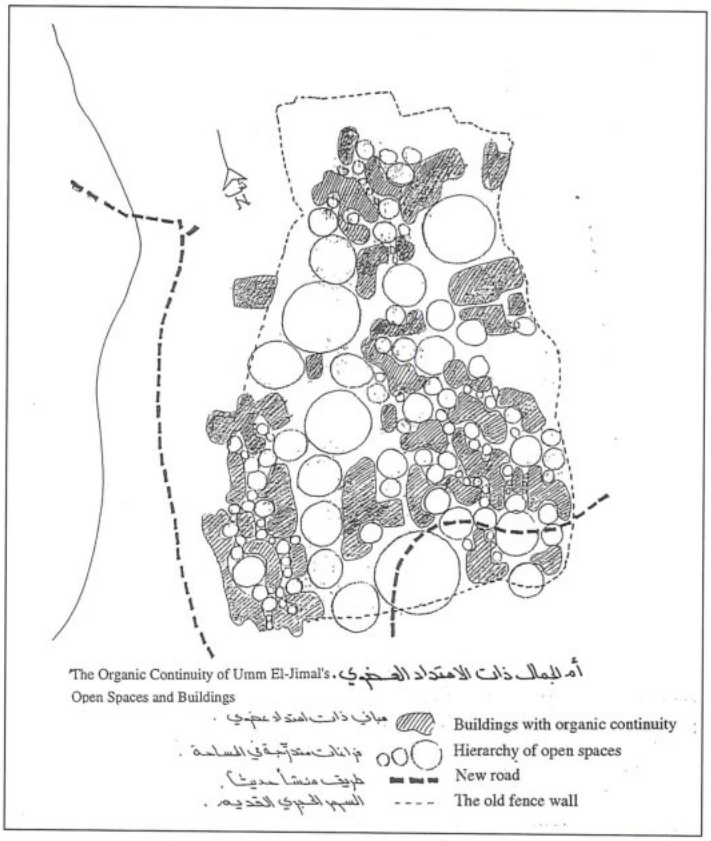


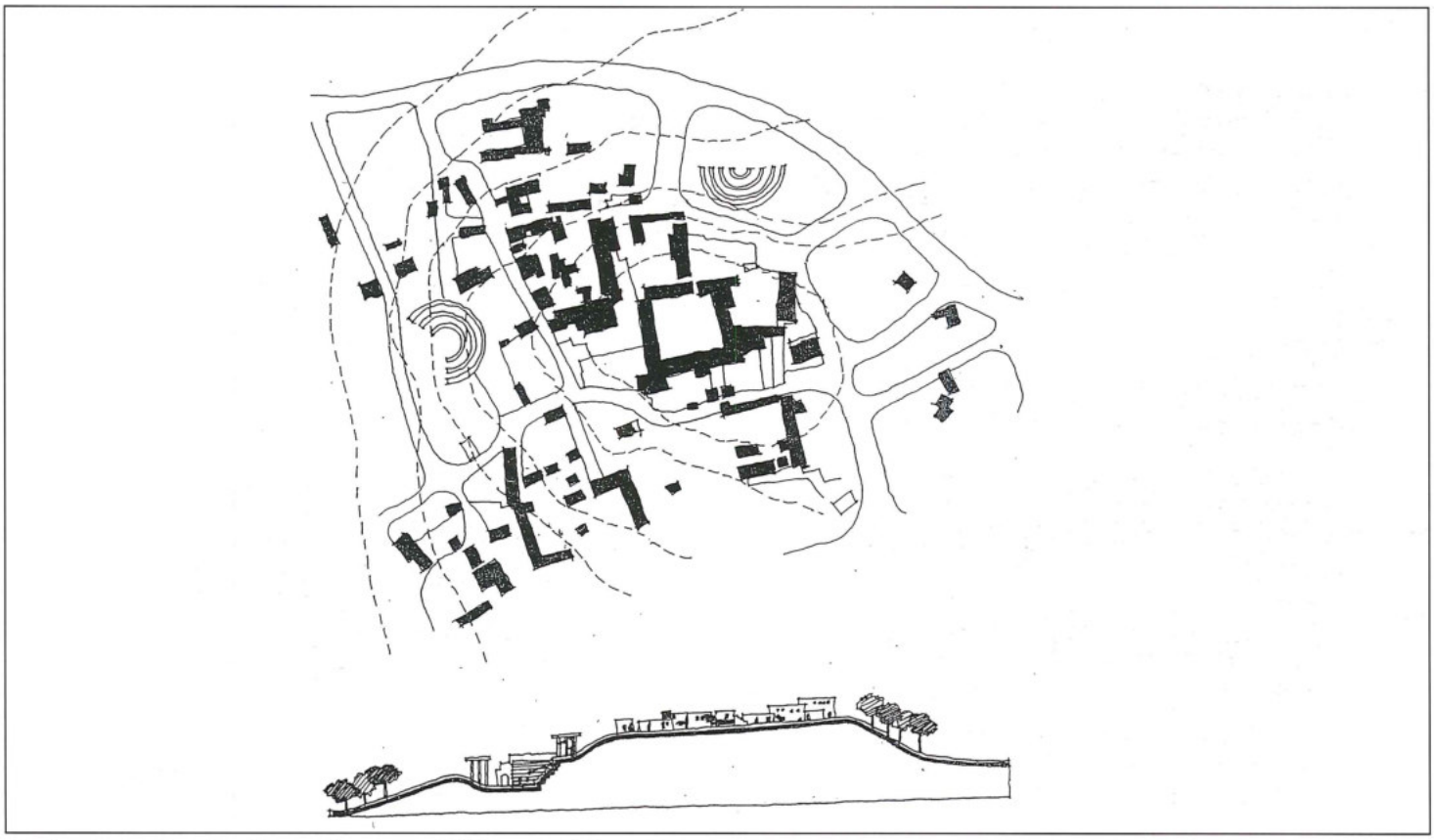

1. Site plan of Umm al-Jimāl (after de Vries 1982).



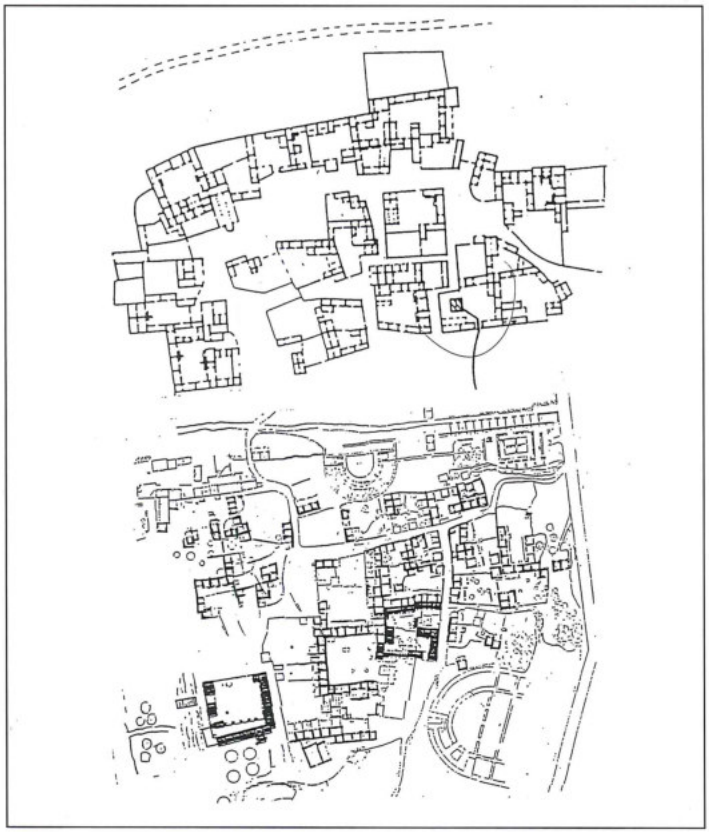

2. Grouping of buildings and open space at Umm al-Jimāl.



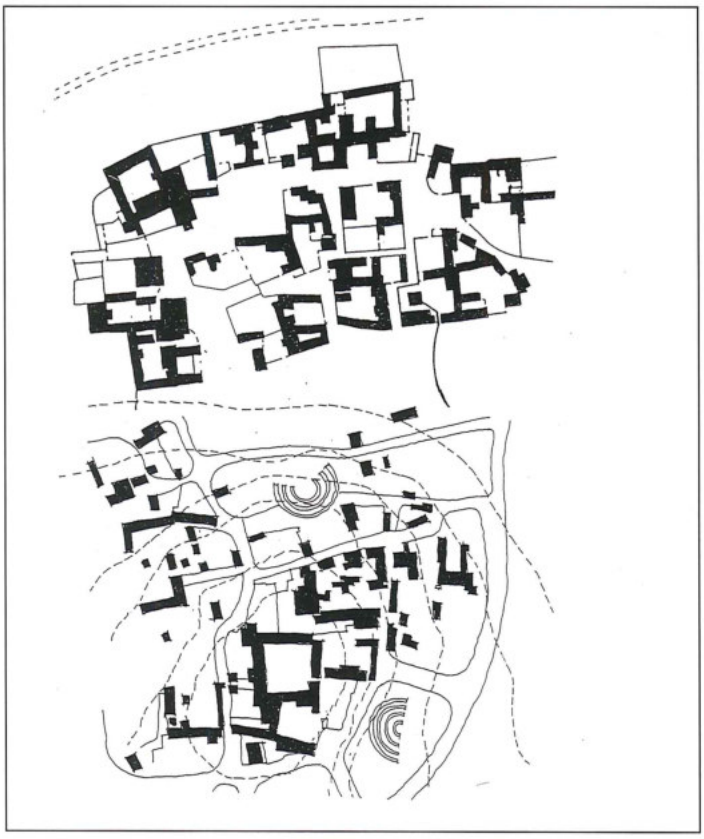

3. Flow of space and building enclosures at Umm al-Jimāl.



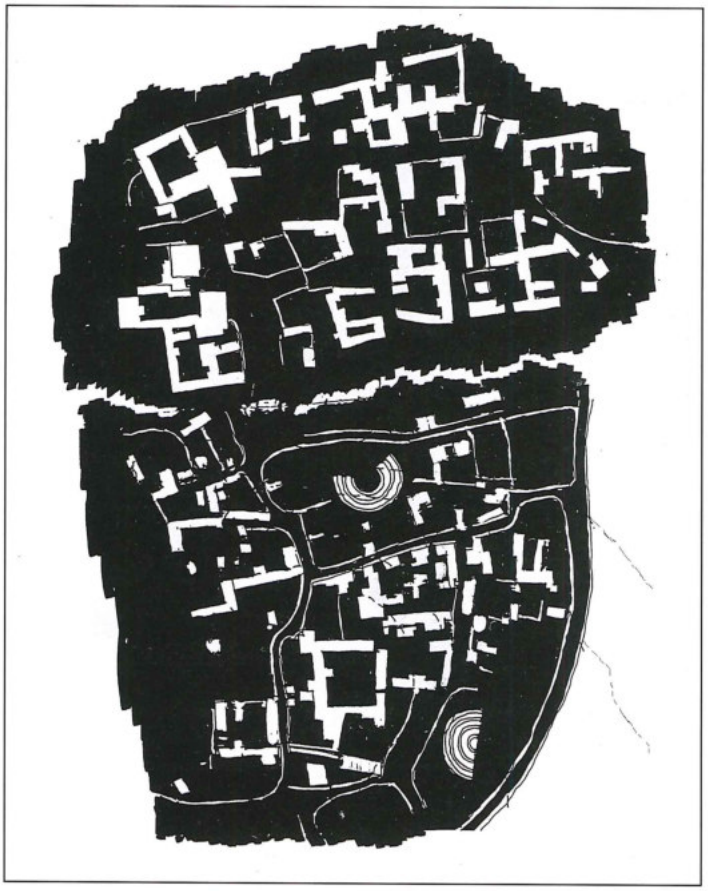
4. Site plan and section. Roman theatres and 18th century Umm Qays.



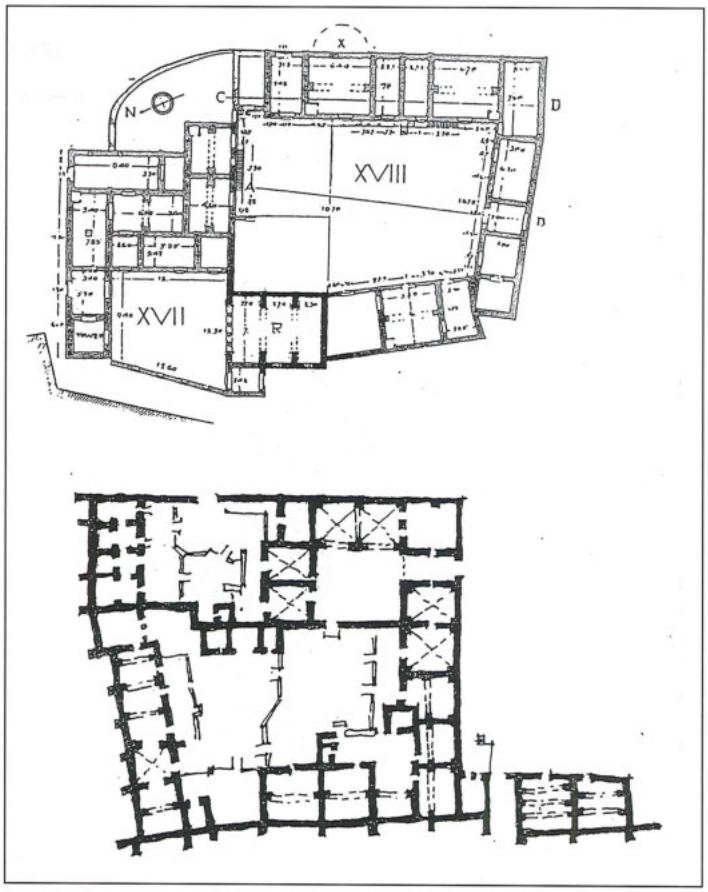
5. Layout plans of buildings and clusters. The southwest part of Umm al-Jimāl and 18th century Umm Qays.



6. Positive and negative spaces. Building clusters in Umm al-Jimāl and Umm Qays.



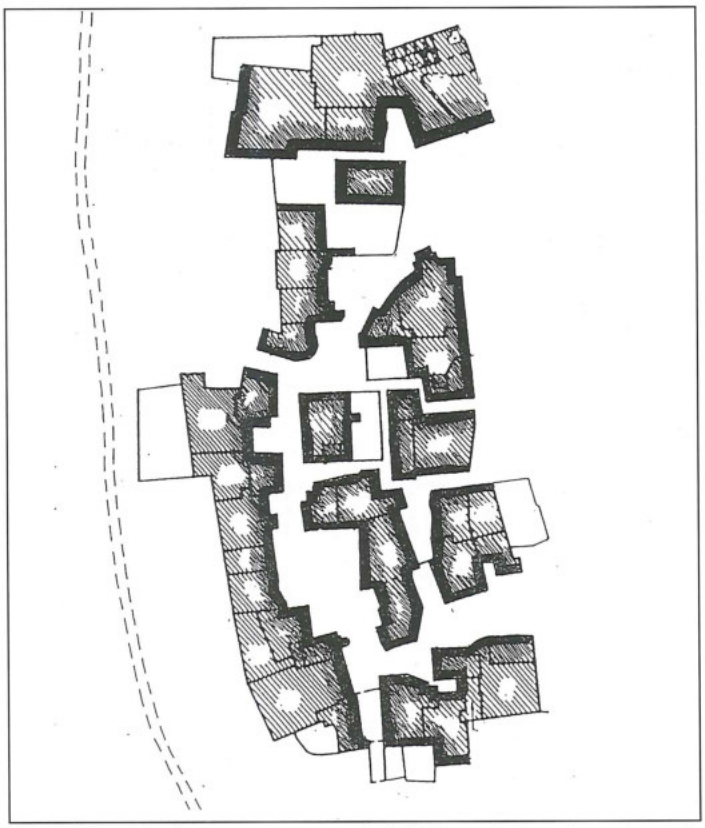
7. Negative and positive spaces of building clusters in Umm al-Jimāl and Umm Qays.



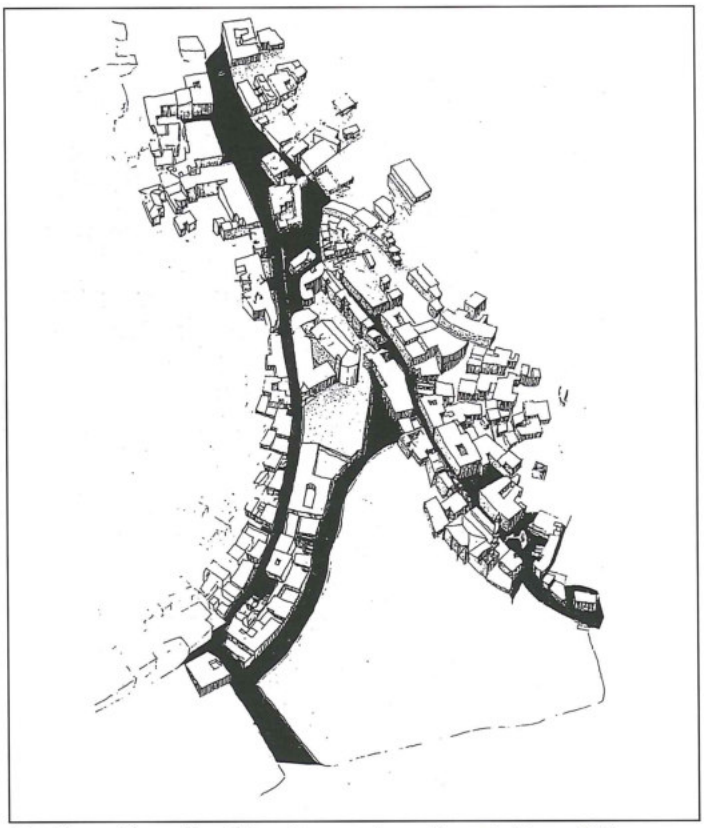

9. Plans of typical courtyard houses in Umm al-Jimāl (Houses XVII-XVIII) and Umm Qays (Bayt al-Rousan).



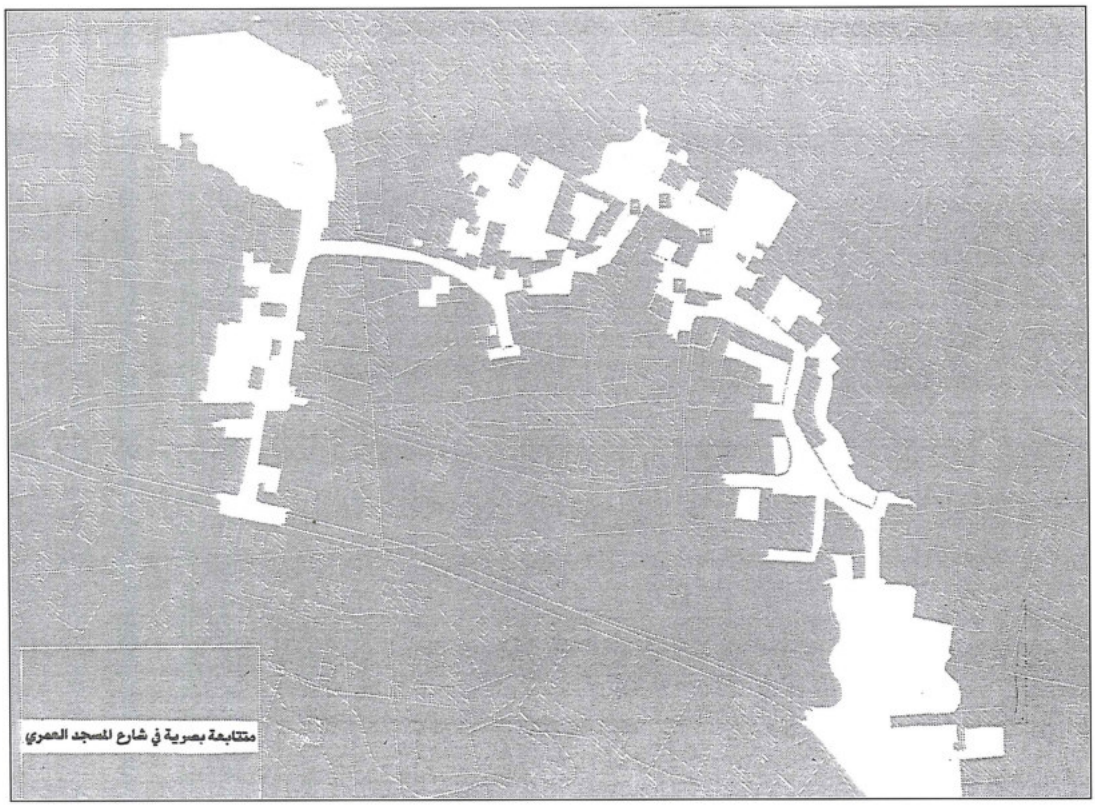
8. Site plan showing part of Ramthā town. Buildings layout and effect of new roads. (After the development plan for Ramthā, Ministry of Municipal and Rural Affairs and the Environment).



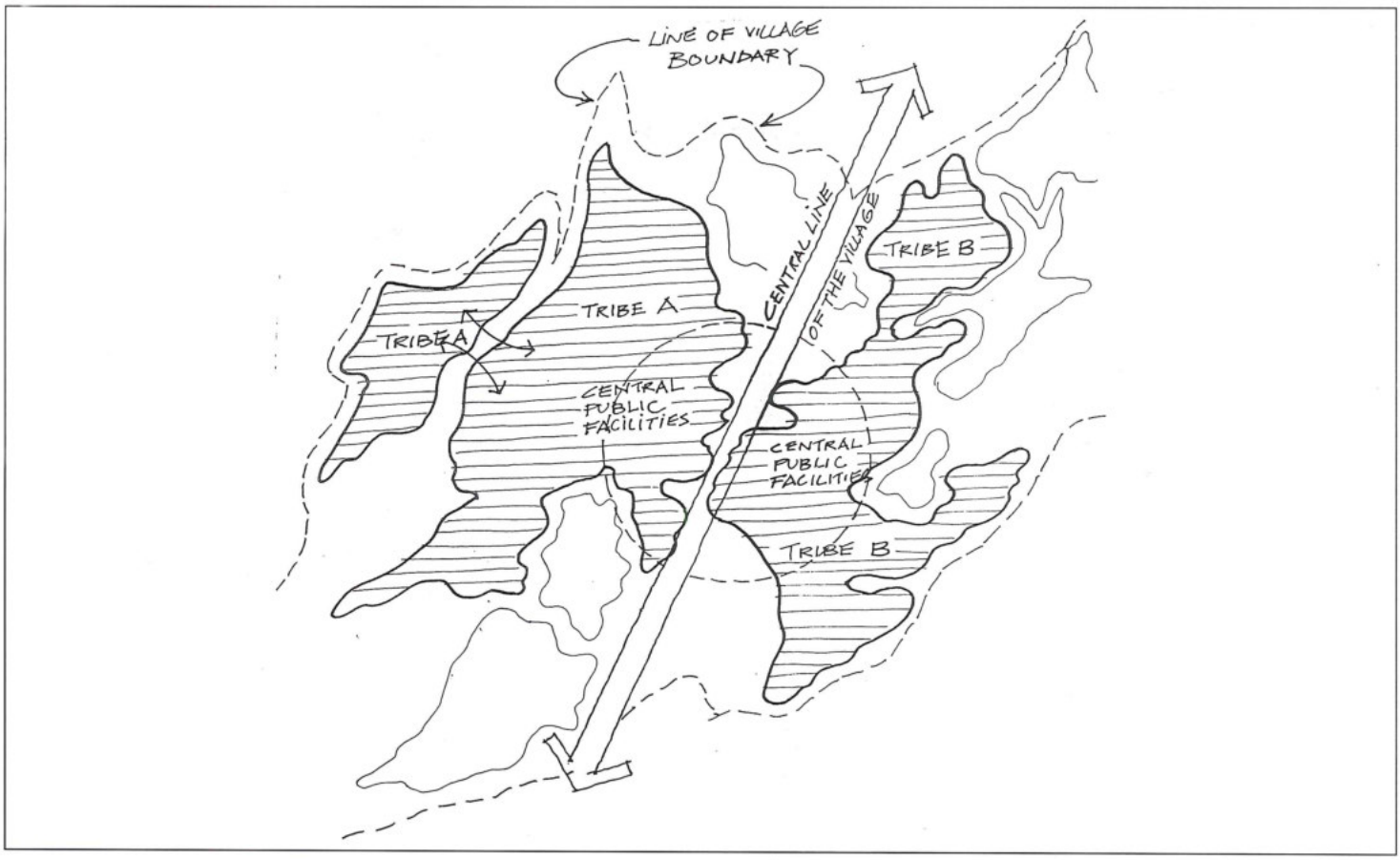
10. Plan showing open space and building clusters in volumetric variation flow (Umm al-Jimāl).



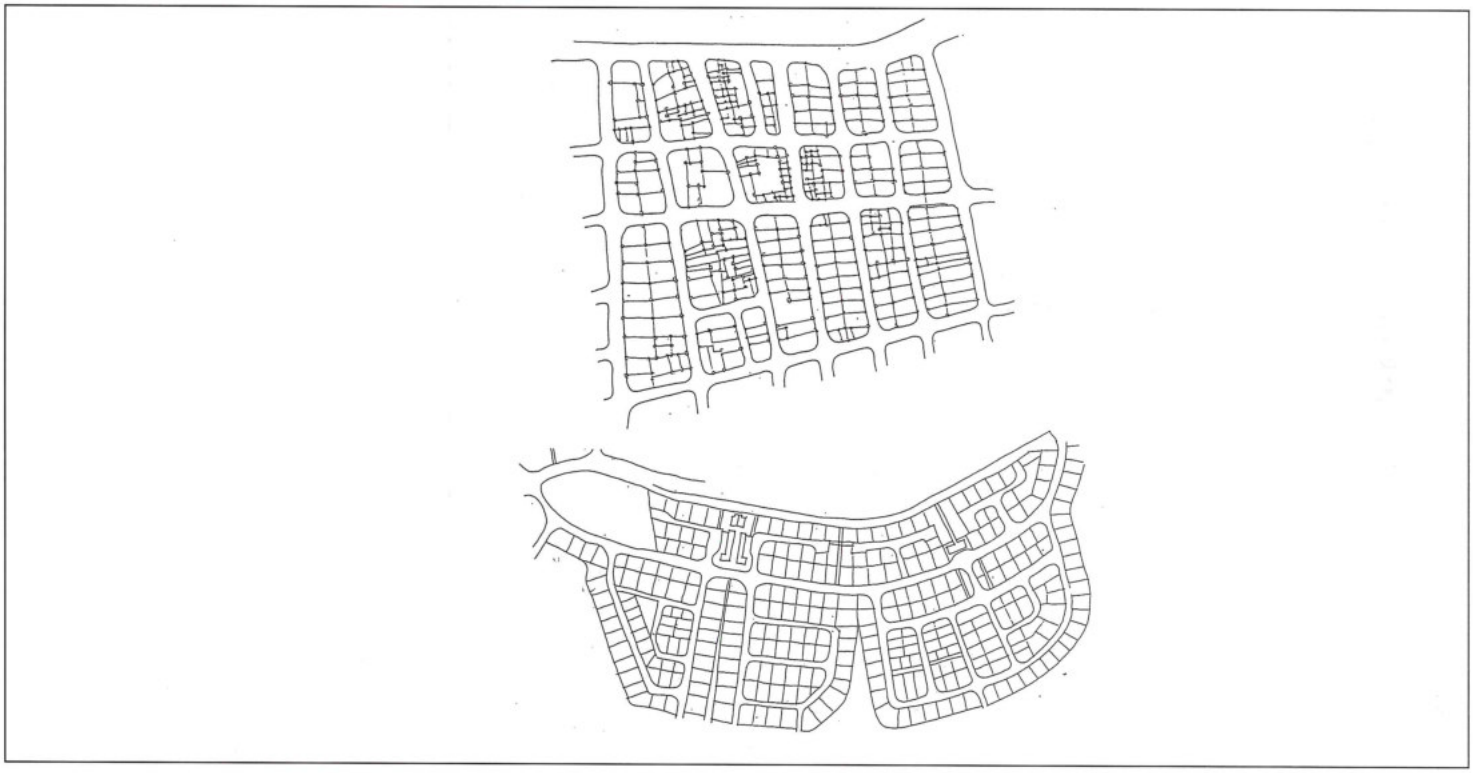
12. Three dimensional drawing – volumetric variation – Salṭ.



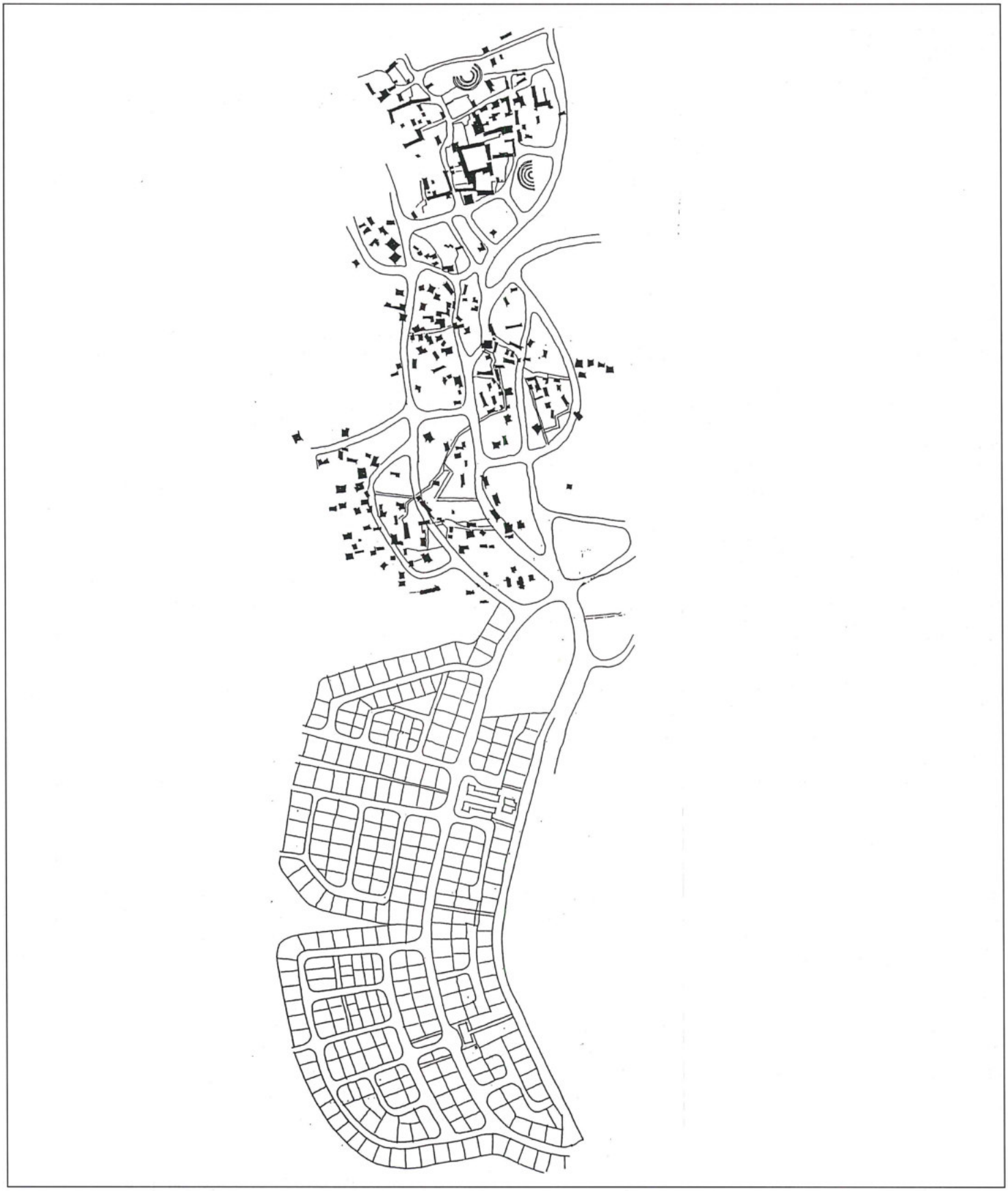

11. Site plan showing flows of vision space and volumetric variation. Sūf near Jarash (based on a survey by the Jordan Royal Geographic Centre).




13. Diagrammatic plan showing the relationship between social effects, topography and settlement form. An-Nu'ayma near Irbid.



14. Site plans of Mafraq central area and the new housing area in Umm Qays. (Based on the development plans for Mafraq and Umm Qays, Ministry of Municipal and Rural Affairs and the Environment).



15. Site plan of developments at Umm Qays, showing three stages of pattern found in most settlements in Jordan.

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# The Resurrection of the Ḥijāz Railroad Line

## Introduction

Trans-Jordan has always been an important connection between Syria and al-Ḥijāz. Prior to Islam, trade caravans used to travel back and forth between the Arabian Peninsula and the Eastern Mediterranean. After Islam millions of pilgrims to Makka embarked on the same journey and re-confirmed the existence of the Royal Sacred Path through their sacred mission to the holy land of al-Ḥijāz.

The character of this sacred path was shaped by religious, political and architectural events, the most recent of which was the construction of the Ḥijāz railroad line at the turn of the century. It was a continuation of other railroad lines that commenced from Istanbul and connected Damascus with al-Madīna and Makka. Beside its political and religious importance, the Ḥijāz railroad line represented the beginnings of the modern history of Jordan, when Trans-Jordan underwent dramatic changes that introduced it to the world as a defined region with a unique architectural heritage.

In Jordan, only sites dating earlier than the year AD 1700 are protected by the Antiquities Law. This has led, unintentionally, to the neglect of the modern architectural heritage that flourished during the last one hundred and fifty years or so. Even though part of that heritage might not be considered historic according to government laws, the preservation and rehabilitation of such a heritage is important for the future generations in Jordan. These monuments and sites, if preserved, will stand as a living proof to Jordan's existence and way of life during that critical period.

The Ḥijāz railroad line stands out starkly against the desert landscapes of Syria and Jordan as a reminder of the Muslim Ottoman period. The construction of the railroad was a symbol of resistance to European control and was one of the most complex administrative and engineering tasks undertaken by a non-Western government — the Ottoman Empire — in the 19th century. The stations of the line show that regional traditional architecture does not take the form of domestic architecture only, but that the public sector of Jordanian regional architecture is just as significant, and deserves the attention of concerned parties. This paper will shed some light on the historic, religious and political aspects of the Ḥijāz railroad line, among which are the notion of the sacred path, and the notion of the line as a cultural conveyer of ideas, tradition and architecture. It will also demonstrate how one of these stations — the Ḥijāz railroad station at al-Maḥaṭṭa in 'Ammān — could be adapted and brought back to life through a comprehensive rehabilitation scheme and advocacy plan. The adaptive-reuse of the station at 'Ammān will be approached as an issue of contemporary intervention in a built-up environment, in order to achieve continuity in time and preserve the existing context.

The issue of reviving the Ḥijāz railroad line and stations, not only for the transportation of pilgrims but also for economic and commercial purposes, is a vital and crucial solution to a more progressive and upgraded region. Responsibility for such revival does not lie only with architects, historians and conservators. It is a responsibility shared by all citizens and agencies in all domains of life.

## The Ottoman Empire in the 19th Century

The deterioration of the Islamic Ottoman Empire started a long time before its formal collapse after World War I. During the 17th and 18th centuries, the Ottomans could not keep up with a booming and progressive Europe after the Industrial Revolution. This led to the colonisation of Islamic territories by Britain, France and Russia. The Ottomans saw Germany as the best ally to get rid of the British and the French, so they sided with Germany in World War I. After the War Britain and France took over the East Mediterranean region — Syria, Lebanon, Palestine and Jordan — and they occupied Istanbul.

During that period of rapid change and catastrophes, lived a prominent figure to whom history has not done justice — the Ottoman Sultan, Abdulhamid II, who ruled between 1876 and 1909. He tried to stop the deteriora-

tion of the Empire, but unfortunately he failed, especially after the revolution of 1908 and the coming to power of the Committee of Union and Progress (C.U.P). The Committee's main aim was to destroy both the Islamic Empire and Abdulhamid II, claiming that progress could be achieved by separating religion from state. Another figure who came on the political scene later was Mustafa Kemal Ataturk, who was supported by France, Britain, Russia and several other European nations. In 1919, he announced the independence of the modern state of Turkey. In 1922 Ataturk declared the end of the Islamic caliphate and established the secular state that advocated a complete separation between religion and state affairs.

Sultan Abdulhamid saw in the erection of the Ḥijāz Railroad, which he incorporated in 1900, a way of upgrading the Eastern Mediterranean. He considered it a Muslim project, not only transporting pilgrims from the northern parts of the Islamic World to the holy land, but also reinforcing Muslim unity and economic growth by connecting all the regions. The French and the British opposed the construction of the railroad line and did their best to stop it.

> Throughout the 19th century, the territory east of the Jordan river and south of the Hauran was sparsely populated, inhabited chiefly by semi-sedentary and nomadic Bedouins. They were dependent for their income upon irregular agriculture, animal husbandry and the pilgrimage. Ottoman authority among them was purely nominal. After the Russo-Ottoman war of 1876, refugees from the Circassians founded a number of villages and the town of Amman, which was to become later on the capital of Jordan (Ochsenwald 1980: 23).

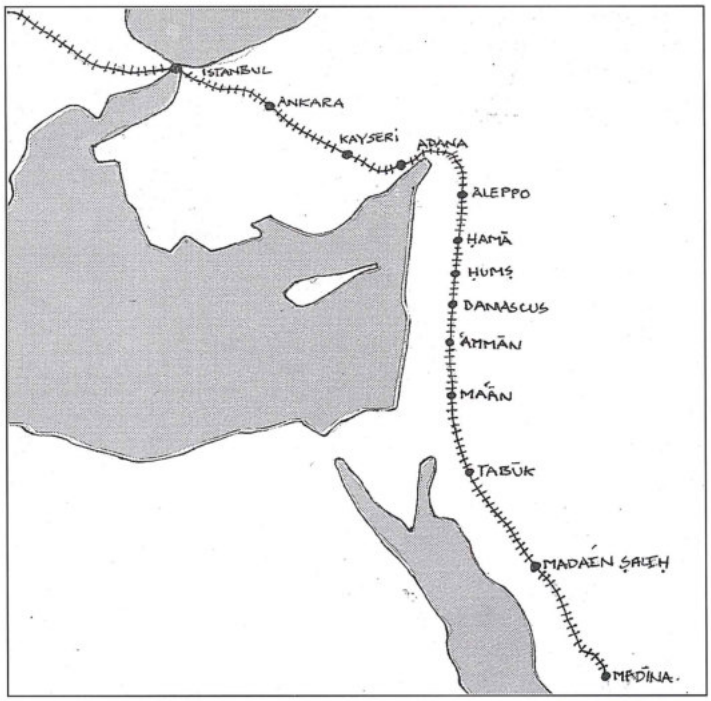
Research concerning the Ḥijāz Railroad, as with other aspects of late Ottoman history, is faced with numerous difficulties, mainly because written documentation concerning the Ḥijāz Railroad have been less lasting than its rails, freight cars and stations. In general the sources for Ottoman and Arab institutional history are less abundant and more difficult to find than those dealing with more dramatic military history.

## The Sacred Path: From Istanbul to Makka

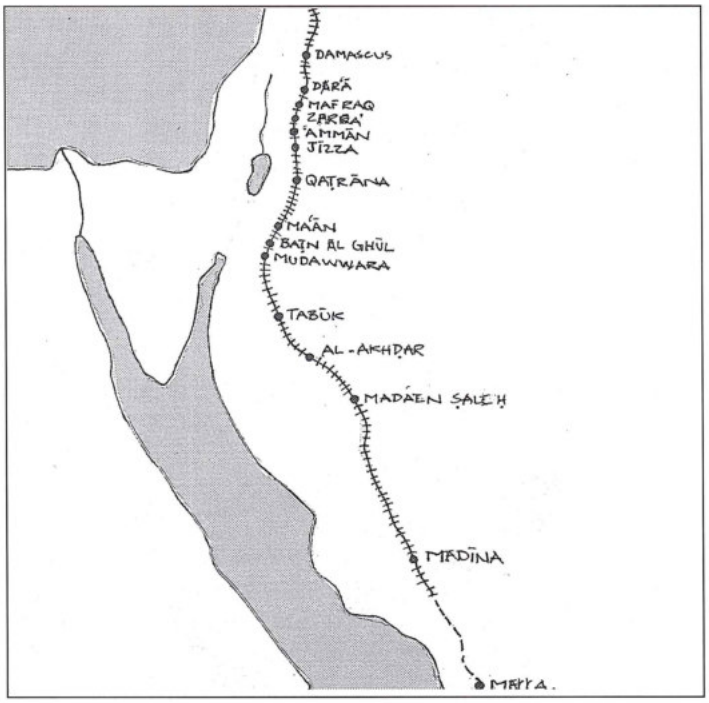
The concept of the Sacred Path connecting or leading to various religious magnets is an ancient one. The Sacred Path has always had an impact on architecture, urbanization and techniques of transportation.

### *From Istanbul to Damascus*

The route of the railroad line from Istanbul to Makka was divided into two main parts. The first part, called the Taurus Express, connects Istanbul with Damascus via Ankara, Kayseri, Adana, Aleppo, Ḥamā and Ḥumṣ (FIG. 1). The second part, the Ḥijāz Railroad line, connects Damascus with al-Madīna (FIG. 2), and will be discussed in length below.




1. The Sacred Path from Istanbul to Makka.




2. The Ḥijāz Railroad Line, from Damascus to al-Madīna.

> Most of the line between Istanbul and Damascus was already laid out by foreign railroads with the collaboration of the Ottoman Empire. By 1900, a number of lines had been built or planned by Germany and France. In the north, the German-dominated Baghdad railroad connected Berlin with

Baghdad via Istanbul, Aleppo and Mossoul. That was an appropriate step to foster the alliance between Germany and the Ottoman Empire. The central area of Syria was served by a French-owned company, the Damas, Hama et Prolongements (D.H.P), which reached Damascus and had a connection with Beirut. (Ochsenwald 1980: 45).

*From Damascus to al-Madīna and Makka: The Ḥijāz Railroad Line*

The Ottoman Sultan Abdulhamid II did his best to bring the Ḥijāz Railroad into existence, taking into consideration the millions of pilgrims going to Makka every year. He was aware of the project's religious and political impact at the same time. Work started from Damascus in September, 1900. The line reached Dar'ā and then 'Ammān in 1903. From 'Ammān, construction continued south, reaching Ma'ān in September, 1904. The line reached al-Mudawwara in 1906. The first train to reach al-Madīna was on 22 August, 1908 (TABLE 1).

**Table 1.** Stages of construction of the Ḥijāz Railroad Line.

| *Date* | *Place* | *Distance in kilometres* |
|---|---|---|
| 1/10/1901 | Muzayrīb to Dar'ā | 14 |
| 1/10/1902 | Dar'ā to az-Zarqā' | 80 |
| 1/10/1903 | Damascus to Dar'ā | 123 |
| 1/10/1903 | az-Zarqā' to 'Ammān and al-Qaṭrāna | 124 |
| 14/10/1904 | Ḥayfā to Baysān | 59 |
| 27/5/1904 | Baysān to Jordan Bridge | 17 |
| 1/10/1904 | al-Qaṭrāna to Ma'ān | 132 |
| 1/10/1904 | Ma'ān to al-Mudawwara | 113 |
| 15/11/1904 | Jordan Bridge to Muzayrīb | 73 |
| 1/10/1906 | al-Mudawwara to Tabūk | 120 |
| 1/10/1907 | Tabūk to al-'Ulā | 287 |
| 22/8/1908 | al-'Ulā to al-Madīna | 323 |
| Total: | | 1465 |

The distance from Damascus to al-Madīna was about 1320 km. The Ḥijāz Railroad Line never reached Makka as intended, even though all survey work was already done for that task. There were several reasons why: 1) the revolution in 1908 in Istanbul that led to the overthrow of Abdulhamid II; 2) the opposition of the Bedouins to the line because they used to live off guiding the caravans going to Makka; and 3) the aggressive attitude of Great Britain. The British saw in the railroad line a threat to their interests in the region. They bombed parts of the railroad with the help of Lawrence of Arabia, who collaborated with the Bedouins and made numerous raids on construction camps and different train stations. TABLE 2 shows the principal stations of the Ḥijāz Railroad in 1914.

The major problems for workers resulted from the weather and absence from families. Health problems developed from the extreme variations between heat and cold, lack of water and especially recurring attacks of communicable diseases. Attacks of scurvy and dysentery were followed by typhoid and in 1902-3 by a devastating attack of cholera. Between Dera and Amman, at least four hundred workers died from cholera; many fled the area. Health conditions for workers were improved only in 1907, when doctors and pharmacists were sent from the Fifth army and several hospitals were opened. Separation from wifes and families involved all but a few engineers and administrators who were able to afford housing accommodation near the railroad. (Karpat 1985: 17).

Some other problems involved raids on the railroad by the Bedouin tribes, but Circassians and Ḥawrānī Arabs in maintenance crews along with the troops doing

**Table 2.** Principle stations of the Hijaz Railroad in 1914.

| *Name of station* | *Distance from Damascus (km)* |
|---|---|
| Damascus | 0 |
| Kiswah | 21 |
| Dayr 'Alī | 31 |
| Masjid | 50 |
| Jibāb | 63 |
| Khabab | 69 |
| Muḥajjah | 78 |
| Shaqra | 85 |
| Izra' | 91 |
| Dar'ā | 123 |
| Naṣib | 136 |
| al-Mafraq | 162 |
| as-Samra | 185 |
| az-Zarqā' | 203 |
| 'Ammān | 222 |
| al-Jīza | 260 |
| al-Qaṭrāna | 326 |
| Ma'ān | 459 |
| Ghadīr al-Ḥajj | 475 |
| Baṭn al-Ghūl | 520 |
| al-Mudawwara | 572 |
| Tabūk | 692 |
| al-Akhḍar | 760 |
| al-Mu'aẓẓam | 822 |
| ad-Dār al-Ḥamrā | 880 |
| Madā'in Ṣāliḥ | 955 |
| al-'Ulā | 980 |
| Hadiyya | 1133 |
| al-Madīna | 1302 |

construction work, provided security against raids. Topography presented fewer problems than did the climate. Most of the track was built on flat or slightly rolling terrain. The tracks covered 210 kilometres of plains, 54 of steep hills, and 1164 of slightly hilly areas.

After World War II, efforts were made to re-open the Ḥijāz Railroad Line. In 1947, 1953, 1954, 1955 and 1981, several meetings were held between the governments of Jordan, Syria and Saudi Arabia. Unfortunately none of these meetings resulted in a firm decision to use the line again. Since then, there has been many demands asking for the resurrection of the line, to be used on both national and regional levels.

During the second half of the 20th century, the Middle East went through many political and geographical changes that resulted in several Western-dependent societies. Currently, beside the desperate need for political stability in the region, there is a growing need for the re-evaluation of the economic infrastructure, with the hope of more cooperation between different poles. The revival of the Ḥijāz Railroad Line could be a perfect example of organizational cooperation in the Middle East. The project's contribution to regional economic growth in transportation, trade, accessibility and political unity is of great and sensitive value. It could set the first step to a more upgraded region.

## Typology of Train Stations along the Ḥijāz Railroad Line

The term "Islamic Architecture" is often misused, because of its broad and general meanings. Islamic culture and architectural style had remarkable impacts on the Islamic World. At times these impacts were genuine in their form and meaning. There were times when these impacts blended and interacted with what was already there, to produce ultimately a "regional architecture" with Islamic influences.

The architectural style in the Eastern Mediterranean went through many periods of change: ancient, classical Greek and Roman, Byzantine and Islamic. The final product that we see in the 20th century is the result of all these periods. It is noticeable that for the last two centuries, Syria, Jordan, Palestine and Lebanon were influenced by Ottoman Architecture. This style was disseminated gradually from north to south. The following study of train stations in Asia Minor, Syria and Jordan shows how this dissemination was carried through. Geographic proximity, strong social relations and similar climatic conditions were the foundations for such a dissemination.

Alongside the Ḥijāz Railroad Line, stations can be categorized into two main types. The first "terminus" type is found in major urban centres, such as Istanbul and Damascus (FIG. 3) where the tracks enter the city and end at the station itself, giving a sensation of terminating a journey and arriving at one's destination. The terminus stations tend to be very grand and represent the architectural style that was popular at the time.

The second "rural" type is found in towns and villages. From visits to different locations, it can be noticed that in the case of the rural type, the tracks tend to run parallel to the stations with platforms that run also parallel to the configuration of different buildings forming the station. The station is a stop along the way and the town is usually not a major destination. This type is found in places like Aleppo, Qadam (FIG. 4), Dar'ā, az-Zarqā', 'Ammān (FIG. 5), al-Qaṭrāna (FIG. 6), Ma'ān and many other places.

*The "Terminus" Type*

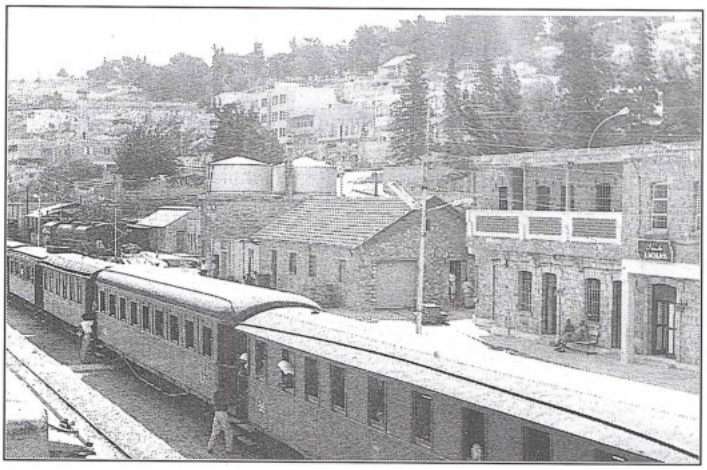
One of the few examples that fully represents this type on the Ḥijāz Railroad Line is the Ḥijāz Railroad station in the centre of downtown Damascus. This station was built after the Qadam station in the outskirts of Damascus. The reason for building this station in the middle of the downtown area was to attract and encourage local trade



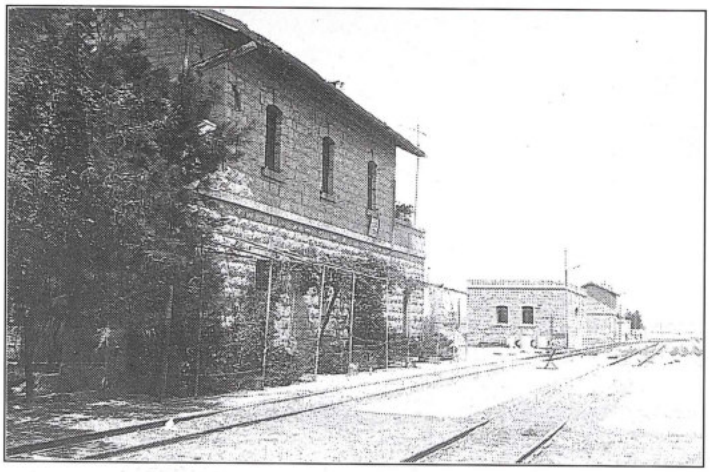
3. Al-Ḥijāz station, Damascus,1990.



4. Qadam station, suburb of Damascus, 1990.



5. ʻAmmān station, 1990.



6. Al-Qaṭrāna station, 1990.

to use the train and make it as accessible as possible. The station is famous for its interior wood work, proof of skilled Syrian craftsmanship.

*The "Rural" Type*

The other type of train station exists in small towns and villages, and rural areas. There are dozens of rural stations between Istanbul and Makka. The stations are usually built parallel to the tracks, with simple cubic forms, and either flat or pitched roofs — an influence from Ottoman Turkish architecture. Most of these stations are identical or very similar to each other, the same design was used more than once as a prototype in the Eastern Mediterranean. The Qadam and ʻAmmān stations are examples of rural stations.

*Qadam Station* (FIG. 4): The station is located outside Damascus, on a historical and religious site. The Prophet Muḥammad used to head the caravans going north from Makka, and the place called Qadam — meaning the foot — is thought to have been where the Prophet dismounted from his camel. It is the furthest point north from Makka that the Prophet visited during his life. The Qadam station, rather than the Ḥijāz station in the centre of Damascus, is the one currently in use for passenger service into Damascus, serving the lines coming from Aleppo and ʻAmmān.

*ʻAmmān Station* (FIG. 5): The Ḥijāz Railroad Line reached ʻAmmān in 1903. At that time when the station was built, ʻAmmān was a small town serving a modest population, and the station was built with such a capacity in mind. The main station building was built parallel to the tracks, and several houses were also erected to house the people who worked at the station.

**The Preservation and the Rehabilitation of the Ḥijāz Train Station at ʻAmmān**

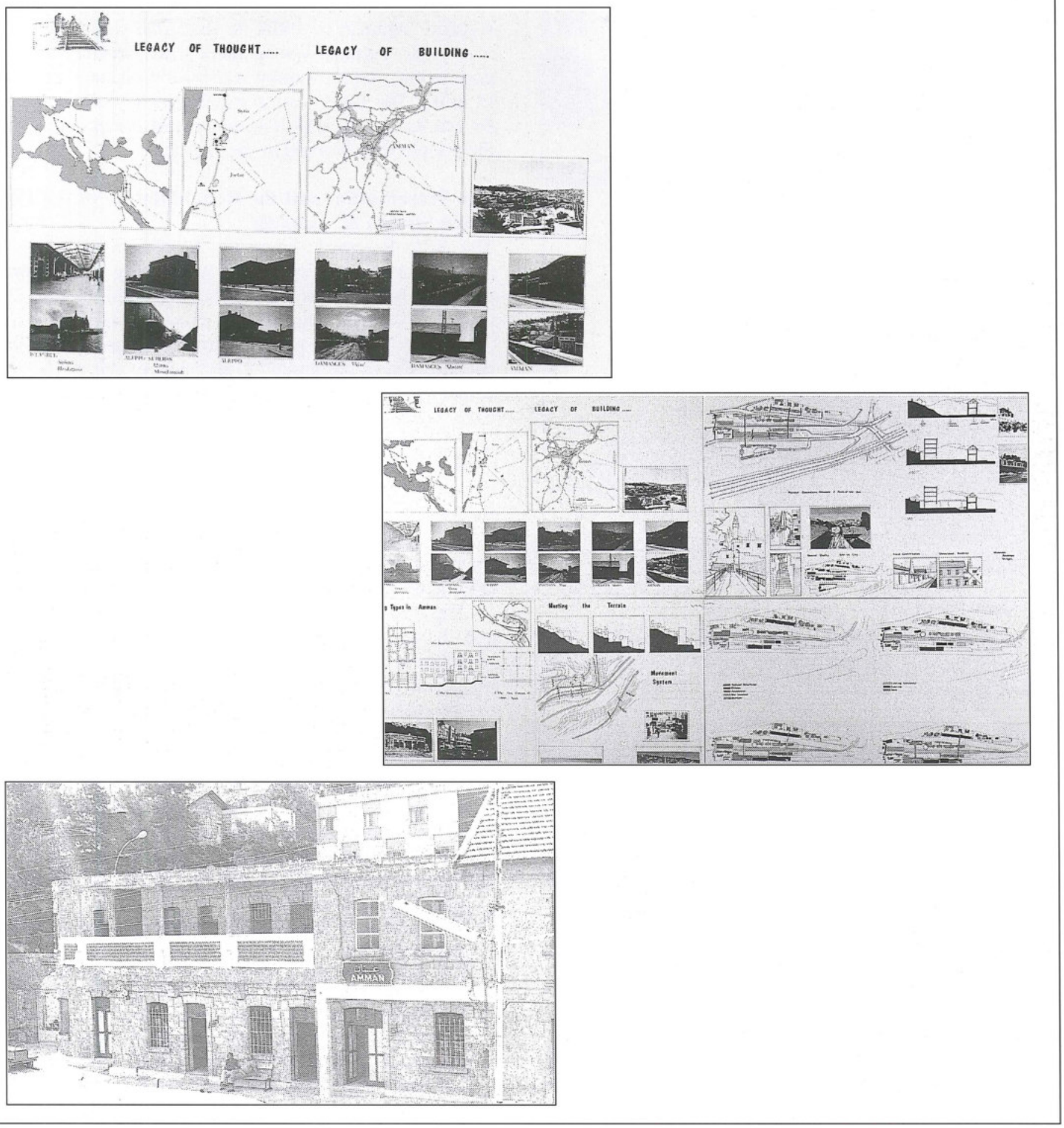
The Ḥijāz Railroad station in ʻAmmān occupies an important part of the city, which was a very busy centre in the early 1920s up to the 1930s. The station is also close to the old airport. Three major factors contributed to the deterioration of that part of ʻAmmān in general and that specific site in particular: 1) the shift of the city's urban centre to the new downtown area and then to suburbs away from the old part; 2) the construction of the new Queen Alia International Airport 40km south of ʻAmmān; and 3) the unpopularity of the train as a medium of transportation, now replaced by cars and buses. Besides, the line does not connect as many countries as it used to in the past. The station at ʻAmmān still functions for commercial goods and weekly trips to Damascus and other touristic areas.

The resurrection of the Ḥijāz Railroad Line in general and the preservation and rehabilitation of the station at ʻAmmān in particular are the foundations for broader political and architectural objectives. Two main objectives can be easily identified: 1) on a political level, salvaging the concept of a unified Muslim nation, through an architectural proposal that advocates the revival of the Ḥijāz Railroad Line and corresponding stations; and 2) on an architectural level, preserving and rehabilitating one of these train stations at ʻAmmān within its existing context and surroundings. Discussing the architectural objects in depth leads to several essential points that the design project took into consideration:

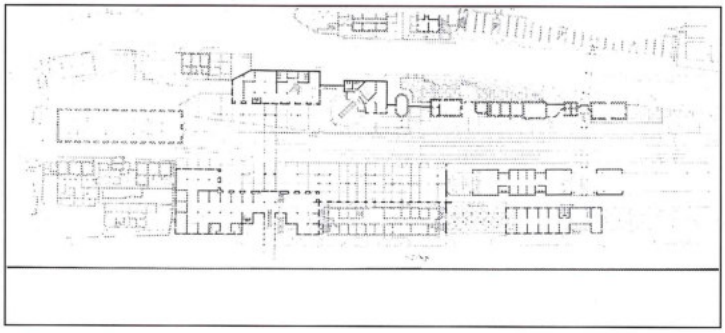
1) The issue of contemporary intervention in a built-up environment.
2) The meanings and messages of place, formed by the character of a local region or a particular location.
3) Implementation of the movement system by erecting physical connections between the different parts of the site, and establishing other kinds of physical connections with the surrounding neighbourhoods, thus attracting people either to or through the site even if they do not want to use the train station.

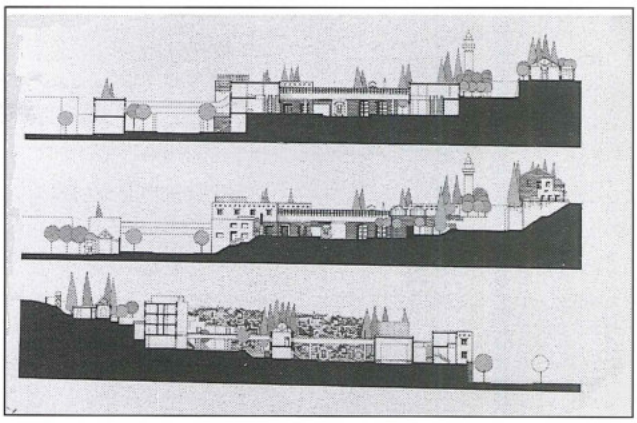
For more details, refer to FIGS. 7, 8, and 9 that il-

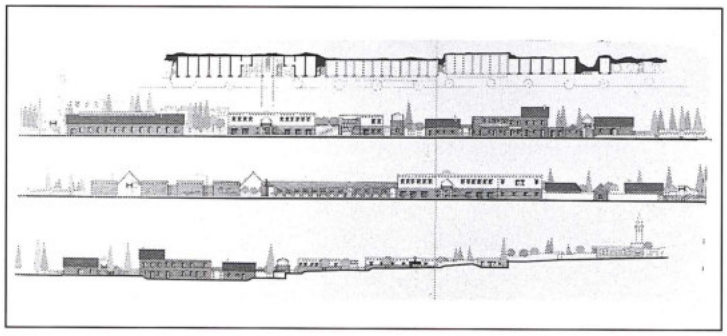
lustrate the architectural drawings and the proposed scheme for the rehabilitation of the station and its immediate surroundings. In brief, the proposal advocates the reuse of the old station to serve as a railroad-archive museum, and the construction of a new terminal and additional freight service facilities. The adaptive-reuse of the station at ʻAmmān is approached as an issue of contemporary intervention in a built-up environment, in order to achieve a continuity in time and preserve the existing context.

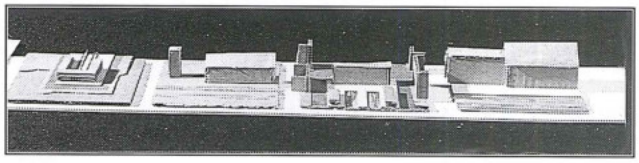


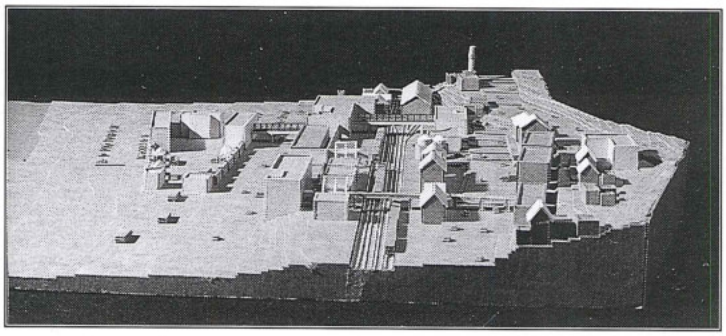

7. Rehabilitation Project, ʻAmmān station. Journey and site analysis.

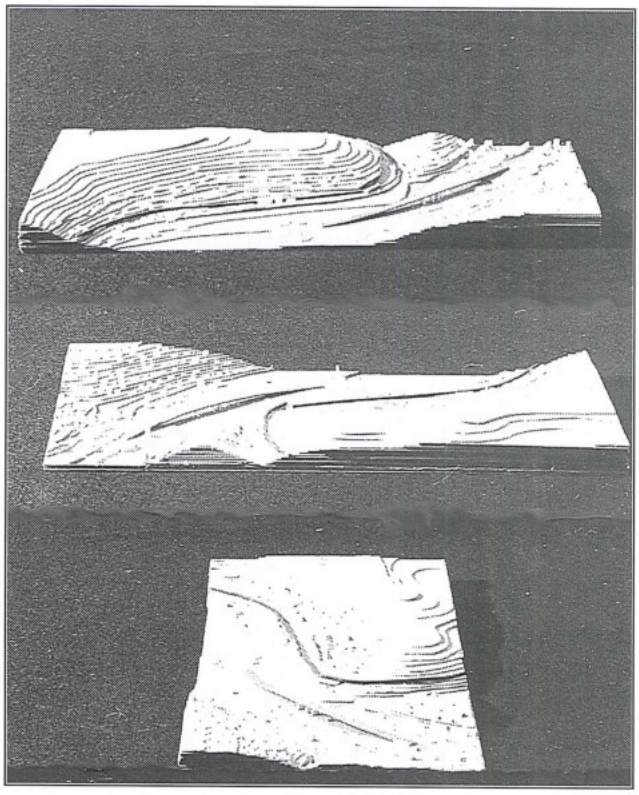






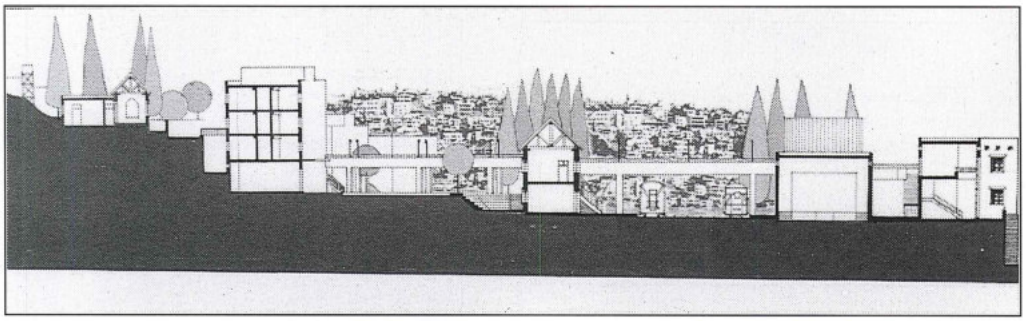


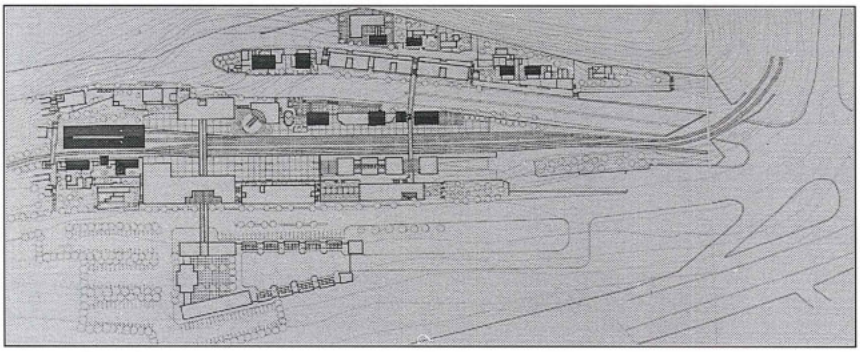


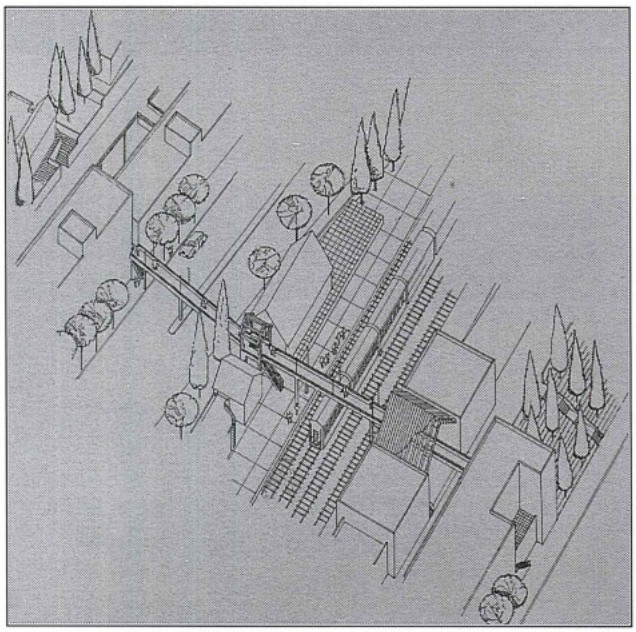


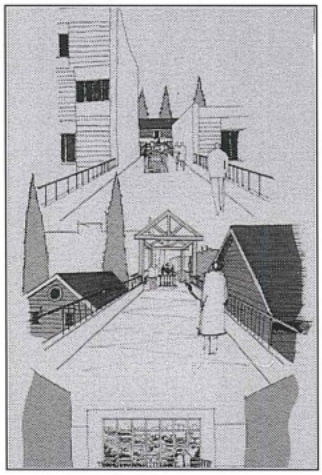


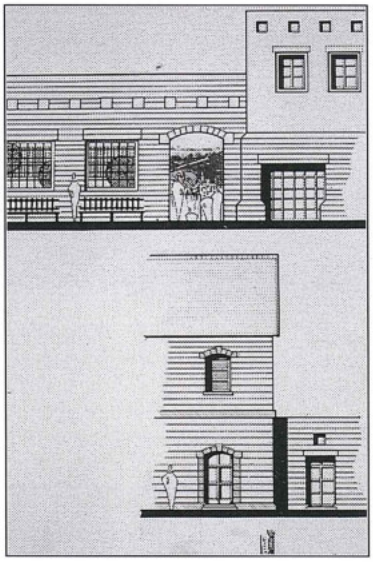
8. Rehabilitation project, ʿAmmān station. Plan, elevations and model.

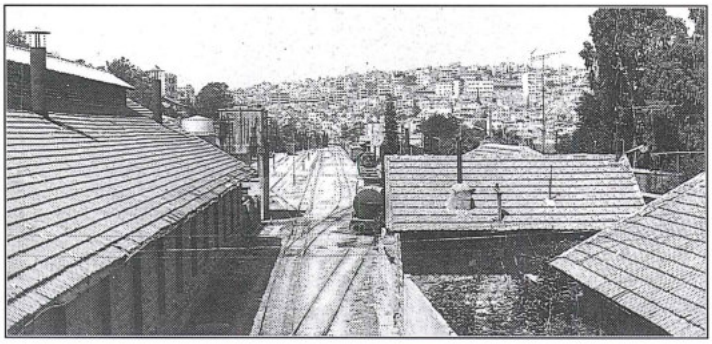












9. Rehabilitation project, ʿAmmān station. Sections and details.

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# The Golden Era of as-Salṭ (1870-1950): Urban and Architectural Development

## Introduction

This paper is based on extensive work and research carried out by a team of architects from the Building Research Centre at the Royal Scientific Society (RSS). The research started in 1987 when the RSS embarked on a pioneer project to document the architectural heritage of Jordan. As-Salṭ was taken as a pilot study and the first volume of the *Handbook of Architectural Heritage in Jordan* was published in 1990. During this period, RSS was commissioned by the as-Salṭ Development Corporation to conduct a study to define the extent of the old city that should be preserved and redeveloped in order to stimulate economic activity in the area and maintain the historic character of the city. This involved preparing an Implementation Plan for the city centre. The study was produced in three volumes covering the general strategy of preservation for as-Salṭ, the Implementation Plan, the supporting actions, and full background material on survey and research data.

The authors acknowledge the efforts made by colleagues who took part in these two important projects.

## Background

Since time immemorial, as-Salṭ was endowed with all constants necessary to support a human settlement and form an urban gathering; geography, topography, climate and water supply. In addition, prosperity of inhabitants, regional historic events, the city's cultural ambience and the introduction of new building materials have all gradually formulated the present as-Salṭ.

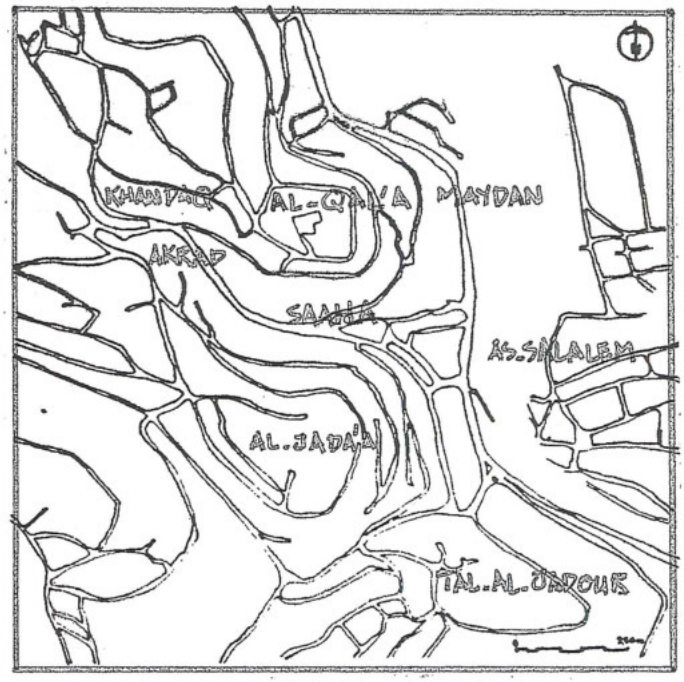
As-Salṭ lies 30 km north-west of 'Ammān at an altitude of 800 m. Its fertile land and mild climate have attracted settlers from the Stone Age onwards. It has traditionally been a trading and market centre serving Gilead on the East Bank, with links to Nāblus, Jerusalem and the Mediterranean to the west and Damascus to the north.

Under the Ottoman rule (starting in the 16th century), the area went into a state of instability and depopulation. This continued until the later part of the 19th century when the Ottomans attempted reforms in their ruling systems, hence improving the living conditions for the people.

The revival of as-Salṭ started in 1866 when the Governor of Damascus re-established order and moved the *Kaimakam* to it. Shortly afterwards, the Governorate's building (*Sarāya*) was built. New people moved in, in particular the merchants from Nāblus, to extend their commercial base across Jordan. Various Christian missions were also established. The city expanded and the architecture changed from rural to urban.

## Expansion and Growth (FIGS. 1-3)

By the end of the 16th century, as-Salṭ was composed of two major *Maḥallāt* (settlements); namely, Akrād (the lower slopes of al-Qal'a and al-Jada'a and the valley between them) and 'Awāmla (the eastern slopes of al-

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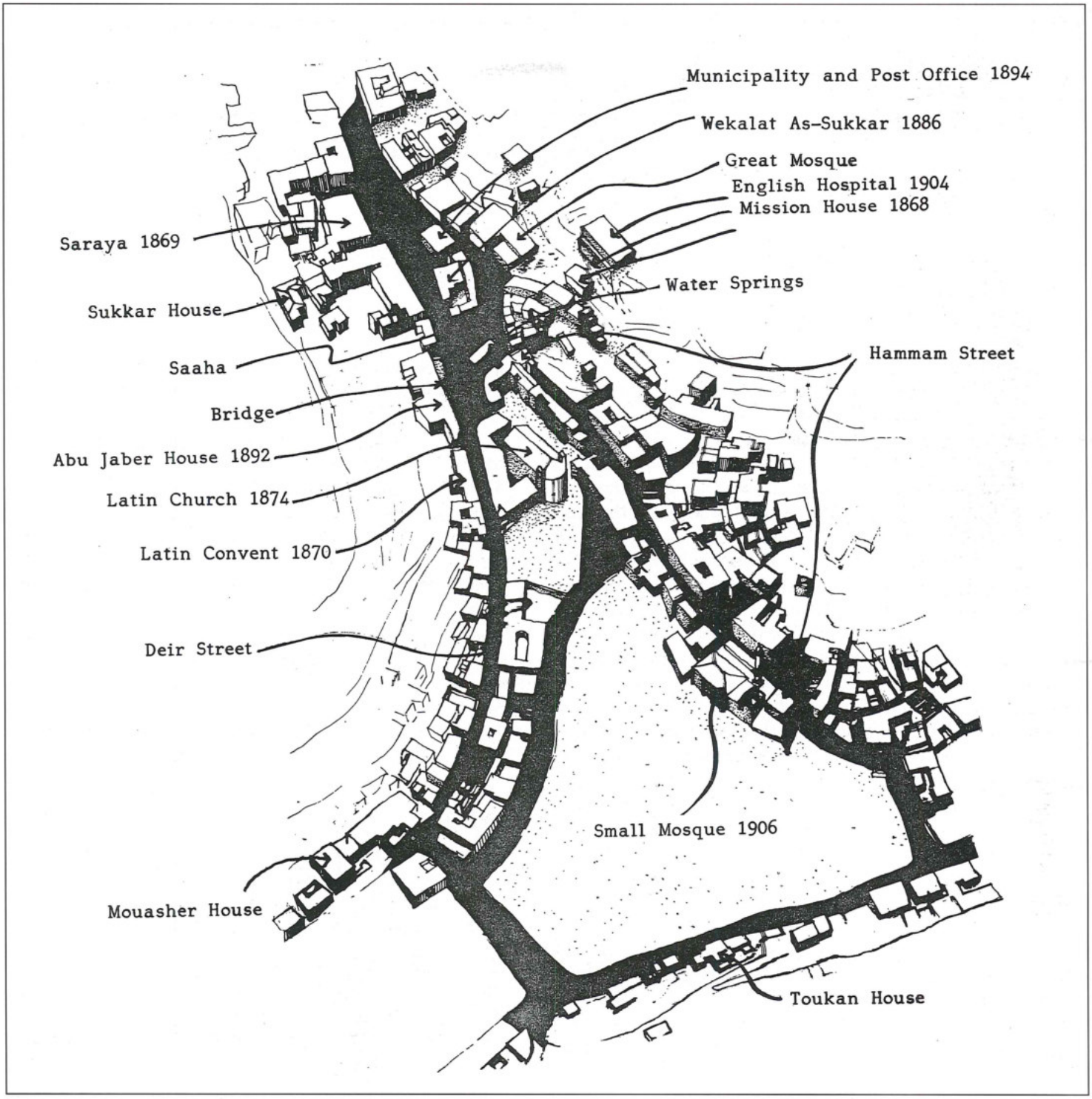
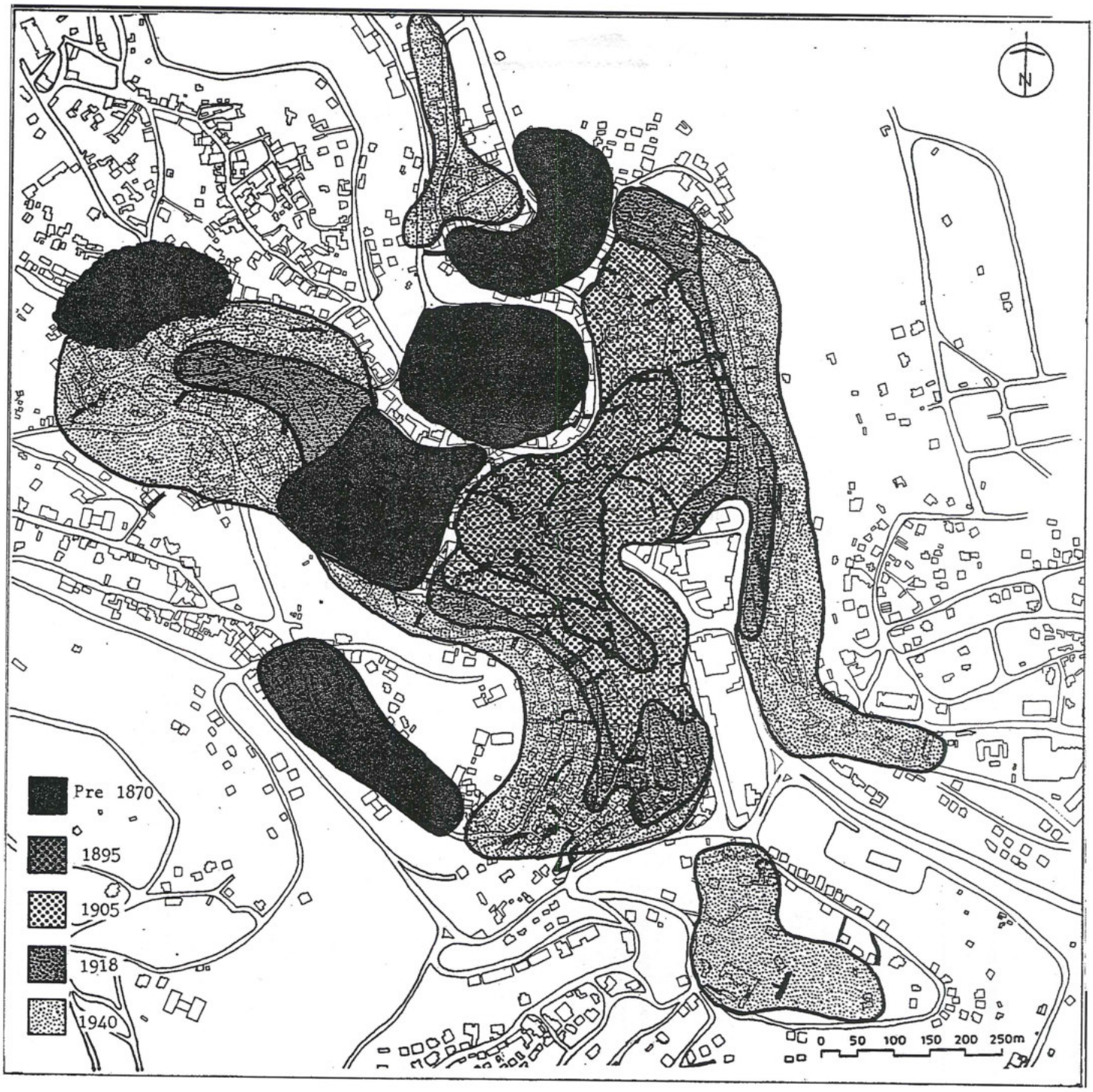



2.

Qal'a) as well as the castle (al-Qal'a). In the early 19th century, a third Maḥalla (Qṭayshāt) appeared on the slopes of al-Qal'a between 'Awāmla and Akrād.

With the establishment of the Governorate, and the construction of its building, as-Sarāya, in 1869 in as-Sāḥa (in the valley between the hills of al-Qal'a and al-Jada'a), the city as a whole grew around it and the Maḥallāt were interlocked. This attracted various important activities; amongst them was "Wikalat as-Sukkar" which was built in the centre and accommodated a specialized *sūq* for expensive goods at its eastern part as well as various public facilities at its western part (i.e., the Post Office, the Tax Department and the Health Directorate).




3.

An important feature of as-Sāḥa was the three water fountains serving people and animals. In the 1920s, yellow "Salṭ stone" pavement was added to as-Sāḥa and the nearby areas such as al-Ḥammām, al-Khaḍir and ad-Dayr streets. Various religious buildings surrounded the area; mainly, the Great Mosque (which existed before the 1860s although the exact date of its construction is not known), the Latin Convent (built in 1871), and the Anglican Church and Hospital. Rich merchants and influential people had their houses built close by as well.

The people who moved to as-Salṭ as a result of the prosperity and order of the late 1860s — mainly traders from Nāblus — then settled east of as-Sāḥa, at al-Ḥammām Street and its surroundings. This area was later

called Maḥallat an-Nawābulsa (referring to the origin of the settlers) or Maḥallat al-Aghrāb. As the majority were traders, the street became a commercial one with shops on the lower level and houses on the upper. Cattle were sold at its lower or eastern end while vegetables were sold at its upper or western end on Fridays and Mondays. The street was named after the public baths that existed half way through the street but were demolished in the 1940s when as-Salṭ had its water network. Other commercial areas appeared such as ad-Dayr Street and Iskāfiyya Stairway.

By the end of the 19th century, the city covered the slopes of al-Qal'a and al-Jada'a as well as as-Sāḥa and al-Ḥammām Street. Expansion continued into the 20th century, so that by 1918, it covered al-Maydān Street (the valley between al-Qal'a and as-Salālim), further parts of al-Jada'a, as well as al-Khandaq (west of Akrād). Afterwards, the rate of growth slowed down. This was due to various political events (mainly, the First World War and the establishment of the Emirate's capital at 'Ammān) so that by 1940, the major expansion in the city was in as-Salālim area with minor expansions in Tall al-Jadūr and al-Khandaq.

**The Townscape of Old as-Salṭ**

During this rapid growth of the city, various townscape features evolved. The city grew on the steep slopes of the three hills (al-Qal'a, al-Jada'a and as-Salālim) and the valley between them. The architecture went in harmony with the landscape and topography, and together, they formed an architectural amphitheatre with the green fields of the valley as its base (FIG. 4).

The buildings of as-Salṭ were usually subdivided into cellular units, thus giving the impression of fragmented architecture rather than big solid masses. As they go up the hills, these units follow the contours, and recess to allow the neighbours to overlook rather than block the view (FIG. 5).

Walls were usually built of courses of yellow "Salṭ stone" with a smooth texture and no pointing. Adjacent buildings had their exterior walls aligned, thus resembling the walls of citadels or otherwise the traditional terraces of the area's countryside. These walls emphasized the containment of the valley in the middle, and stressed verticality and the importance of the skyline. This is especially felt when one enters the city from 'Ammān and faces the clusters of buildings on the slopes which dominate the view.

Due to the steepness of the slopes, stairways were used as the major circulation pattern (FIG. 6). A web of footpaths and stairways running across the slopes was formed which gave a close-knit pedestrian scale to the city. Where the contours allowed, narrow streets went along them with buildings built right to the edge.

In the 1920s, streets and stairways were paved with yellow "Salṭ stone" in courses of 25-30 cm laid across. They sloped to the middle to allow the water to drain.

As for the commercial areas, shops usually had wide arched doors with wooden shutters of 2-3 panels (FIG. 7). No shop fronts existed and goods were stacked in piles and bundles and hung on walls inside and outside the shop. Corrugated sheets fixed to metal frames were used as awnings. The metal frames were also used for hanging goods.



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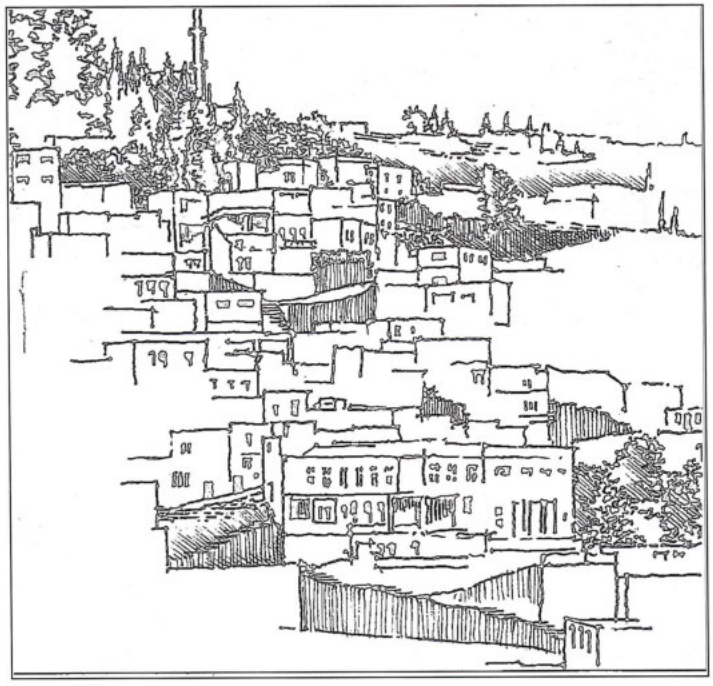

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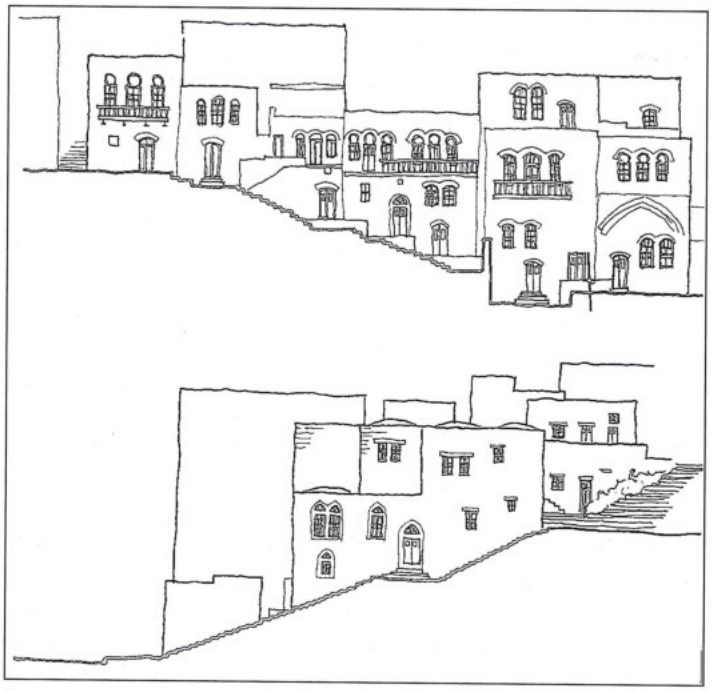


6.



7.

The city has a dense urban form with minor patches of greenery spread around. Amongst them are the tree-covered summit of al-Jada'a and the adjacent cemetery, and the small hill of Tall al-Jadūr around the old secondary school. As-Salālim, however, has a different character with very steep slopes of barren rock and a few sparsely vegetated terraces.

**Style and Character: Characteristics by Period**

As-Salṭ is unique, not only in its townscape quality, but also in the merit of its individual buildings, which possess a distinguished architectural value and special characteristics that have been gradually outlined throughout the course of history (FIG. 8).

Developments of building techniques, architectural characteristics, building materials and construction methods have been traced back in history in order to identify and explicate the successive periods of development.

In the last 100 years or so, as-Salṭ merged into an important phase of its evolution, during which the architectural style changed from traditional "peasant" houses built of local materials (e.g. rubble stone, tree trunks, mud and hay) to one influenced by the International Modern style using new materials (e.g. concrete and I-beams). The transition was generally gradual and naturally overlapped. But, nevertheless, five general periods can be identified starting prior to 1866. These are:

*The Pre-1866 "Village" Type*

The influence of the Ottoman rule over as-Salṭ in this period was weak. As-Salṭ was composed of three large Maḥallāt (Akrād, 'Awāmla and Qṭayshāt) characterised by simple single-storey "peasant" houses scattered about the hillslopes, totally integrated with nature in form, material and setting.

The single-storey "peasant" house, typical of the Jordanian village houses of that period, was built in local style using local materials. It was composed of one cubical unit on a hillslope. Walls were one metre thick with rough untreated stone on both sides. Roofs were supported on stone arches (*qanṭara*), usually three, spaced at 1.5 m. Tree trunks covered with mud and hay spanned



8.

over them (FIG. 9). This allowed for a longitudinal space expandable through the addition of more arches. Each arch spanned four to six metres across. Thus, an uninterrupted space reaching about 50 m² was provided in a three-arch construction.

Back facades were usually buried in the hillslope, the roof being at the same level of the backgrounds (FIG. 10). Openings were confined to the front facade where structural arches formed the door lintels. Windows were generally two small arched ones as well as a few tiny squared ones (*ṭāqāt*) which were used for ventilation purposes. Cut stone outlined both doors and windows.

The single space interior formed from such construction was divided through change of level into three subspaces (FIGS. 11, 12); the first, closer to the door and lower in level, was used for animals (*qā' al-bayt*). This led through a number of steps to a higher living area (*al-masṭaba*), and the third and highest was used mostly for storage and sometimes for sleeping (*as-Sidda*).

Storage bins built from wooden frames covered with mud were fitted between the arches (*rawāyā*). Crops were dried on the roofs, then filled in the storage bins through small openings penetrating the roof. Smaller bins (*kawāyir*) were built from mud and hay in the living area adjacent to the walls; these were used for storing food supplies for daily use.

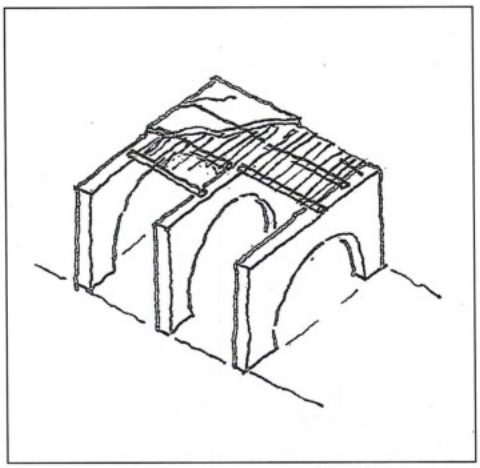
In this period, people, mostly farmers, lived outdoors while using their houses for sleeping, protection and storage.

*The Regional Era (1866-1890)*

In 1866, the Ottomans attempted to re-assert their authority over as-Salṭ by moving the Kaimakam to it; this ensured political stability and resulted in immigration, prosperity and urban/commercial growth. Development in this period was completely different from the traditional pre-1866 "peasant" houses.

New buildings were urban in character — although, no doubt, "peasant" houses continued to be built into the 20th century — presumably constructed by skilled Nābulsī craftsmen. Constructions were more sophisticated, built using squared masonry (FIG. 13). The inner side of the wall was built of rough untreated stone, while the outer side was built from coursed "Salṭ stone" brought from the as-Salālim quarries.

A building was composed of a number of cells adjacent to each other, where each cell was around 4 x 4 m, two storeys high. The ground floor roof was a crossvault while the upper floor roof was a shallow dome, both constructed from rubble stone.



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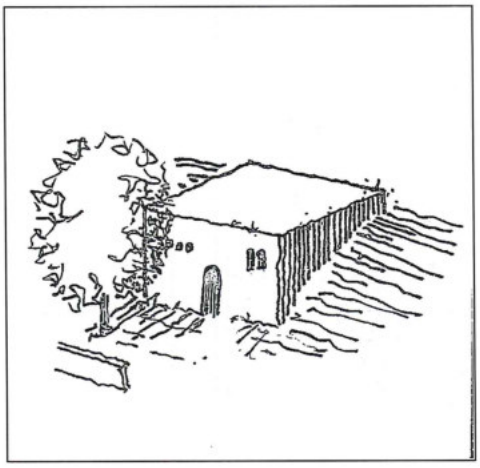

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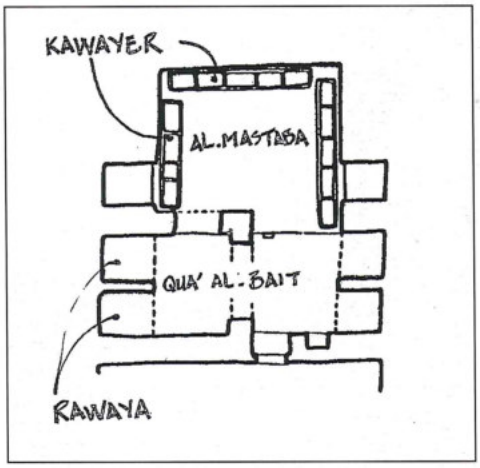


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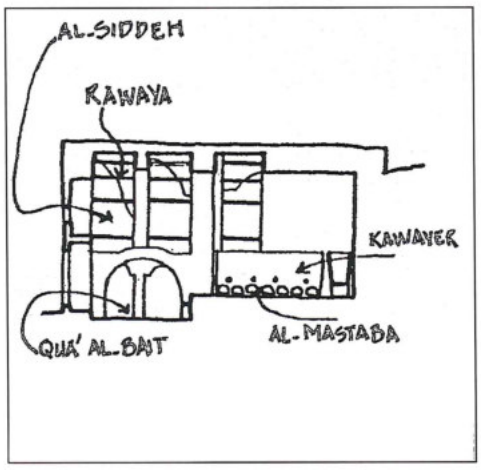



12.

Openings were distributed on all facades, with a higher proportion to the solid wall than before. Gateways were emphasised through recessed planes. Windows, usually paired with pointed or semi-circular arches, were treated in a flush manner. Some corbels were also used in this period.

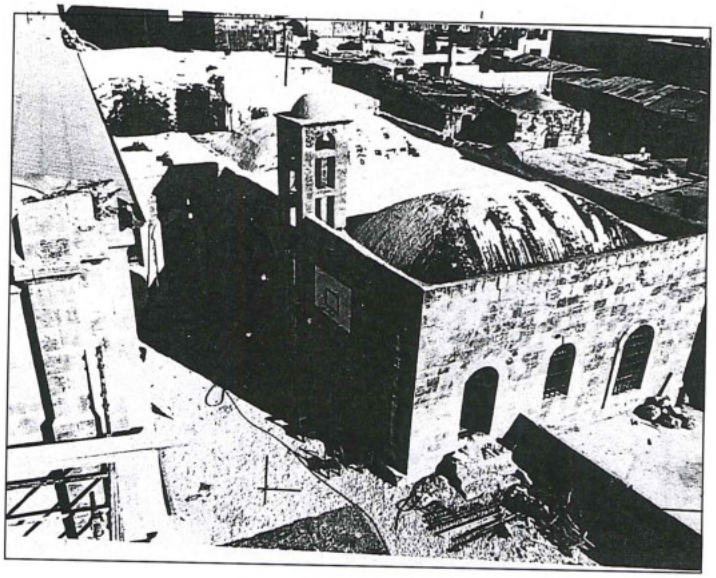
Unlike the previous period, a building's interior was divided into a number of rooms, each with a defined function; kitchen, bedroom, sitting room. The number of hours spent indoors by the inhabitants increased. Farming was no longer the major occupation; some worked as traders, others as public employees.

***The Boom Years (1890-1918)***

In the 1890s, commercial activities with Palestine, especially Nāblus, along with contacts from the West, brought additional prosperity, culture and craftsmanship within a very short period of time. This enhanced the uniqueness and importance of the city, and created a distinguished style originating from regional heritage and influenced by European and Near Eastern styles and techniques.

Growth was very rapid, and the development became more complex in character. Imported materials such as roof tiles, timber, I-beams and marble were introduced. Buildings, still compact and urban, rose up to three and four-storeys high. Each was subdivided into several cubical units terraced one over the other (FIG. 14).

More elaborate urban houses and public buildings (institutional, commercial and religious) started to be built; these formed prominent landmarks.



13.

Walls continued to be built from coursed "Salṭ stone". Although pitched roofs were introduced using timber trusses, the majority of buildings still used crossvaults and shallow domed roofs.

Highly decorative gateways, window surrounds and carved details were common. Steel I-beams started to be used for projecting balconies. Some prosperous families and establishments could afford more flamboyant buildings using imported roof tiles, colourfully designed ceilings, interlacing glass formations and ingrained marble.

*Post War Era (1918-1935)*

After the fall of the Ottoman Empire at the end of the First World War, as-Salṭ was temporary capital for the young newly established Emirate of Transjordan for a few months, after which, the capital was moved to 'Ammān. Expansion began to slow down. Influence became more European but still reflected regional style.

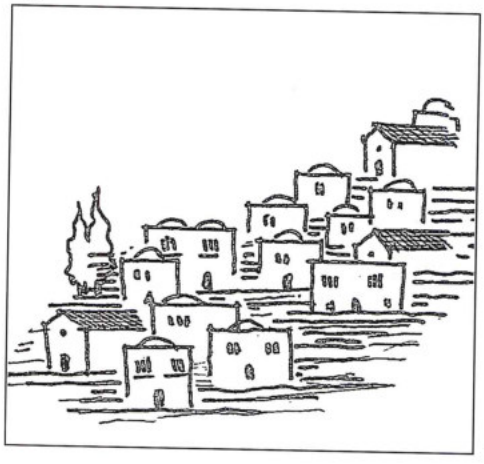
In 1923, the Municipality paved some streets, planted trees and introduced street lights. In addition, all houses were given 15 days notice to install latrines.

The major change which affected the architectural style was the introduction of I-beams and concrete slabs for floors and flat roofs; I-beams were spaced every 60 cm with a 12 cm concrete slab on top (FIG. 15). This became standard after the 1927 earthquake which resulted in the collapse of 1000 rooms. Buildings became vertical three storey structures with no stepwise pattern (FIG. 16).

Details were generally simpler. Decorative gateways continued to be used. New window shapes such as keyhole and segmental arches were introduced. Window surrounds were simpler and more European in character. Corbelling was no longer used and the ashlar became smoother with no emphasis on stone or joints.

*Modern Influence (1935-1950)*

Towards the end of the 1930s, the growth became slower and as-Salṭ gradually lost its vitality to 'Ammān. The traditional style started to give way to International Modern style.



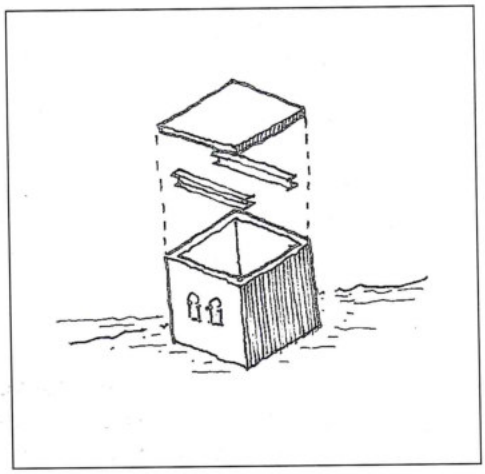
14.

Buildings were built in modern cubical form, using straight lines; they became less urban in character and took on a villa type. Roofs were built of reinforced concrete slabs and beams, and walls were reduced in thickness and made of concrete with smooth "Salṭ stone" facing (FIG. 17).

High quality of masonry such as refined details based on recessed planes and rectangular architraves were common. Reinforced concrete lintels allowed wider rectangular openings with flat arches for windows and shop fronts. Frames outlined both doors and windows.

*From the 1950s Onwards*

From the 1950s onwards, the city's importance began to decline. With the loss of much of its human and financial power, many buildings were abandoned, irreplaceable structures were pulled down, and many 'Ammān-like buildings were built of white stone using reinforced concrete frames, causing visual disharmony and bisecting the traditional image (FIG. 18). Wide streets were opened and out-of-proportion masses were added, all of which were composed of rather diverse elements in contrast with the urban nature.



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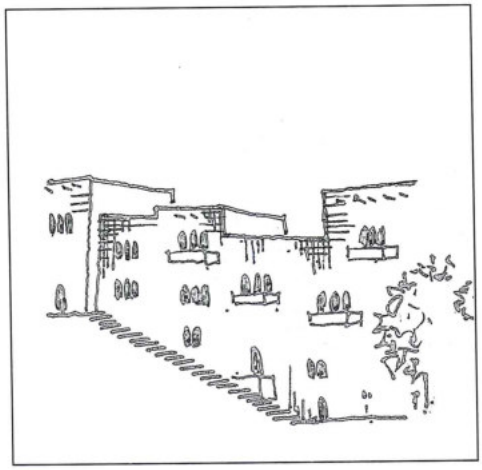


16.

**Typology** (FIG. 19)

During the various periods of development, several types of plans were used. These were not directly associated with the period they were built in. Nevertheless, the numerous plan forms used can be sorted under main headings, drawing on the distribution of spaces in the buildings and the access to them.

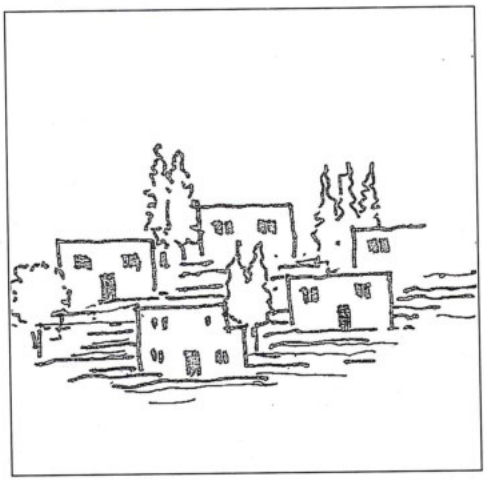
The earliest house type was the "peasant" house, after which urban houses came to be built in various forms; these include the courtyard, foyer and three-bay types.

Due to the topographic nature of the area, many caves existed; additions were made to some of them to form another type.

Access to buildings was either through a stairway (public or private), or through an alleyway; both led to a closed or semiclosed space.

During the various periods, institutional buildings were also built (i.e. mosques, churches, schools, shops as well as a hospital).

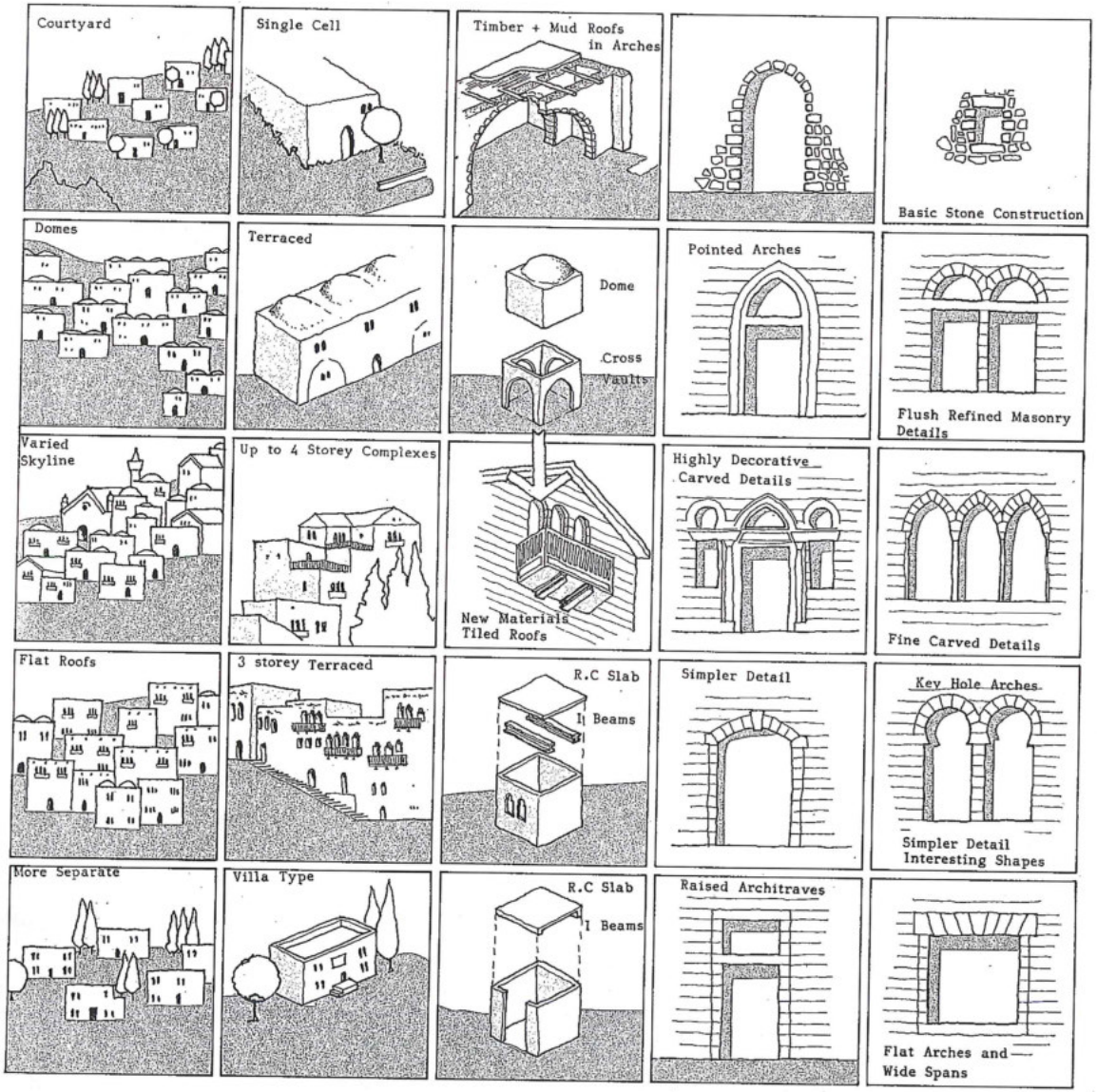
As-Salṭ is still with us in the here and now. It continues to develop and expand, at a relatively rapid rate with new transformation occurring every day due to development pressure, causing incontrovertible damage to



17.



18.




PRE 1866 LOCAL STYLE AND MATERIALS.

1866–1890 REGIONAL STYLE AND LOCAL MATERIALS.

1890–1918 MIDDLE EASTERN + EUROPEAN INFLUENCES, IMPORTED MATERIALS.

1918–1935 MIDDLE EASTERN + EUROPEAN INFLUENCES, NEW STRUCTURAL TECHNIQUES.

1935–1950 INTERNATIONAL "MODERN" STYLE INFLUENCE.

the traditional image created by the bustle of the *sūq*, the silhouette of the terraced masses against the sky and all the richness one can never cease to extol.

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# Ṭayyiba "A Thriving Village"*

## Introduction

The aim of this paper is to study a fading vernacular heritage as represented at Ṭayyiba, a village in the southern part of Jordan, located within the moderate mountainous climate region of Jordan. This village offered a potential for a thorough study for what it represents of an intact example of village, that still contains some vestige of life.

Although a thorough historical study is not available, it is interesting to note the phases of development in the architecture and the planning of the village that relates it to the development of other villages of Jordan, and can provide a prototype for village study, specifically of the mountainous regions.

The study focuses on the house village prototype and its evolvement. It also tries to put into context the different elements of a village: its pathways, fields, water sources, houses and mosque, and other public facilities. The study also tackles the existing status and conditions of the village and its inhabitants, in order to provide some future prospects of this village and to outline some of the lessons inherent in this heritage, in order to project some strategies and policies for their continuous existence and growth.

## 1.1 Location

Ṭayyiba lies within the governorate of Ma'ān, Wādī Mūsā region, which is to the west of the city of Ma'ān along the Sharāh mountain range (FIG. 1). It is located about 9km to the south of the town of Wādī Mūsā, at an altitude of 1350m above sea level (FIG. 2).

The old agricultural settlement of Ṭayyiba occupies more than 40 dunums of land, overlooking from the west the Petra mountain ranges. The main approach to the old village is along the main road from Petra to Rājif, and al-'Aqaba, which separates it from the new village of Ṭayyiba.

## 1.2 Ṭayyiba Today

Ṭayyiba today is a village of 2865[1] inhabitants, 40% of its population work in farming, the rest work in different sectors, such as the army, or at companies in al-'Aqaba or Ma'ān. 5% only work in commerce. The people of Ṭayyiba rely mainly on rain water for agricultural purposes and on spring water to a lesser extent.

The new village of Ṭayyiba has prospered on the account of the old village, which stands there almost deserted or turned into storage barns nearer to the fields. The old village of Ṭayyiba is subjected to continuous deterioration due to many factors.

*1- Human Factors*

An identity problem related to the new westernized standards of living that affected all underdeveloped countries, where mud and stone village houses were classified as backward, arose. The migration of people to large cities and commuting with other developed parts of the country accentuated this attitude. Old villages became unsuitable for the new modes of life.

Problems related to upgrading the infra structure, car roads, electricity and building technologies, led the inhabitants to leave their old houses for new concrete units. New planning policies and housing projects encouraged the need to build at new sites adjacent to the old village.

*2- Natural Factors*

Age and time are the prime elements accelerating the deterioration of the building stock. Mud roof houses can be very efficient, but need continuous maintenance. Cement as a material is not homogeneous with the basic mud constituent of the roofs. This could lead to different material attitudes and new cracks developing. The deterioration of the roof and its collapse could lead to further deterioration problems of the walls.

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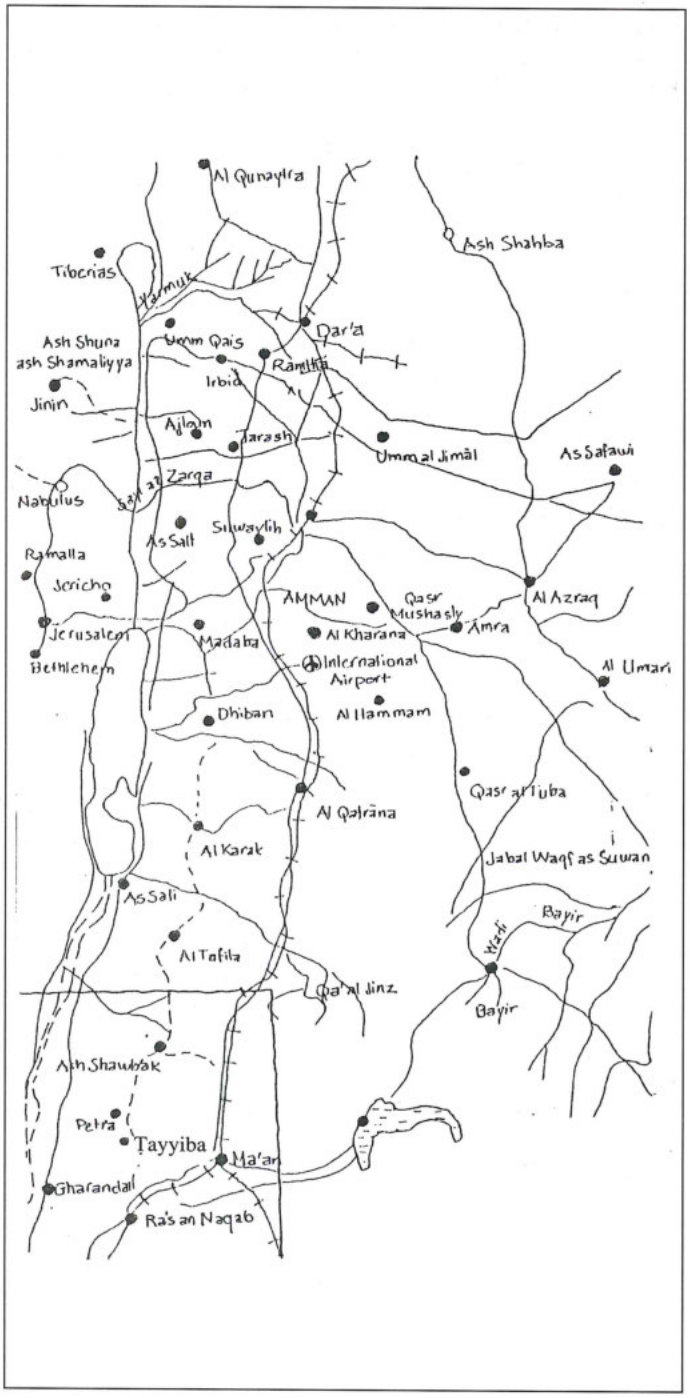
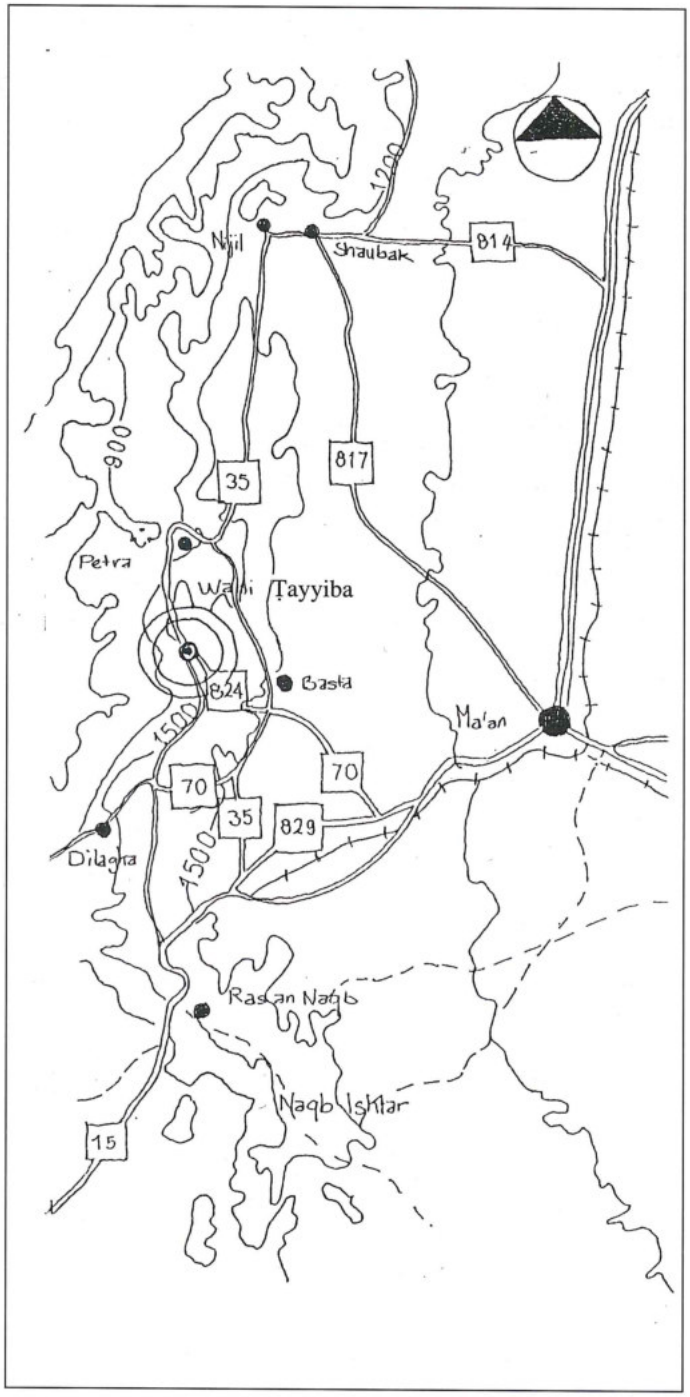
* Field investigation and drawings were carried out and compiled by the Ṭayyiba Architectural Design Team at Ruqn Al Handasa. Project Manager: Architect Rukni F. Sweiss; Team Leader: Architect Leen Fakhoury; Architect Akram Omeish, Architect Rima Masri, Architect Ruba Fakhoury, Architect Mayada Za'roor. Drawings for this report were prepared by Architect Rima Masri.

[1] Department of Statistics, *Statistical Yearbook 1989,* Department of Statistics Press, Amman, 1989.




1. Location of Ṭayyiba in Jordan.




2. The southern region of Jordan.

## 1.3 The History

The region of Wādī Mūsā witnessed the prosperity of several civilisations throughout the ages, since the basic needs for stability and prosperity were available: water sources, fertile land and a strategic location in relation to trading with surrounding areas.

"Aṭ-Ṭūr", the caves, provided basic shelter for many settlers at Ṭayyiba. Not enough information about the particular history of Ṭayyiba has been researched or recorded. Further historical and archaeological investigation could discover that its history is most probably welded within the folds of the early history of man; as is known of the history of the surrounding areas.

The clans in Wādī Mūsā were named after Banī Layth "Layāthna", and lived in the village of al-Jaī which is located at the centre of the existing village of Wādī Mūsā.

The nucleus to the "Layāthna" tribe was originally formed of al-'Ubaydiyya, Banī 'Aṭa, al-'Alāya and al-Shrūr, who lived as bedouins all around the valley and united for self existence against the other bedouins, living in the mountains.

Al-Layāthna lived in simple stone houses during winter, and during summer their houses became stores and barns for their food supplies. Their livelihood was based on agriculture and some trading with the West Bank of the Jordan River as well as the pilgrims on their way to Makka.

Security and stability helped the settlements of the Layāthna to prosper although plague attacked the area between 1840-1870 and the locust attacked their villages between 1920-1925. All through the dry seasons the Layāthna left al-Jaī and settled in the surrounding mountains.[2]

With the return of stability and the establishment of Transjordan, life returned to al-Jaī. Land was distributed amongst the four clans. And with the increase in the number of population, several clans started to leave the centre "al-Jaī" and resettled at the surrounding mountain slopes.

Al-Rawaḍiya, al-Khlayfāt as well as al-Sa'adāt who are part of al-Shrūr clan of al-Jaī came to Ṭayyiba some 120 years ago. They built part of the old stone village as storage barns which were used afterwards for lodging in winter time. Its land was first used for raising their cattle and agriculture, but afterwards they settled there completely. They first occupied the flat areas of the site, "which had some ruins that could date back in its occupation to the history of the Nabataeans and Romans."[3]

## 2 . ARCHITECTURAL ANALYSIS

Ṭayyiba represents a threatened vernacular pattern of villages, in the southern part of Jordan, at the turn of the century. Its traditional features represent a typical pattern of architecture,[4] distinct in its indigenous simplicity, impulsiveness, and in harmony with its local environment; be it the climatic factor, simple engineering methods, economical factor or social order.

The simple forms of stone houses, the random stone and thick mud walls are still standing there, as a continuous evidence of a genuine builder closely related to the land form, to man's basic need for shelter and to the lifestyle of a farmer. Yet all of the previous solutions have reached a high level of development in providing efficient environmental solutions, while still maintaining their simplicity and authenticity.

### 2.1 Site Features

Many water springs are located within the vicinity of the village and fields, in addition to a small creek bordering its planted olive and fig terraces. 'Ayn Ghazāl, 'Ayn Ḥamma, 'Ayn Ṭayyiba and Krayb provide available water sources for the village.

Several natural caves and openings, scattered in the surrounding mountain slopes, provided primitive shelters for the first settlers. The village site was probably chosen to overlook the fields in order to maintain security and accessibility to the field crops and the villagers.

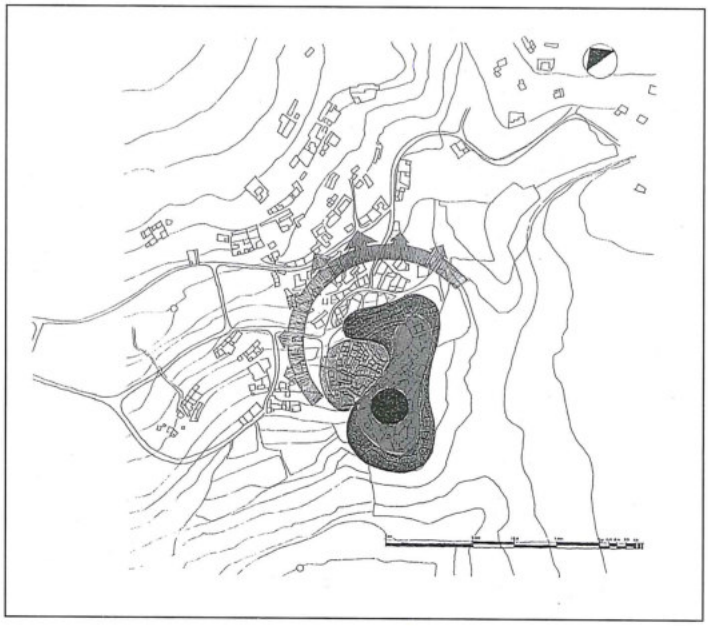
### 2.2 Planning of the Village

The village planning resembles that of many small villages spread on the mountains of the rural lands of Jordan. The nucleus of the village started nearer to the fields, and later on spread about with the growth of the village. The new village developed along the main road from Petra to Rājif and al-'Aqaba, to the north and west, to natural limitations and locations of the planted fields (FIG. 3).

An intricate and meandering network of pathways reflects the organic nature of the village. The interwoven pattern and tissue of the village houses and public buildings provide an indigenous example of a vernacular knowledge transferred through the ages.

The organic tissue of the clustered units, forms small alleys opening on to several major and other minor open areas, sāḥāt and nodes (FIGS. 4, 5).

A mosque is situated on the one end of the village, while a group of converted commercial units developed on the northern approach of the site at a later stage and

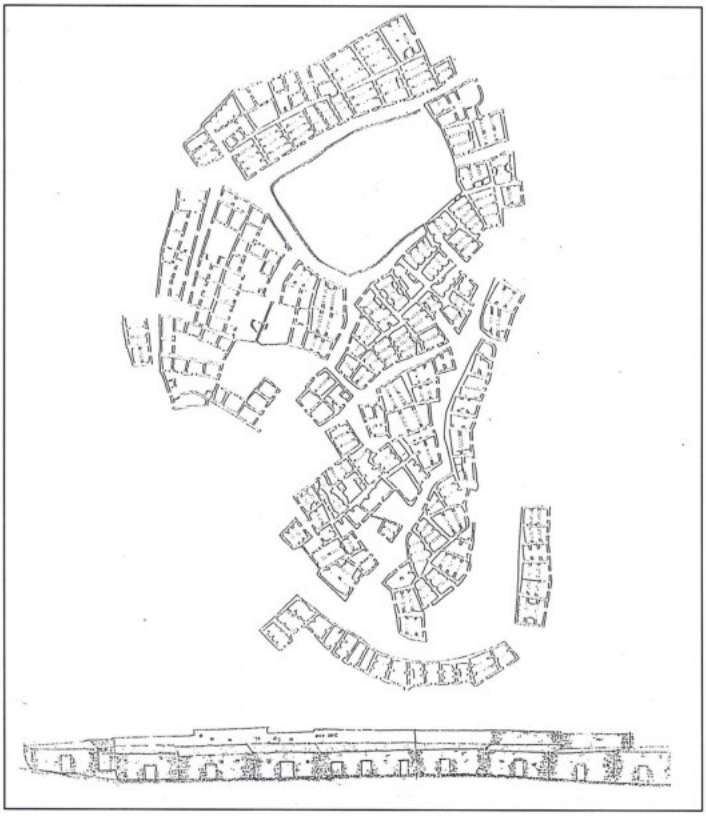


3. The old village of Ṭayyiba: stages of development and growth patterns.

[2] Department of Architecture/University of Jordan; urban design studio, *Wadi Musa; Demographic and Historic Study,* unpublished report 1991.

[3] Mayor of Ṭayyiba, field investigation, 1991.

[4] Taleb Rifaii, Ruba Kana'an and Muhammed Yaghan, *Iraq Al-Ameer, Bardon; Architectural Features of Jordanian Villages,* Jordan University Publications, Amman, 1988.



4. Existing plan of Ṭayyiba village.

with the prosperity of the village (FIG. 6).

*2.2.1 Existing Road and Pathway Network*

The main approach to the site is from the north and the west along the main road from Petra and Wādī Mūsā, where the new village Ṭayyiba has spread.

A network of major and secondary pathways organize and link the different areas of the old village (FIG. 7).

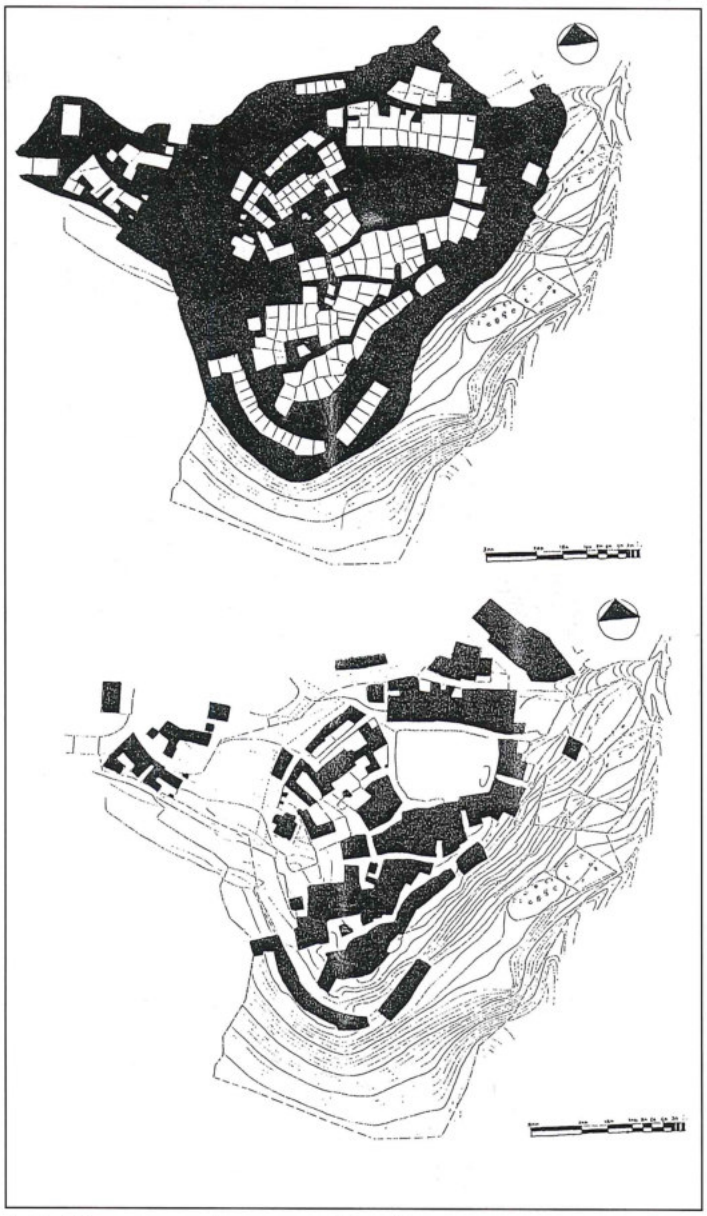
Major pathways are usually linking pathways going along the contour lines. Secondary pathways link the major pathways together. A third hierarchy is the dead ends which branch off major pathways to provide accessibility to other land plots.

*2.2.2. The Villager's House*

The old village is basically an agricultural village, its houses were built to protect and overlook the fields as well as to provide shelter and storage facilities for their inhabitants, human or cattle, and their crops.

Typical farm houses along the main pathways and courts were built of one unit, as in a one clear space or of a one space formed by a repetitive modulation of arched walls (FIG. 8).

The rhythm of everyday life patterns associated with the farmers' role is fully reflected in his household. A typical farmer's house should accommodate his family, his animals, their food stock, his farming equipment and



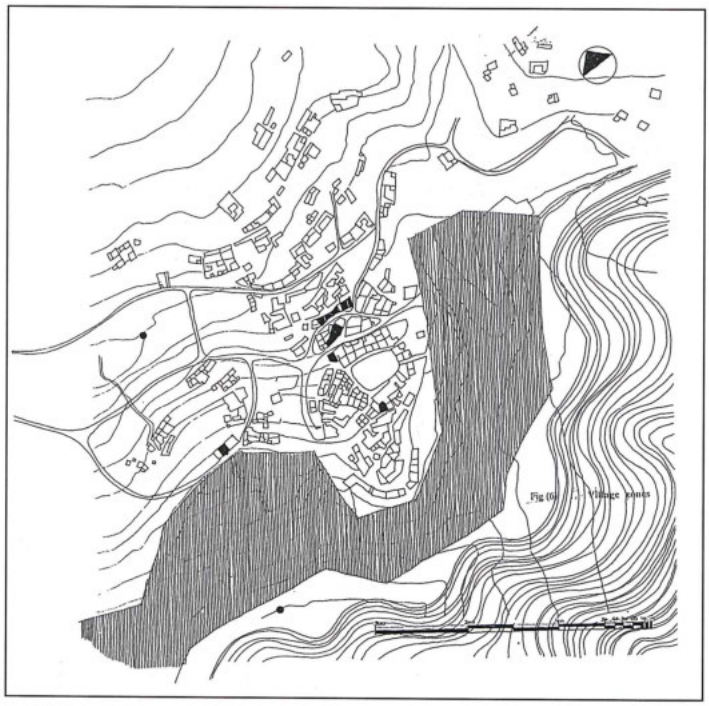
5. Positive and negative spaces of the village.

food storage space.

The rhythm of the day and night cycle is associated with outdoor and indoor facilities. During day, the farmers are in the fields. Cooking and other household activities are usually practiced in open air. At night the animals are brought inside. The farmer and his family usually sleep indoors.

The cycle of summer and winter is also reflected in the use of space. The house provides shelter for the farmer's family and his cattle during winter, while in summer they can sleep outside and roam around the fields and even move to Wādī Mūsā (FIG. 9).

Specific terminologies are related to the use of space such as *ar-rāwiya*, designated to describe food storage units along two arched walls used for storing hay for an-



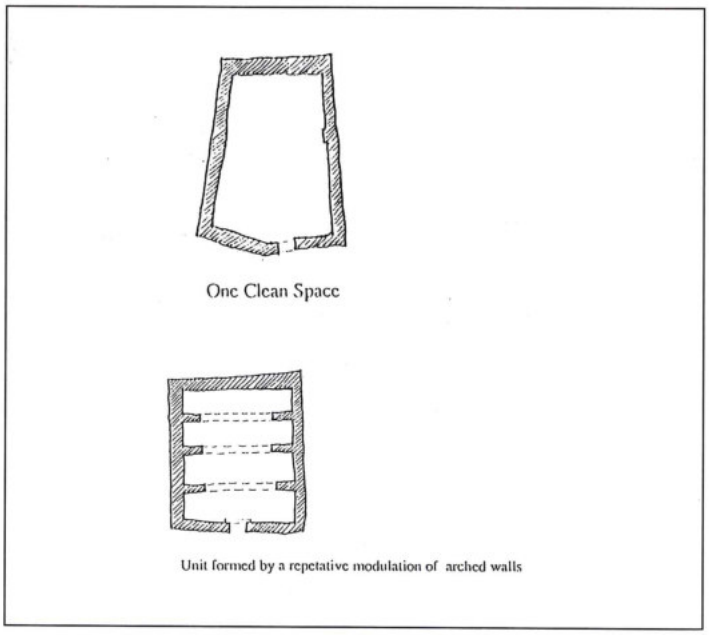
6. Village zones.




7. Network of the village.

imals. Other independent units, *al-kawāyir,* were modelled of mud and hay in the form of barrels, used for storing cereals for the household.

A villager's house is a multipurpose space used by the farmer, his family and his cattle. The front layers are usually designated for the cattle, while the rest is for different household activities and sometimes raised on a *masṭaba.*




8. Spatial organisation/basic unit.

The simple module of a villager's house evolved according to new needs, to the rise of the economic status and the rise of the level of technology related to the building activity.

New patterns evolved, the two bay house, which is an illustration of the need for more space, two arched walls were planned, and in other cases additions to existing rooms were planned for further extension (FIG. 10).

With more prosperity, the courtyard (*ḥawsh*) house evolved; which is a later development related to settling and trading with surrounding villages and towns where the roots of urbanism had evolved. The *ḥawsh* or the terrace became the transitional space away from the public pathway.

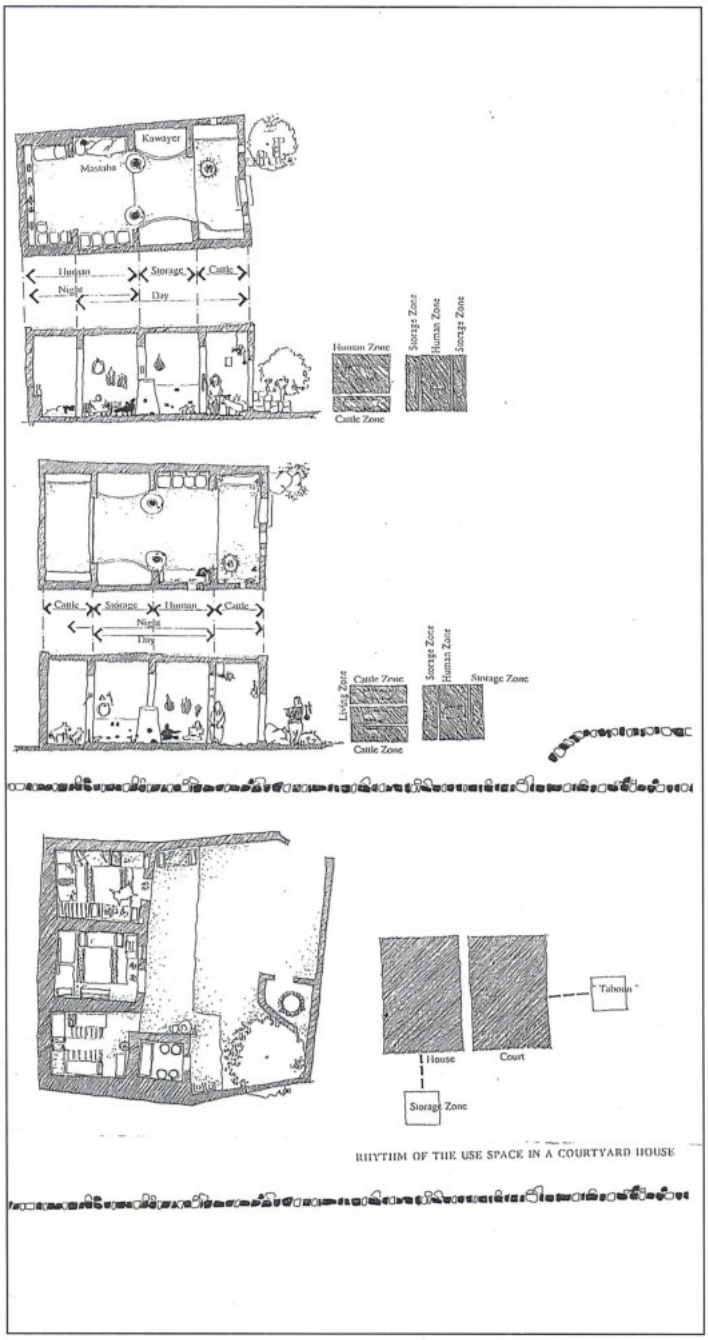
The three bay house is another expression, where rooms are aligned along both sides of a longitudinal centralised outdoor space (FIG. 10).

The arcade house is a special feature of the grand house where a semi covered transitional space (arcade) is designed to connect the different rooms opening on the *ḥawsh.*

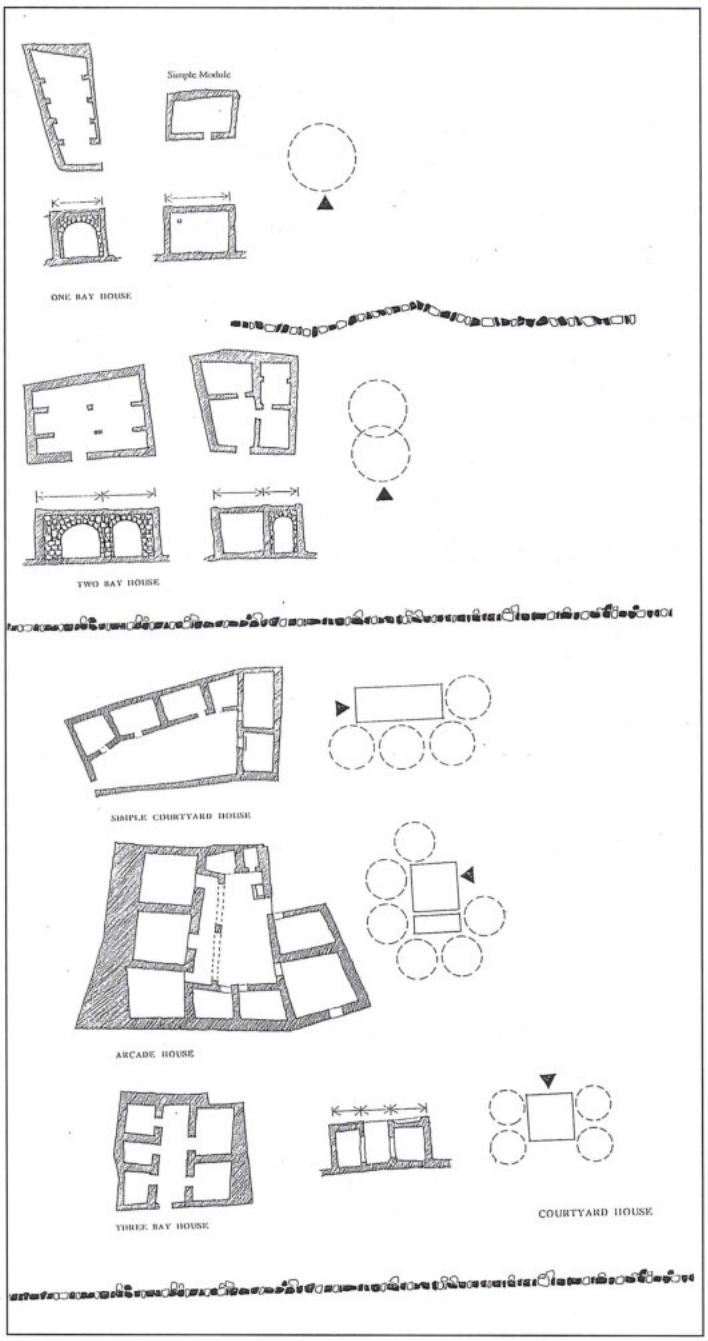
*2.2.3 Cluster Organization*

A cluster of houses was a direct response to land formation and its limitations, as well as to social patterns and modes of privacy, interwoven within an economical system based on agriculture, availability of construction materials and traditional technologies, and the environmental factors reflected in the climatic considerations.

Clusters of houses were terraced along paths, flanking either one or both sides, or surrounding outdoor communal courts (FIGS. 11, 12).




9. Rhythm of the use of space, the simple module.




10. Evolution of new models.

Different inside-outside relationships were developed, either based on a direct relationship between a unit and the public pathway or through a transitional space, be it a courtyard or combined with a semi covered transitional space (FIG. 13).

*2.2.4 Dealing with the Topography*

Appropriate terracing of the slopped terrain was adopted to encounter difficult slopes. Terracing was used for both agricultural and building purposes, using loose stones and small boulders to create series of low wall profiles.

Flat terrain was developed at earlier stages creating outdoor communal courts and yards to provide for the houses. The pattern and form of the village units reflect the contour levels.

**2.3 Structural Analysis**

Local materials were directly used for building purpose, the villager has used such simple technologies since early times (FIG. 14). Rubble stone, undressed stones col-

lected form the surrounding mountain slopes were the main structural element of the walls. Together with mud, the bonding agent, thick walls of 60-100cm were constructed to support flat roofs.

Roofs were constructed in layers; a mattress of bamboo or tree branches on top of 'ar'ar (*Juniperus Phoenicia*) treated logs were laid as a framework to support the multi layered mud tampered roof, constituent of basically mud, hay and water and some additives such as animals hairs and ash. Large stones were sometimes used on top of the main log to provide support for the mud roof.

The roof was well tampered and rolled by a special stone roller after which it becomes water resilient and its surface becomes smooth. Continuous maintenance and good water drainage is necessary for such type of roof.

With the prosperity of the villagers, bigger rooms were needed and arched walls were necessary to support larger spans and bigger room spaces (FIG. 14). The rhythm of the spaces were thus following a structural rhythm based on the length of the wooden logs found and their capabilities for supporting roof loads.

With the rise for the need for larger spaces, two bayed arched walls were used for providing for larger houses (FIG. 10).

With the introduction of iron steel railway tracks and cement after World War II to the construction field, new materials were used by the villagers. Such development has spread widely in the construction field whether in the countryside or the major cities of Jordan, as well as Bilād ash-Shām. Ṭayyiba, an example of continuous development, responded to the new materials (cement, I-sections) while still maintaining its traditional character (FIG. 15).

Due to different ideological, political and economical issues, eventually the villagers abandoned their old traditional houses for new concrete units. The traditional buildings still stand almost deserted as a witness of old achievements.

## 2.4 Architectural Character

A functional discipline was used for the treatment of the facade. The logistics of the environment and the potential aggressiveness of an invader resulted in an almost dry character of a small unit with one major opening (FIG. 16). The village looks like a continuous bead wall of small heights.

A typical facade of one household comprised a door opening and some small openings for ventilation. At a later stage and with the introduction of the courtyard house, more openings were used on the internal facades (FIG. 17).

Some vines, lemon, olive, fig and other fruit trees were planted in the yards and gardens of the village.

### *2.4.1 Visual Analysis*

The village clusters form introverted environments, where some of the paths open suddenly to grand natural views of surrounding mountains, or major *sāḥāt* and other minor nodes. The paths usually follow the contours encompassing terraced clusters of houses, where a path opens on one side to the house clusters and on the other side on to the harsh mountain slopes.

### *2.4.2 Architectural Details*

A wooden 'ar'ar lintel was usually used over windows and doors (FIG. 18) and sometimes large stone lintels were used. 'Ar'ar was the main timber used for door openings, while metal doors were a later addition (FIG. 18).

Arched walls were built of stone of up to 80cm thickness and more (FIG. 4). Metal sheet water spouts were used to discharge the rain water drainage of the flat mud roofs.

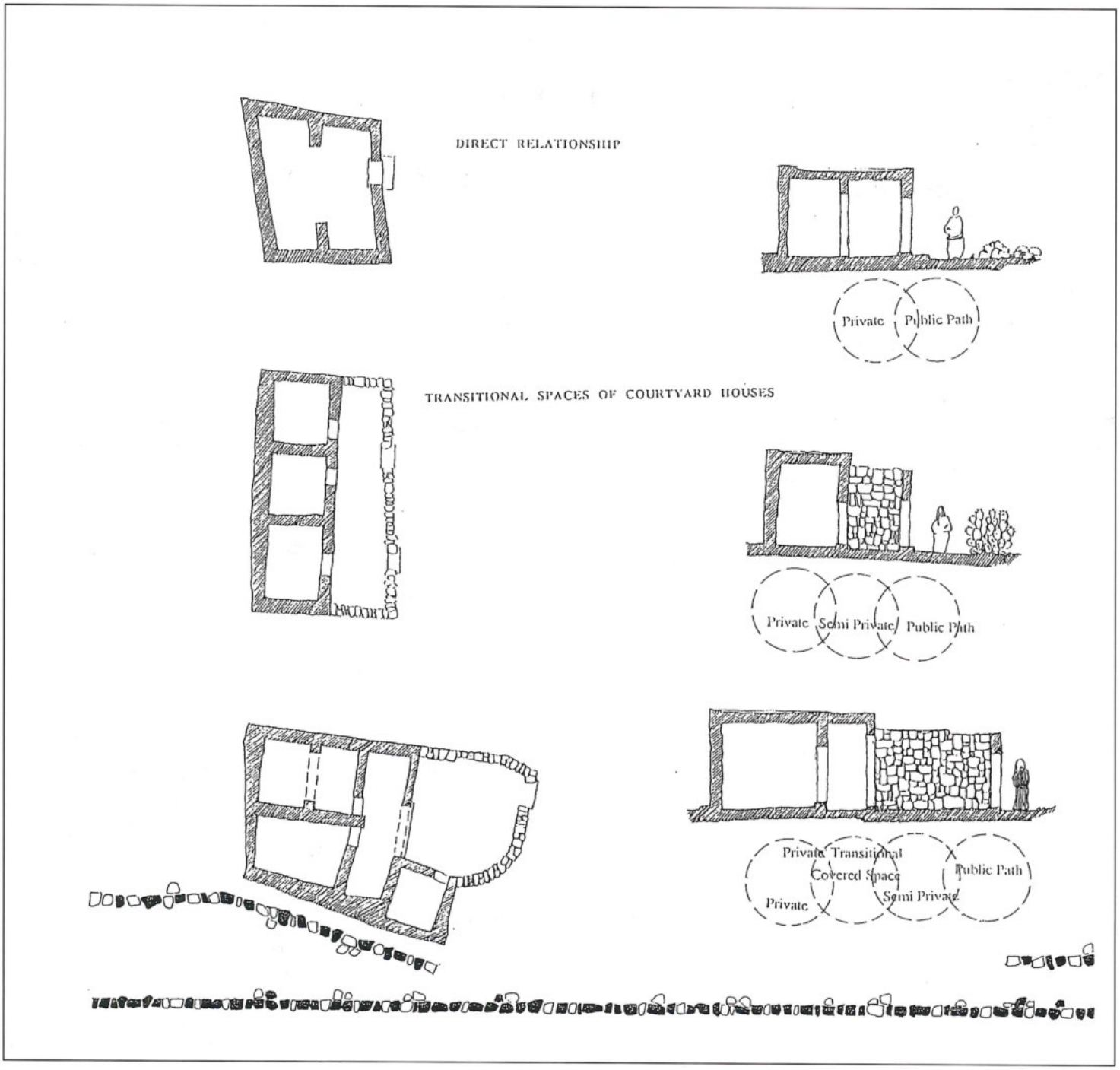
*Finishes:* Floor finishes were of well compacted earth sprayed with water. Internal walls were sometimes plastered with mud, ash and hay plastering to soften the internal effect of the random stone walls.

## Conclusion

The problem that is being faced here is not just the issue of a discarded architectural heritage, but also of a lost identity of the rural lands and its inhabitants.

Proper investigation of the rural settlement and the local architecture of Jordan, be it of the mountains, the plains, the Jordan Valley or the desert should be conducted as an exercise of documentation for cultural and historic continuity. The deserted state of such old villages necessitate general guidelines and policies to be adopted by the different planning levels dealing with the following issues:

- The existing development policies aiming at social development neglect the existing craftsmanship related to traditional building technology, its economical feasibility, availability of local building materials and the environmental values related to that level of passive traditional technology.
- Women's role in building and maintenance procedures has been neglected for a long time. New roles can incorporate such outlooks.
- Most of the modern building activity is provided by labourer from outside the village, using reinforced concrete imported technology. If the traditional technologies were adopted and adapted, further job opportunities can be provided for local people.
- The need for the development of available building techniques and maintaining passive design principles, could provide us with better built up environments for



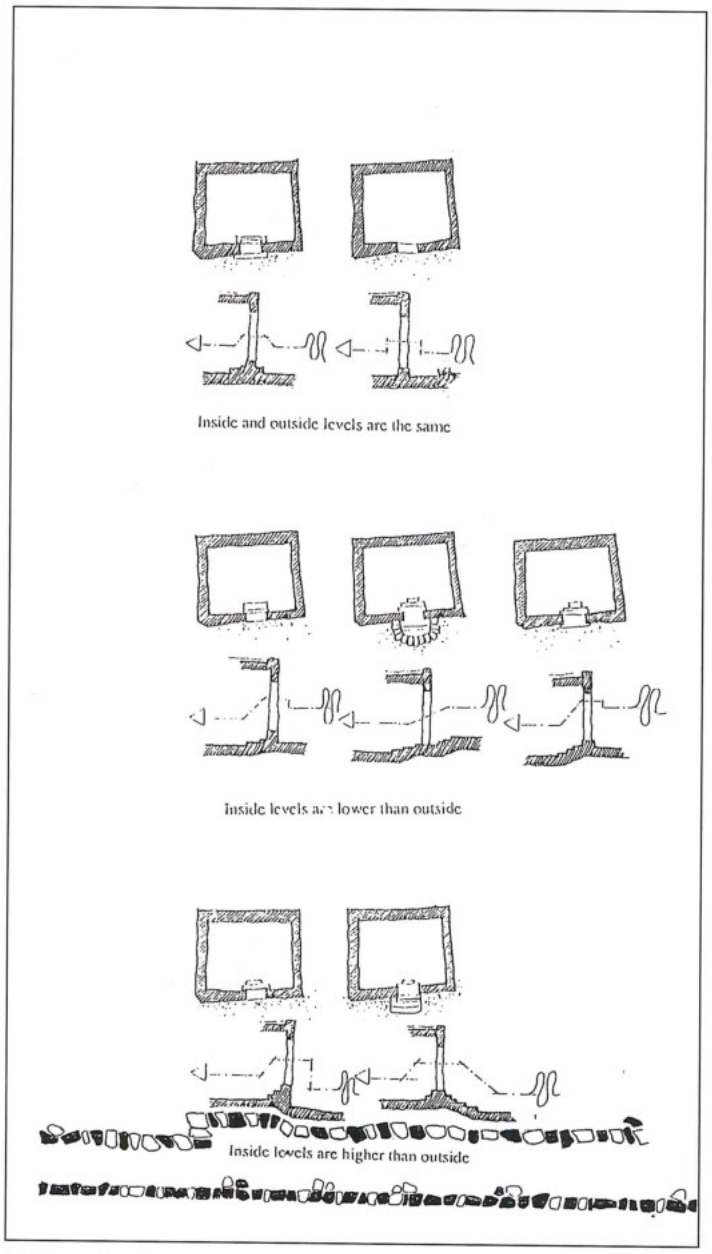

11. Inside/outside relationship.

living — cooler spaces in summer and warmer in winter.

- No rehabilitation scheme is valid without a proper investigation of an economic viability of upgrading the old fabric, taking into consideration the local need for a proper living environment. It is imperative also to provide better job opportunities to maintain the continuity and prosperity of the village life and raise the level of awareness and pride of the villagers in their village and its heritage.

Our aim is to record our heritage and culture for the inherent lessons within, no just for an intellectual exercise of a "Romantic Elite", who think they can still live as was in the past.

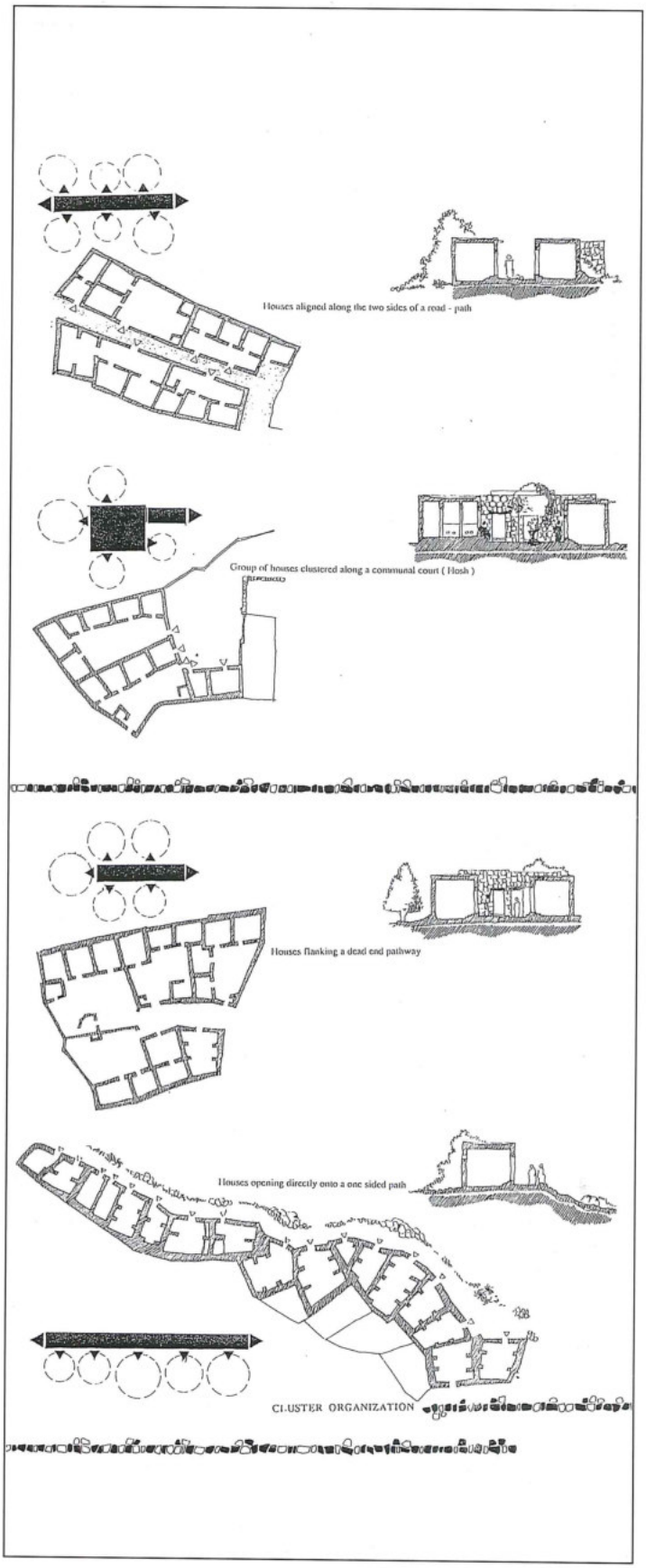
Part of old Ṭayyiba will still be thriving since it has been adopted for a scheme of revitalisation and tourist rehabilitation undertaken by the private sector and the Ṭayyiba villagers. This project comprises a pioneer ex-



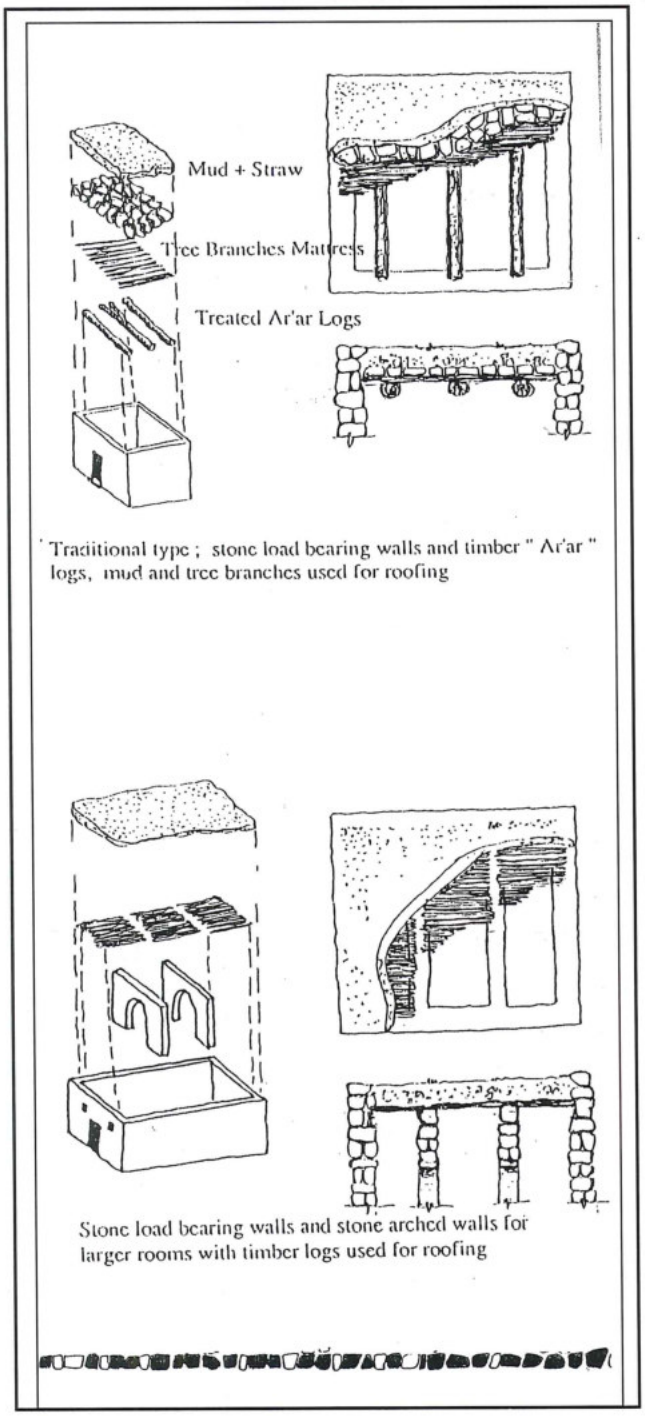

12. Entry levels.

perience in revitalising the old village of Ṭayyiba as a tourist village. Ṭayyiba, an intact example of a Jordanian village near the ancient city of Petra, could create a new attraction point for the south, thus providing further social and economical development.

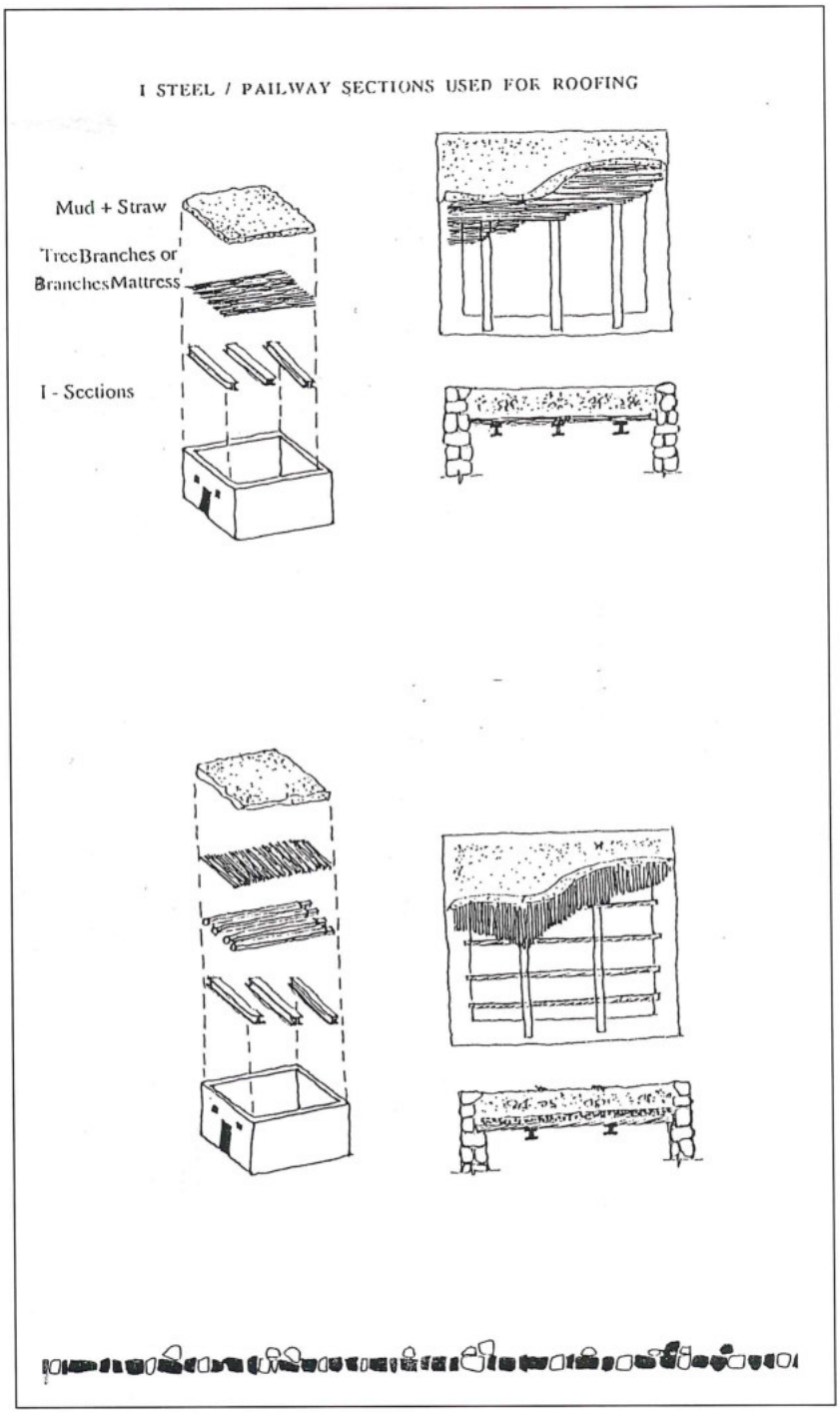
The old villager's houses can still have a future role, but not all our villages are Ṭayyiba.



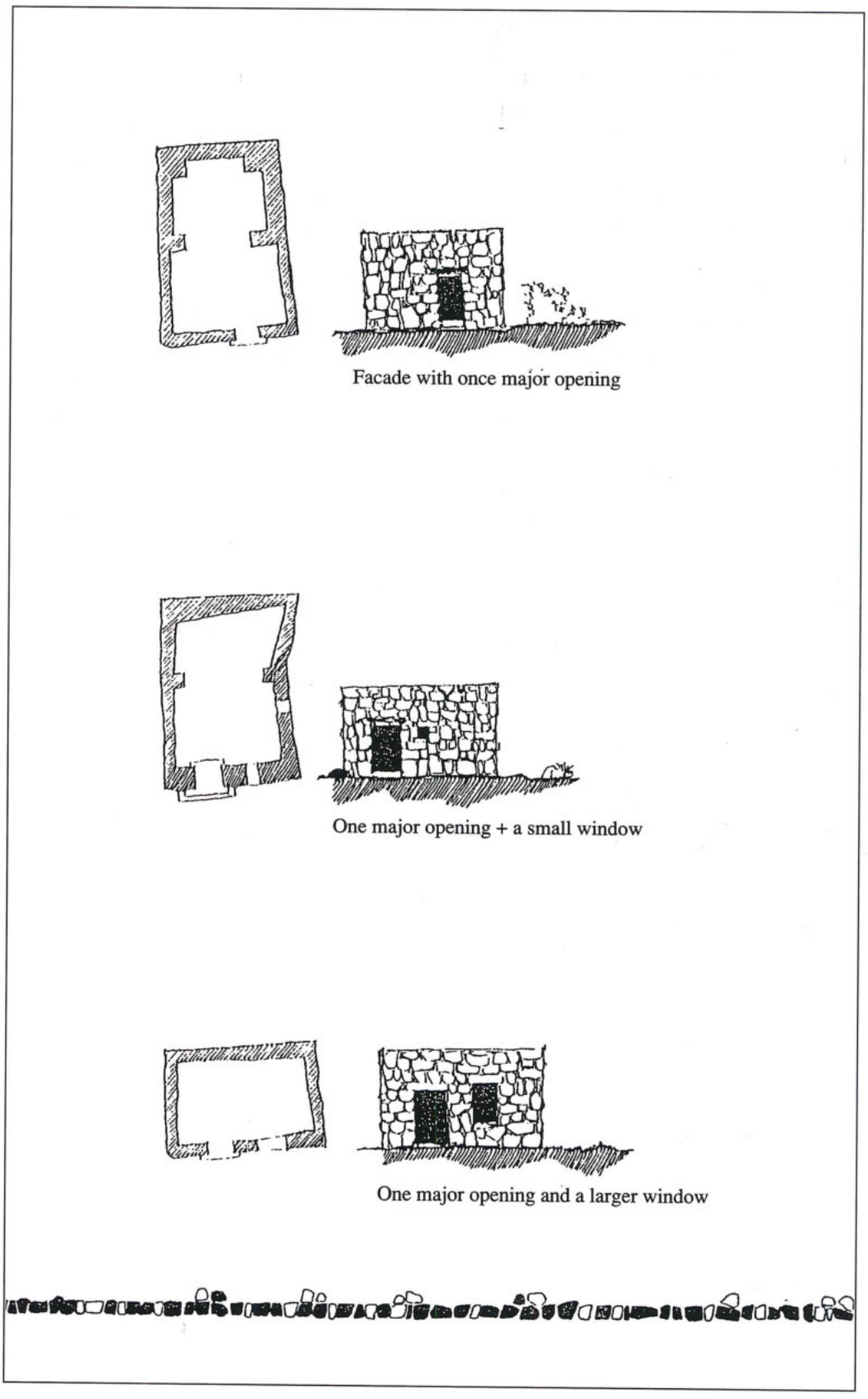

13. Cluster organisation.



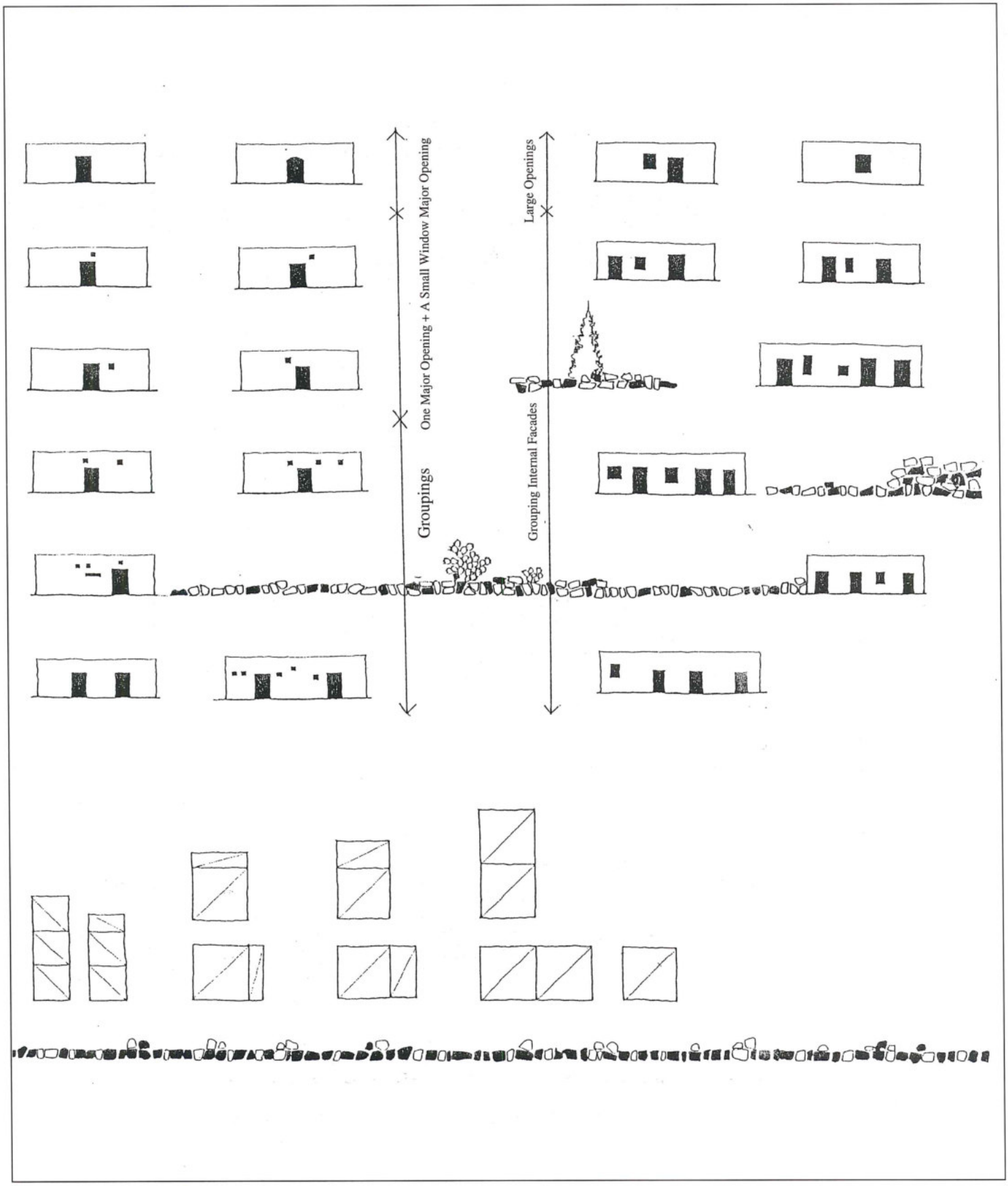

14. Structural analysis.



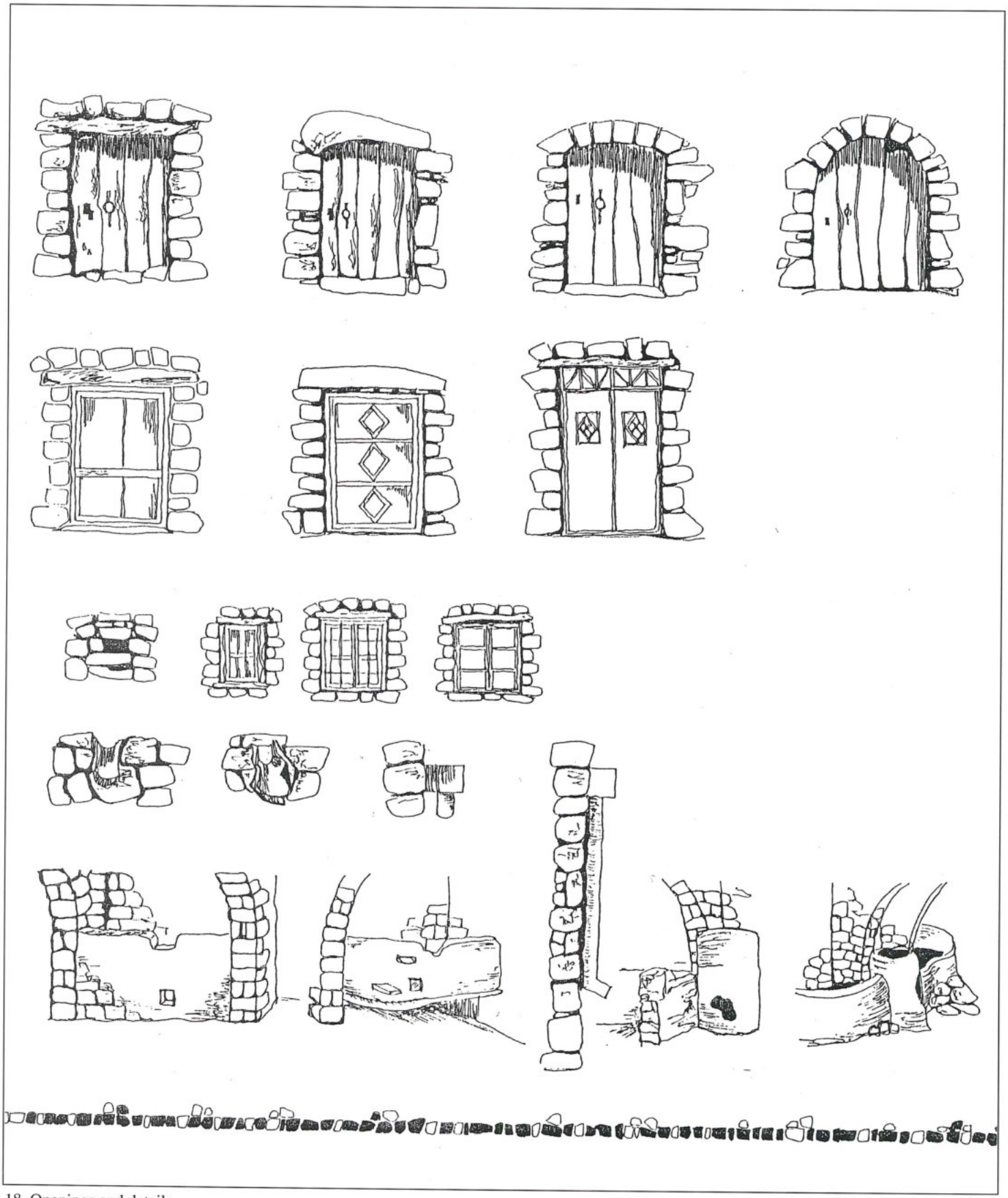

15. Roofing development.




16. Character.




17. Facade: openings.



18. Openings and details.

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# Frescos: From the Decapolis to the Umayyad Palaces

Frescos are found at many Jordanian sites from the Roman period. The art of frescos, among other forms of art, flourished during the first century AD when the Roman Empire spread its control over the Arab East — due to the fact that the Roman state was the superpower as pertaining to its economic and military capabilities, and the spread of the empire over the continents of Europe, Asia and Africa (Bienkowski 1991: 22). It is worth noting that the Roman Empire was the sole heir to the Hellenistic state with its prolific workshops and creative abilities in the sciences and arts in all the countries it controlled (Wheeler 1964: 191). Therefore we notice that all the nations that came under Roman control were mature nations in their culture, industry and sciences and we find that most of the abilities on the Hellenistic arena started working within the Roman framework in a short period of time (Ainalov 1961: 185). Without doubt, arts depict a distinct aspect of human behaviour as it is a sublime method of portraying creative abilities in culture and the sciences in general, and in religious traditions in particular.

The nature of the Roman and Hellenic culture and sciences undoubtedly converge in many aspects despite the variance of the Greek and Latin languages. They represent a common orientation dependent on the European culture. As for the religious framework, mythology has shown that the religious roots prevalent during the Hellenistic period had matured in a clear and fine manner during the Roman period, therefore we may assert that both states had the same religion despite the variance in some names or cultic practices.

The Roman flow into the Arab East continued to represent the spread of culture, sciences, literature and religions under the supervision of the Roman power and its economic and military capabilities. Here we notice the transmission of culture, arts and sciences through traditions, industry and works of art. In spite of the might of the Roman Empire it could not force Latin on the local nations because of the spread of Greek and the entrenched Greek culture among the people of southern Syria and especially the areas of Jordan and Palestine. One of the most important reasons for this is the proximity of settlements where the inhabitants adopted a common pattern of culture, traditions, industry and sciences — in addition to their dependence on the Greek language which represented the seeds of the Christian religious school, which in turn overthrew the pagan Roman Empire (Weber 1990: 16).

One of the most important indications of the independence of culture, literature and the arts in the area of northern Jordan during Roman domination (especially the first century AD) is the acceptance of the Roman Empire of the civil confederation declared by the inhabitants of the Decapolis. This civil independence was seen on the literally, cultural and economic arenas and was not a military or political independence. For this reason, the Roman Empire did not oppose this confederation and special coins were issued by these cities which kept their trade relations and local culture and traditions (Tell 1982: 30; McKenzie 1990: 114, 115; Vine 1987: 27).

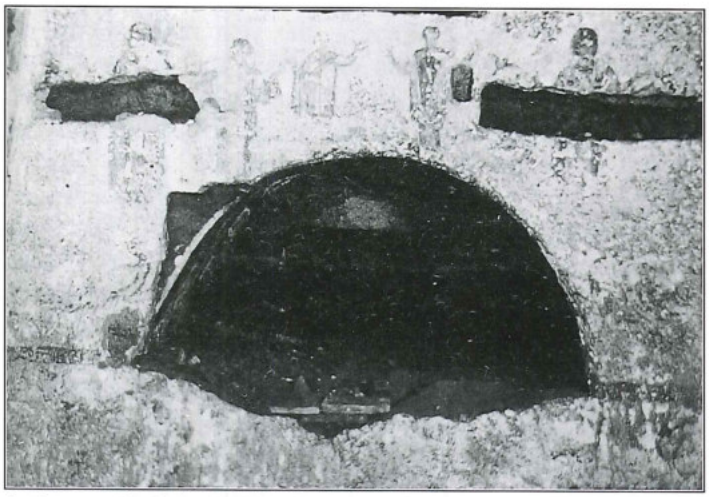
Archaeological excavations at several cities in northern Jordan have discovered important artistic styles which could be studied in order to know the characteristics of the culture and arts prevalent during the Roman period, from 63 BC when the troops of Pompey entered southern Syria until AD 324, the year marking the beginning of the Byzantine era when the emperor Constantine adopted Christianity (Grabar 1963: 15). As the Decapolis represented the most important cultural and civil centres during the Roman period in the Roman Province of Arabia, excavations and archaeological studies were carried out at some of these cities. The cities that joined the confederation are: 1. Gadara - Umm Qays; 2. Abila - Quwayliba; 3. Pella - Ṭabaqat Faḥl; 4. Capitolias - Bayt Rās; 5. Hippos - Fīq; 6. Canatha - Qanawāt; 7. Scythopolis - Baysān; 8. Damas - Damascus; 9. Gerasa - Jarash; 10. Philadelphia - ʻAmmān; 11. Arbella - Irbid; 12. Dion - Aydūn or al-Ḥuṣn; 13. Bostra - Buṣra; 14. Adraa - Darʻa.

These cities are concentrated in the northern area of Jordan (Mare *et al.* 1982: 39). Some of the most im-

portant examples of frescos at these cities are in the group of tombs excavated and studied by l'Institut Français d'Archéologie du Proche-Orient (IFAPO) at Quwayliba (Abila), where a group of rock-cut caves were used as tombs, particularly during the Roman period (first century AD) (Vibert-Guigue and Barbet 1982: FIG. 6, PL. V-X; Barbet and Vibert-Guigue 1994: 317, 318, 320). These tombs represented the common Roman style of cutting the rock with a symmetrical distribution of burials (catacombs) or loculi, in addition to the presence of a stone door for each gate (FIG. 1).

Eighteen caves were discovered on the outskirts of Quwayliba (Abila), most of them decorated with frescos. The interiors of these tombs are decorated with colourful and attractive paintings executed in a superb artistic framework, expressing a highly developed ability in the precise depiction and definition of figures and scenes using true colours and accurate dimensions. These frescos are distributed on the interior walls of the caves in a free style or in an accurate systematic geometrical style. The presence of these frescos inside the caves may have been a common style in the private aristocratic Roman tombs. They reflect a fine practice of creating a magnificent true atmosphere on the interiors of the caves that contained burials of a number of dignitaries. This reflects a fine civilized attitude towards the remains buried in these caves. The themes are varied, some realistic and others imaginary mythological, and this may have been the reality of pagan societies during the first century AD. The most important artistic themes on the facades of these caves are as follows:

1. Representations of people: men, women or children (complete, busts or faces) (FIGS. 2, 3)
2. Representations of mythological figures such as the goddess of victory or wisdom.
3. Representations of symbolic figures (such as the four seasons, sciences and knowledge) (FIG. 4).



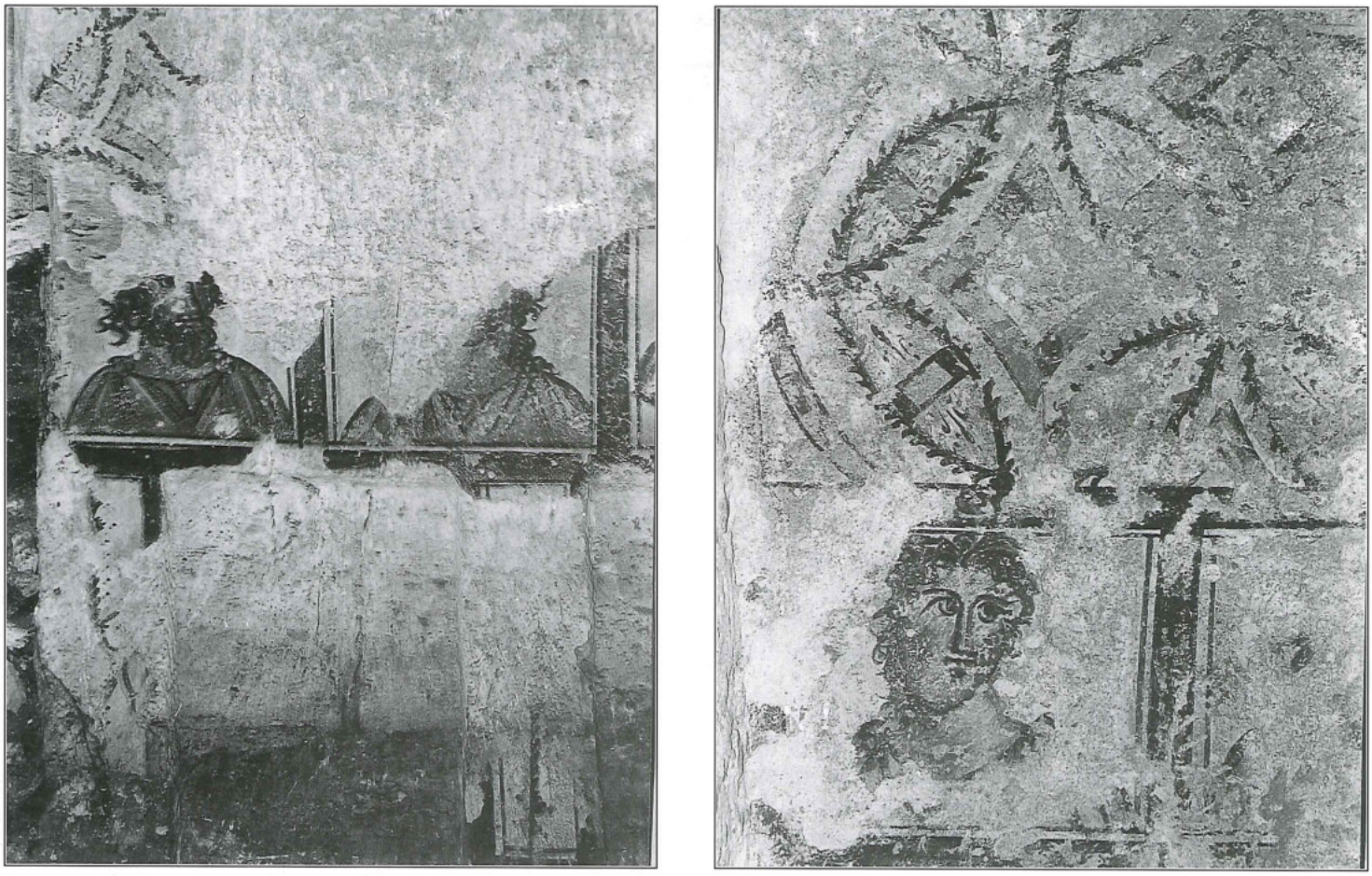
1. Catacomb of St. Callixtus, Rome (AD 200-217): Early Christian fresco on the interior walls of the tomb.

4. Representations of animals or birds, such as tigers, lions, hares, peacocks, eagles, ducks, roosters, pigeons, partridges or fish (FIG. 5).
5. The distribution of scenes within regular geometric grids: octagons, hexagons, circles or rectangles with human faces, fish or wild birds in their centres (FIG. 6).
6. The distribution of scenes within regular geometric grids representing branches, flowers and leaves extending either in a wavy pattern or regularly and in symmetry (FIG. 7).
7. Geometric grids representing a series of swastikas surrounded by faces.
8. Free scenes representing a peacock with an extended tail of coloured feathers, walking among flowers and carrying an ear of corn or a flower in its mouth (FIG. 8).
9. The presence of words in Greek on some specific frescos. They represent the names of the artists or the people buried in the cave.
10. The distribution of scenes among architectural elements such as columns with Corinthian or composite capitals, giving the impression of temples or palace facades.
11. The distribution of figures of ladies in oriental dress, the head covered by a veil wrapped around the body (FIG. 9).

Through these artistic elements of the frescos on the cave interiors, we notice that the majority of these elements are present in most of the caves designated as Roman tombs that were discovered at many sites, for example the caves of Capitolias (Bayt Rās) (FIGS. 10, 11), the cave of Sawm ash-Shunnāq, west of Irbid (FIGS. 12, 13) (Vibert-Guigue 1982: PL. X.3), at Jarash and Marwa, and in the remains of the Decapolis in southern Syria; even as far south as Petra (FIGS. 14, 15).

Frescos survived on the walls of a large number of Roman palaces, houses and tombs in several areas of the Roman Empire. The most important of these example are those of Pompeii in Italy, dated to the first century AD and known by their originality and fine standards (Mancinelli 1981: FIGS. 8, 9, 11, 38, 39, 43-46, 51-56, 60-91). At any rate, we cannot compare the arts of the provinces and colonies with that available at the Roman capital or the great cities near it. I think that the practice of painting on walls in the Roman Empire is a tradition that spread in the Empire and many emperors and generals transferred these arts to the Roman provinces. These arts became a representation of a special aspect of copying fine standards which set root at the important Roman centres.

The minor arts flourished in general in all corners of the Roman Empire, and they became the raw material for the Byzantine arts. However, despite the flourishing of the crafts of these arts they were confined to the service of religious art, therefore we find that most of the works of art, be they frescos, mosaics, carvings on solid materi-



2. Abila (Quwayliba): Fresco inside Roman tomb Q.3, C83-5, 8 (IFAPO Archives, 'Ammān).



3. Abila (Quwayliba): Fresco depicting the portrait of a boy inside Roman tomb Q.10 (IFAPO Archives, 'Ammān).

als, illuminated manuscripts, and even official numismatics were confined to the service of the religious trend. In any case, the elements of the Byzantine art school in Jordan depended on the Oriental style which was derived from the local traditions of the districts of the Holy Land (Hutter 1971: 21). The mosaic map of Mādabā may clearly define the boundaries of these lands which incorporated the districts of Palestine and Jordan, as well as parts of Egypt and Syria (Donner 1992: 16). As such, the Holy Land was not only a religious and ecclesiastical reference but the traditions and general characteristics of those districts became a material reference forming a vital point in the Byzantine arts. The Byzantine art examples at Mādabā, Umm ar-Raṣāṣ, Jarash, Umm Qays, Ṭabaqat Faḥl and other cities in Jordan may represent the first examples of when the Roman Empire turned its back on the inherited pagan nomes and became a Christian state. This converted state put all its material and artistic capabilities into the service of the new religious order, which drove the early Byzantine arts in the Orient to the peek of magnificence. Still, the art of frescos and the similar art of mosaics depended on the origins we saw earlier in the tomb caves of Abila and other places and became foremost among the arts of Italy in the early Byzantine period (Hutter 1971: 21).

At the beginning of the eight century AD, after the declaration of the Umayyad state in Damascus, we notice that the Islamic trend was reserved toward many basic elements of Byzantine arts. The spiritual trends even completely banned figurative representation in religious places, still many Muslims had no objection to decorating their civil arts in their traditional way (Ettinghausen 1962: 11, 29, 190, FIGS. 31, 35, 37).

Thus many old local ideas and styles were employed in the civil Islamic foundations such as palaces and houses. For example, the mosaics of the royal Islamic palaces at Jericho, al-Qasṭal and al-Ḥallābāt, and the carvings of the facades at al-Mushatta and aṭ-Ṭūba represent a purely local aspect. As for the famous frescos at Quṣayr 'Amra, they continued the old tradition we saw with the frescos of the tomb caves of Abila, where the elements of the paintings are almost the basic local material for the Islamic arts of the frescos of Quṣayr 'Amra (FIGS. 16-19).

The mere comparison of the table of elements executed in the Quṣayr 'Amra frescos is almost comprehensive. The frescos at Quṣayr 'Amra and Qaṣr al-Ḥayr al-Gharbī in Syria (FIG. 20) were executed by the Umayyad state. The works naturally represent a conglomeration of capacities and capabilities available to the state at the time (Almagro *et al.* 1975: 48). The artistic elements ascertain the similarity and affinity of the Abila and Quṣayr 'Amra frescos as regarding the representations of human figures, birds, animals, flowers, grids and other common elements which ascertain the continuation of the old local style throughout the different periods and ages.

As a result of the different developments of the art of frescos during two thousand years, and despite the great gaps between cultural backgrounds and artistic methods, one can conclude that styles of fresco have reserved a unified oriental character, represented common methods and iconography throughout the Roman, Byzantine and Islamic periods.

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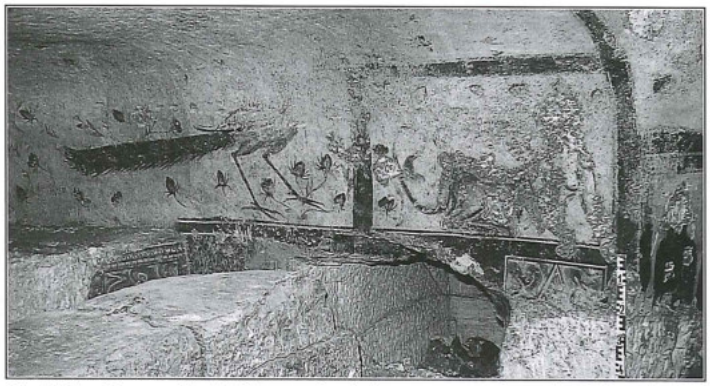
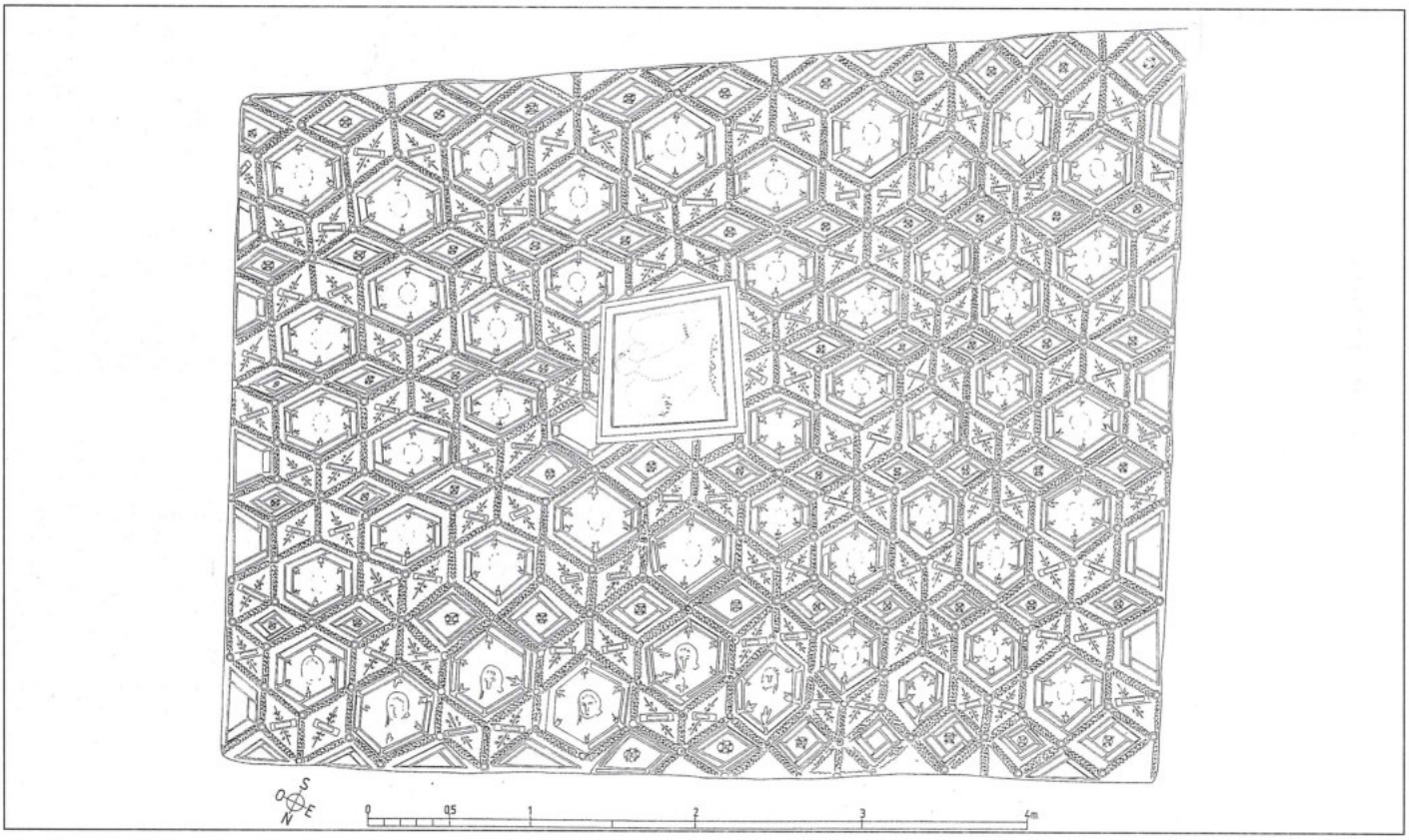
4. Abila (Quwayliba): Fresco representing knowledge inside Roman tomb Q.1 (IFAPO Archives, 'Ammān).



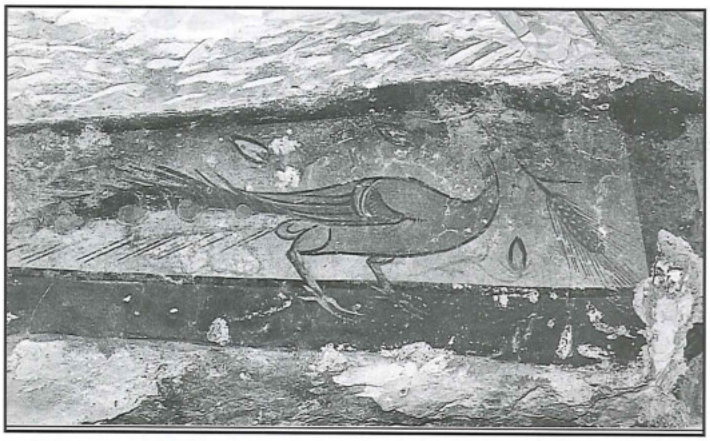
5. Abila (Quwayliba): Fresco depicting a peacock and a feline inside Roman tomb Q.7 (IFAPO Archives, 'Ammān).



6. Abila (Quwayliba): Fresco depicting portraits and fish within a geometrical setting inside Roman tomb Q.2 (IFAPO Archives, ʿAmmān).




7. Abila (Quwayliba): Fresco depicting portraits and flowers within a geometrical setting inside Roman tomb Q.3 (Barbet and Vibert-Guigue 1988: PL. 33).



8. Abila (Quwayliba): Fresco depicting a peacock inside Roman tomb Q.13 (IFAPO Archives, 'Ammān).



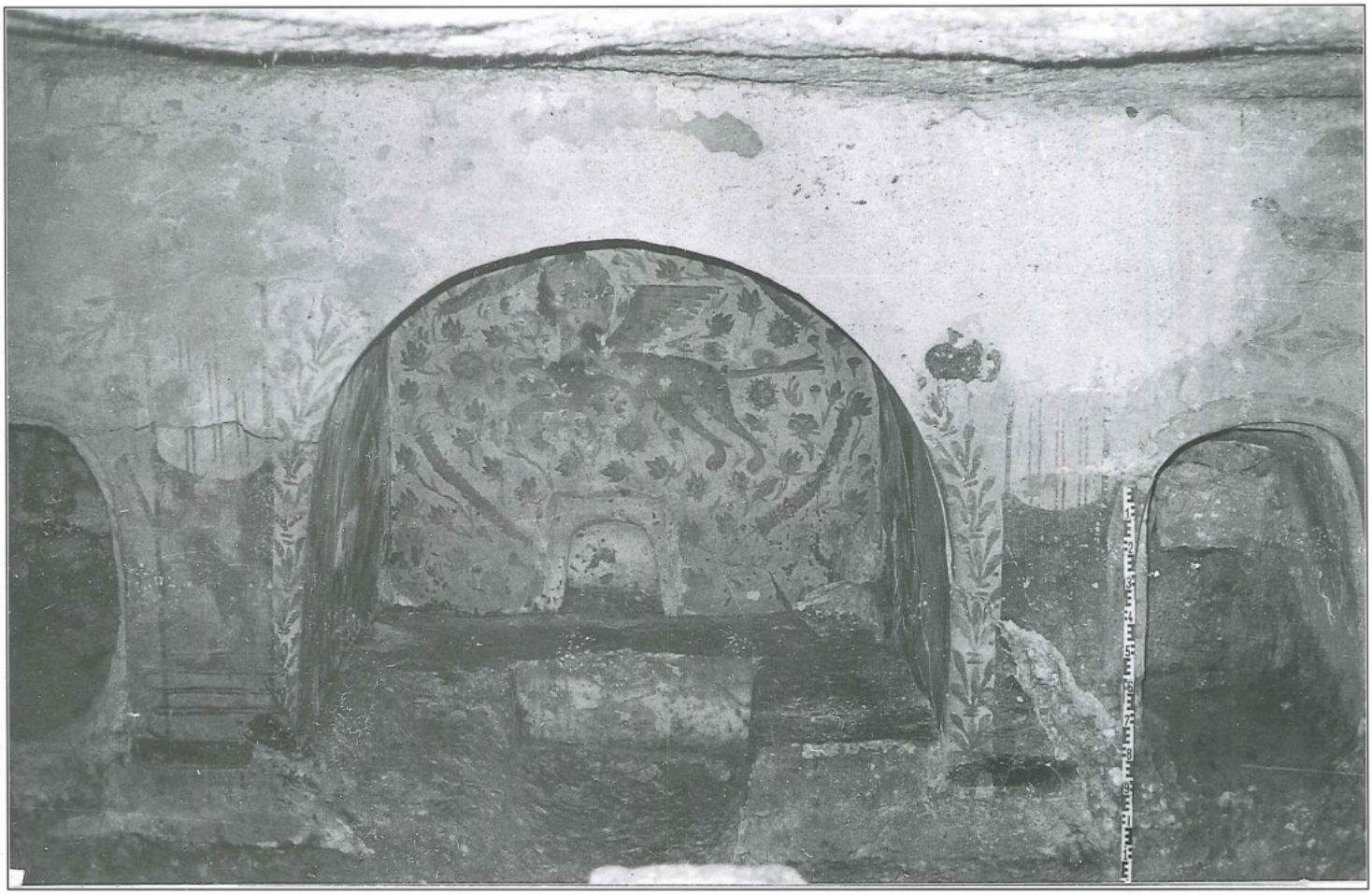
9. Abila (Quwayliba): Fresco depicting women in oriental dress inside Roman tomb Q.13 (IFAPO Archives, 'Ammān).



10. Capitolias (Bayt Rās): Fresco inside a tomb, depicting a warrior (Barbet and Vibert-Guigue 1988: PL. 8).



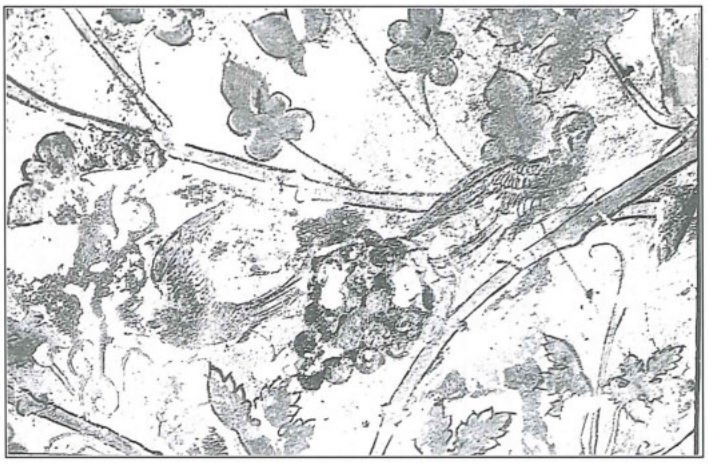
11. Capitolias (Bayt Rās): Fresco inside a tomb, depicting a mythological scene with the name of Achilles (Barbet and Vibert-Guigue 1988: PL. 8).



12. Sawm ash-Shunnāq: Fresco inside a loculus depicting a winged animal with a woman's face (courtesy of Claude Vibert-Guigue, IFAPO, 'Ammān).



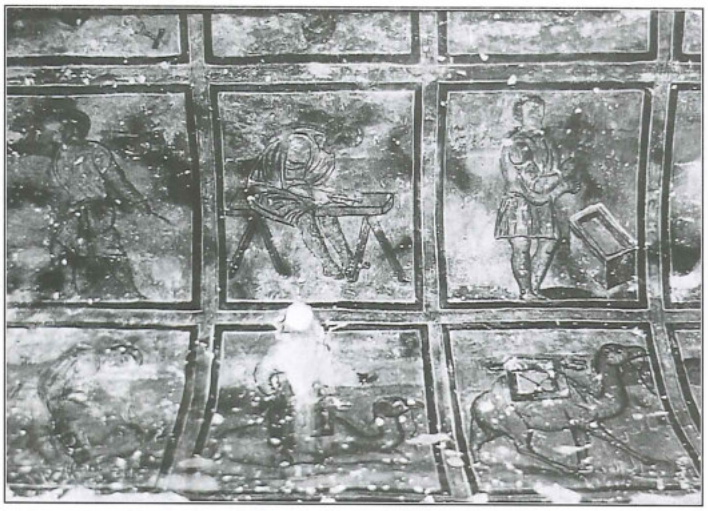
13. Sawm ash-Shunnāq: Fresco inside a tomb depicting a leopard surrounded by floral motifs (courtesy of Claude Vibert-Guigue, IFAPO, 'Ammān).



14. Petra, Sīq al-Bārid: Fresco inside a rock-cut triclinium depicting birds among vine leaves (IFAPO Archives, 'Ammān).



15. Petra, Sīq al-Bārid: Fresco inside a rock-cut triclinium depicting Pan playing the flute among vine leaves (IFAPO Archives, ʿAmmān).



16. Quṣayr ʿAmra: Fresco depicting working men and animals.



17. Quṣayr ʿAmra: Fresco depicting animals within a geometric grid.



18. Quṣayr ʿAmra: Personifications in fresco.



19. Quṣayr ʿAmra: Fresco depicting a lamenting figure and winged cupid.



20. Qaṣr al-Hayr al-Gharbī, Syria: Umayyad fresco depicting Gaea, the Earth goddess.

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# Les caractéristiques de la peinture murale à Pétra

## Introduction

A travers les vestiges exhumés et déjà publiés, il est possible de tracer les grandes lignes du développement de l'art de peindre à Pétra; la difficulté réside en l'absence de témoins à certaines époques et l'absence également de bons critères de datation intrinsèque ou stylistique, ce qui rend le bilan précaire.

Toutefois, on discerne plusieurs groupes, répartis dans le temps. L'un des plus ancien, sans compter le décor en stuc de la falaise al-Ḥabīs, provient de ce qu'il est convenu d'appeler les bains de Pétra, et se compose de rares traces en place et surtout de fragments, dont le remontage a permis de restituer une séquence suffisemment claire pour qu'on puisse le rattacher à une famille stylistique déjà abondante sur tout le pourtour de la Méditerranée.

Ce document s'insère dans une production, où, semble-t-il, des traits archaïques subsistent qui faussent nos perspectives et rendent difficiles la datation.

## Les bains de Pétra

Les stucs peints ont été présentés après leur découverte par F. Zayadine, qui m'a demandé de les consolider en vue d'une étude plus poussée et d'une éventuelle restauration[1]. Ils ont bénéficié d'une campagne de relevés de C. Vibert-Guigue, de l'IFAPO d'Amman, d'une étude et d'une consolidation d'urgence par A. Barbet.

Sur place il subsiste des vestiges de stucs peints sur les murs de la cage de l'escalier à trois paliers, qui donne accès à un étage enterré, qui n'a pas été entièrement exploré (FIG. 1). Au sous-sol, se trouve une salle ronde à quatre niches d'angle semi-circulaires, quatre autres niches sur les côtés, dont deux percées de baies. Il n'y a plus de stucs en place, et les éléments ont été trouvés à l'état de fragments; ils sont conservés dans les réserves du musée archéologique de Pétra[2]. Nous ne disposons pas, pour l'instant, de rapport de fouilles ou de sondages, ni d'éléments de datation par une éventuelle stratigraphie ou par du matériel.

*La cage de l'escalier*

C'est un massif carré autour duquel s'échelonnent trois volées de marches (4, 6 et 8 degrés), entrecoupées de paliers (FIG. 2). D'après les vestiges en place, le décor s'organise en plinthe basse, orthostates règuliers, rouges et jaunes, un bandeau continu et quatre rangs d'appareil isodome à bossages, à restituer d'après les plaques-témoins, sans doute couronnés par une corniche qui a disparu. Les orthostates, les blocs d'appareil et le bandeau sont en biais pour suivre la ligne oblique des volées d'escalier et horizontaux le long des paliers de repos (FIG. 3). Le refend est incisé et les bossages en léger relief.

Si l'on compare ce schéma à un premier style dit "pompéien", ou au style structural grec, dont la datation se place au plus tard au IIe siècle av. J.-C., rien ne permet de proposer une exécution plus tardive à Pétra.

Les comparaisons étant nombreuses, je me bornerai à présenter l'exemple du *tablinum* 19 de la maison de Salluste à Pompéi[3]. Au-dessus d'une partie basse de faible ampleur, des orthostates noirs plus larges que hauts, sont surmontés de deux rangs d'appareil isodome, en quatre couleurs, qui alternent: violet, jaune, vert et rouge, couronnés par une corniche saillante, suivie d'un rang d'imitations de marbres avec une ultime corniche plus saillante. L'ordonnance est la même, sauf les corniches de séparation horizontale qui manquent dans la cage d'escalier de Pétra, et l'absence d'un bandeau continu à Pompéi. Il faut peut-être imaginer des couleurs aussi variées pour les assises en partie haute.

Nous pourrions aussi citer des décors dans les nécropoles d'Alexandrie, de la même époque hellénistique tardive.

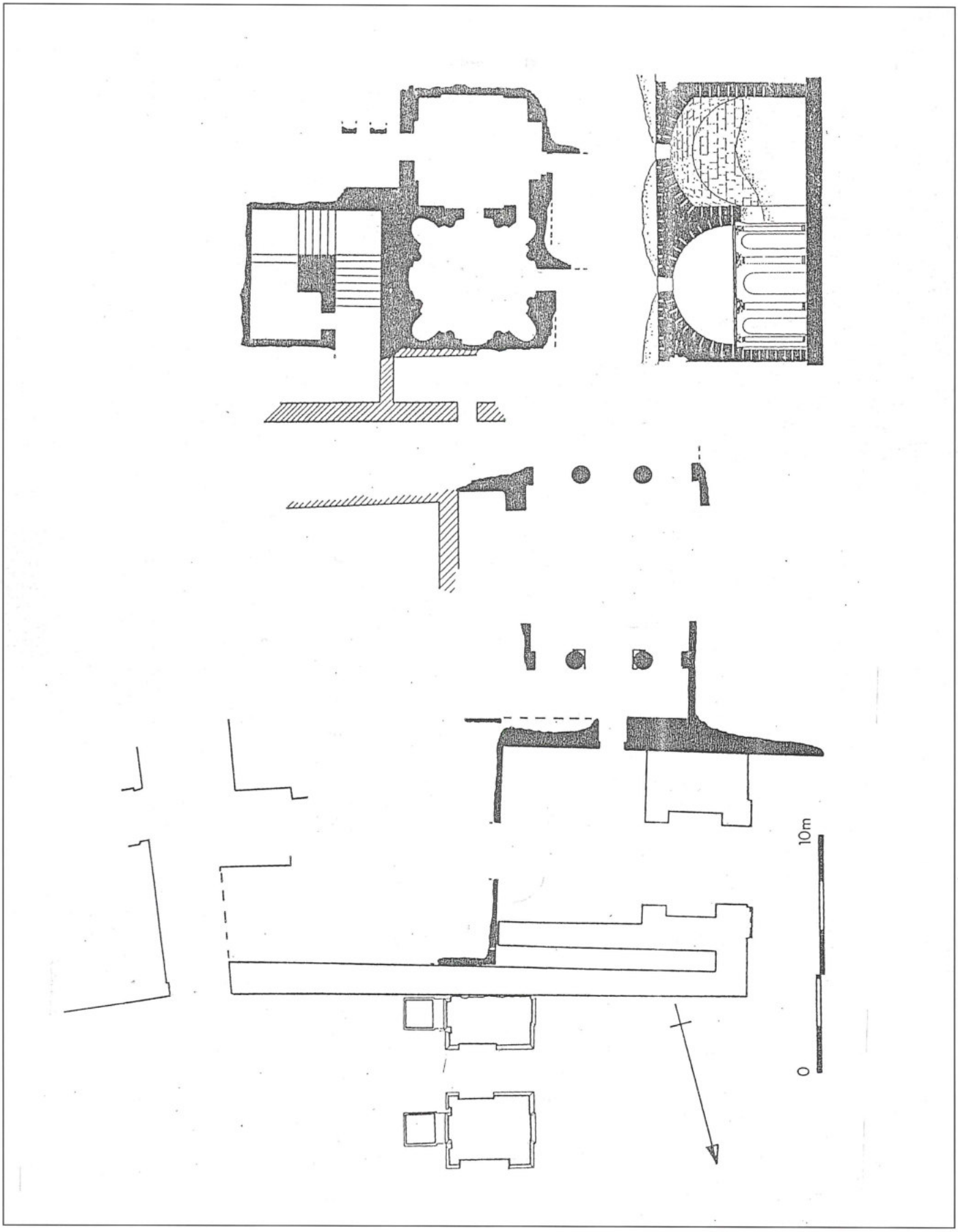
*La salle ronde à coupole*

La salle est entièrement conservée, (FIGS. 1, 4); son rôle

[1] F. Zayadine, 'Decorative Stucco at Petra and others Hellenistic Sites,' *SHAJ* III, Amman, 1987, p. 131-142.

[2] Un fragment a été donné en dépôt au musée de l'Universit à Amman.

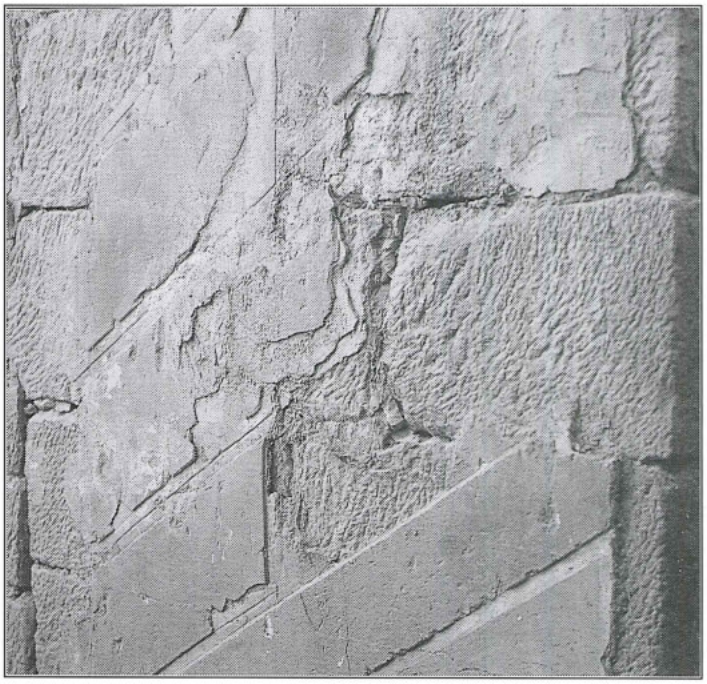
[3] Cf. A. Laidlaw, *The First Sytle in Pompii: Painting and Architecture,* Rome, 1985, FIG. 29, mur de droite, sud, p. 128.




1. Plan du secteur des "bains" de Pétra (d'ap. J. McKenzie, *op. cit*, PL. 75).



2. Vue en contre-plongée de la cage de l'escalier (A. Barbet).



3. Détail des stucs de l'escalier (A. Barbet).

de *caldarium* d'après Wiegand est à reconsidérer[4]. S'il s'agissait de salle thermale, un *laconicum*, conviendrait mieux, comme la salle d'air chaud et sec des thermes du Forum à Pompéi, où l'on trouve quatre niches à abside et une coupole au profil conique. Cependant aucun aménagement d'air chaud n'a été retrouvé et d'après F. Zayadine, l'ensemble architectural s'apparenterait plutôt à un palais[5].

La structure est régulière: une colonne engagée de part et d'autre des quatre niches semi-circulaires de 1m de largeur, qui alternent avec des surfaces incurvées, pleines ou percées de portes. La hauteur sous niche est de 2.27m et celle des demi-colonnes est de 2,81m. Quant aux chapiteaux (FIG. 5) conservés ils appartiennent au groupe A défini par J. McKenzie, auquel se rattachent le Qaṣr al-Bint et la Khazna[6]. Partout la surface nue actuelle, y compris les colonnes et leurs chapiteaux qui en gardent des traces, était revêtue de stucs en relief peint, dont il est possible de restituer les grandes lignes.

Autour des niches et vraisemblablement aussi sur les espaces intermédiaires, entre les colonnes engagées, prenaient place des encadrements rouges, rectilignes en haut et semi-circulaires en bas pour épouser la courbe des niches ou en créer de fictives entre deux niches réelles (FIG. 6). Au-dessus, un couronnement de moulures lisses à filet, baguette, ovolo, doucine, listel et biseau les abritait; le contact avec les arcatures n'est pas sûrement établi. Elles sont blanches pour imiter un marbre.

Au-dessus des chapiteaux on peut restituer l'entablement suivant (FIG. 7): l'architrave était couronnée d'un talon peint de rais-de-coeur. La frise plate et lisse était, selon C. Vibert-Guigue, peinte d'un décor végétal. La corniche est constituée de bas en haut d'une baguette, d'un ovolo peint d'oves et de fers de lance, de denticules, d'un listel plat, d'un talon très aplati peint de rais-de-coeur, d'un larmier dont le front est couronné d'un biseau décoré d'oves et de fers de lance et d'une sima en doucine.

Les couleurs employées sont limitées à des contours noirs et à de l'ocre jaune, avec réserves de fond blanc, en lumière centrale pour les oves et latérale droite pour les fers de lance. De très rares traces de rouge sur les oves du bloc n°42. et de vert sur le côté gauche de plusieurs fers de lance du bloc n°43. indiquent une plus grande richesse de la palette que supposée à l'origine; l'ocre jaune aurait servi de base colorée, et le modelé comprenait du rouge et du vert, ce qui fait soupconner des effets de relief fictif assez élaborés. Des traces de bleu sont perceptibles de part et d'autre des rais-de-coeur qui surplombent la frise de denticules.

Enfin, couronnant l'ensemble, un tore est surmonté d'une grande doucine saillante, dont la surface était vraisemblablement peinte d'un rinceau (FIGS. 7, 8); les couleurs et le tracé sont trop évanescents pour qu'on puisse les restituer, mais le ton gris fait supposer une base noire pour un ton bleu ou vert disparu. Une observation à la binoculaire permettrait peut-être d'en retrouver d'infimes traces, comme le vert décelé sur le tore situé au-dessous.

[4] Cité par F. Zayadine, *loc. cit*, note 41; Bachmann, Watzinger, Wiegand, Petra, Liepzig, 1921, p. 45-48.

[5] *ibid.*, p. 139.

[6] J. McKenzie, *The Arcitecture of Petra,* Oxford, 1990.



4. Vue de la salle à coupole avec niche (A. Barbet).



5. Détail d'un chapiteau et de la coupole (A. Barbet).

S'enchaînant parfaitement avec le sommet de la corniche, nous possédons des montants, ornés de rainures peintes en rouge, qui encardraient ce qu'il faut considérer comme des caissons, ainsi que le supporse justement F. Zayadine[7], et non comme des fenêtres, envisagées un temps par C. Vibert-Guigue[8].

D'après les dimensions, il faut restituer des caissons agencés comme ceux du Panthéon à Rome, puisqu'il s'agit d'une calotte sphérique[9]. Etant donné la présence d'un oculus, il est vraisemblable que les nervures devaient former un dessin rayonnant autour de sa bordure.

**Remarques techniques**

De façon générale les stucs sont parfaitement lissés et blancs; les tracés préparatoires, au moyen de cordelettes, sont très apparents (FIG. 9); sur le bloc n°11 il y en a deux, verticaux et parallèles aux bords d'un caisson, distants de 14,4cm l'un de l'autre, et à la même distance par rapport au bord saillant externe gauche du cadre. Cette constante pouvait se répéter à droite et le caisson mesurerait alors, encadrement compris, 14,4cm x 2 = 28,8cm, soit un pied romain environ. On peut aussi imaginer d'autres multiples de 14,4cm évidemment pour la dimension de ces caissons. Des armatures en roseaux avaient été appliquées sur l'architecture pour servir d'âme aux stucs (FIG. 10). Ils correspondent aux recommandations de Vitruve[10] qui indique la facon de lier les bottes de petits roseaux et de les plier à la courbure désirée sur la structure. On retrouve effectivement les liens en creux obliques, tous les 5 ou 6cm, et les empreintes des petits paquets de longues tiges disparues au dos des stucs, dont la courbure était adaptée à celle de la coupole.

Les stries longitudinales que l'on note sur les parties peintes, dont l'état de conservation accuse des microreliefs, nous prouve l'utilisation de gabarits en bois, dont les veines se sont imprimées longitudinalement. Il ne reste, en revanche, aucune trace de chevilles en bois, alors qu'elles sont nombreuses et bien conservées sur le mur sud du Qaṣr al-Bint. A la place, il y a une trace de clou, dont plusieurs ont dû être utilisés pour maintenir les stucs les plus saillants. L'emploi d'un matériau différent, pour fixer des stucs aussi volumineux dans les deux monuments, est une donnée importante. On peut en conclure à deux traditions techniques différentes à une même époque, ou à l'exécution en deux temps éloignés.

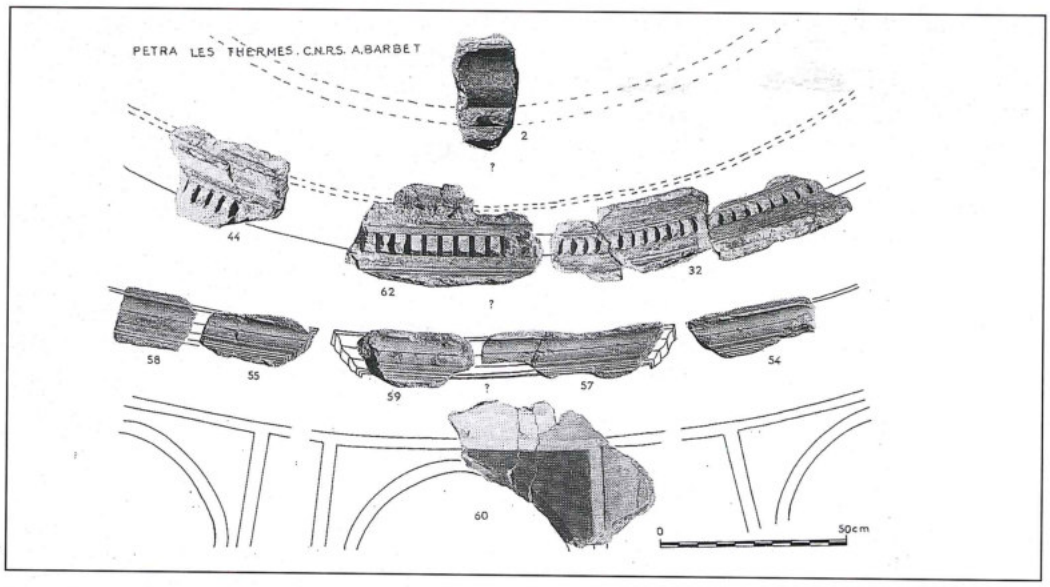
Remarquons, aussi bien dans les bains qu'au Qaṣr al-Bint (FIG. 5), l'existence d'une saillie de la corniche en pierre, là où sera posée une corniche en stuc, qui pénètre dans la gorge située au-dessous. Cet aménagement indique bien, dans les deux cas, la conception d'un projet global de l'architecture et de son revêtement plastique et coloré. C'est un système voisin de celui qui a été observé sur de très nombreux tombeaux de Pétra creusés dans le rocher, où des gorges avaient été ménagées, notamment

[7] F. Zayadine, *loc. cit*, p. 139, note 43.

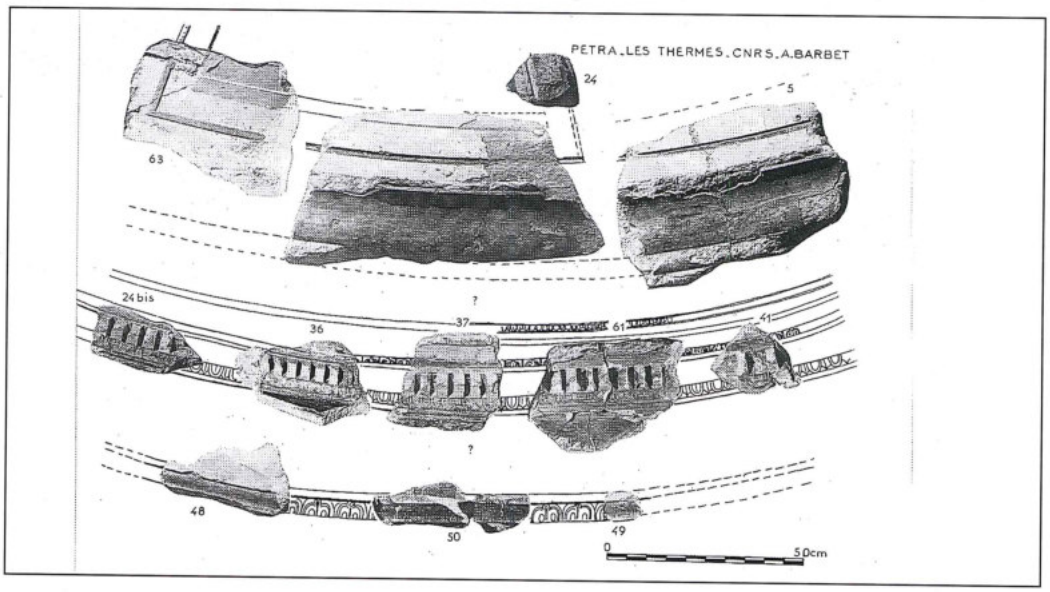
[8] Du fait que les restitutions à partir des relevés inédits sont à revoir, aprés notre campagne de nettoyage et de consolidation, C. Vibert-Guigue n'a pas souhaité confier les dessins à la publication. Je le remercie de m'avoir permis de les consulter.

[9] Pour la coupole du Panthéon, cf. J.-P. Adam, *La construction romaine, matériaux et techniques*, Paris, 1984, FIG. 445.

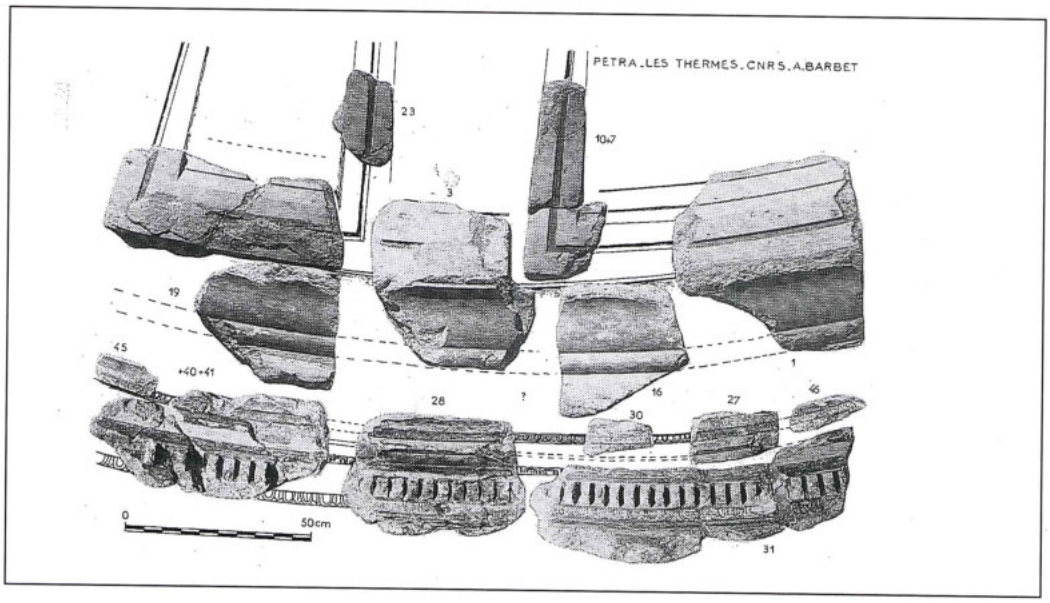
[10] Cf. Vitruve, *De Architectura*, VII, 3, 2, cité par A. Barbet dans A. Barbet, C. Allag, 'Techniques de préparation des parois dans la peinture romaine,' *MEFRA*, 1972, p. 939, note 1.



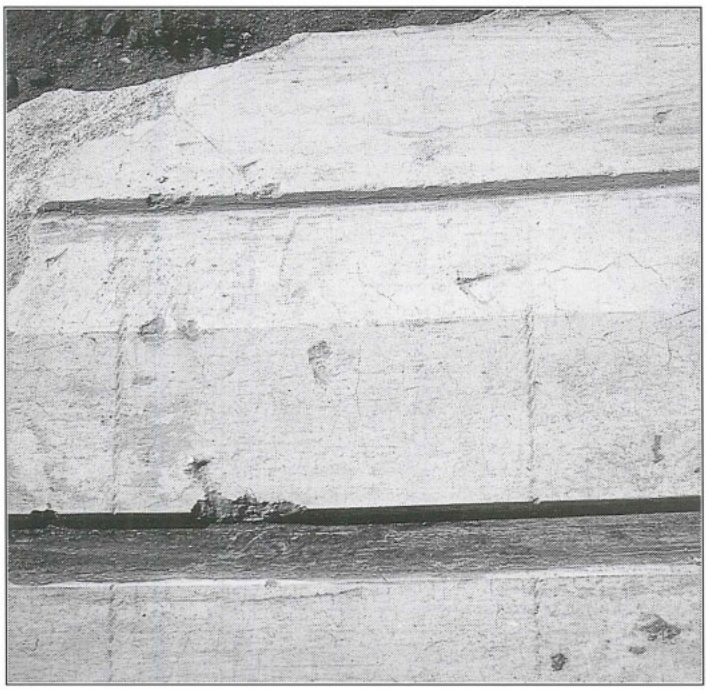

6. Stucs de la partie basse (A. Barbet).



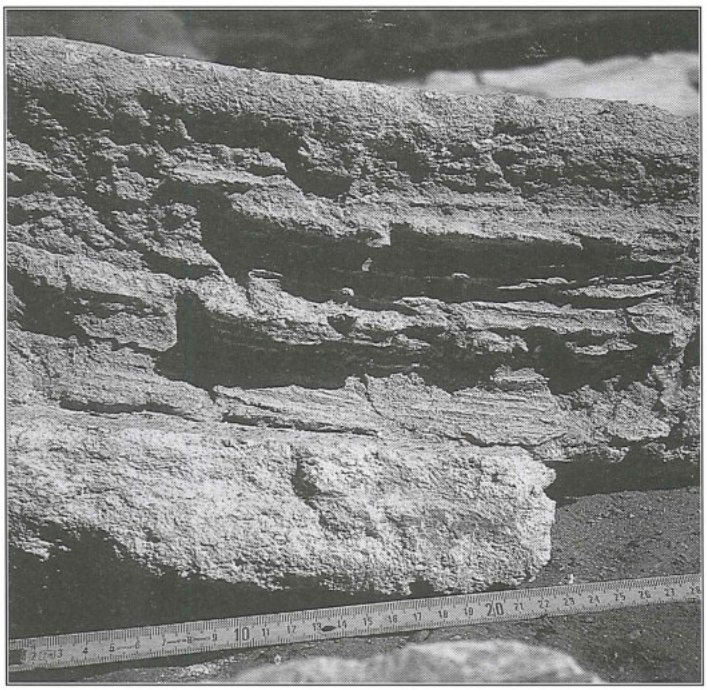

7. Stucs de la partie basse et moyenne (A. Barbet).




8. Stucs de la partie haute (A. Barbet).



9. Détail avec empreinte de deux cordelettes (A. Barbet).



10. Détail avec empreintes de roseaux au revers (A. Barbet).

au dessus-des portes, pour y insérer les corniches de stuc[11].

**Remarques stylistiques**

Je me contenterai de caractériser les stucs par rapport à ceux que nous connaissons dans le monde romain, pour tenter non seulement une datation stylistique, mais aussi pour voir en quoi Pétra fait preuve d'innovation.

- *Mouluration lisse en cavet, talon et doucine.* On en trouve plusieurs dans la nécropole de Muṣṭafa Pacha à Alexandrie, qui est datable du IIe siècle av. J.-C. Au-dessus de chacune des portes d'accès de la cour aux chambres funéraires, elles étaient profilées et décorées de motifs, différents de ceux de Pétra, mais provenant d'un répertoire connu[12]. L'association de l'astragale et de l'ovolo peints avec des oves, directement sous les denticules, se retrouve aussi au Qaṣr al-Bint et au Khazna; ce trait serait caractéristique de son groupe A selon J. McKenzie[13].

- *Denticules.* Ils sont très oblongs, bien séparés les uns des autres, et semblables à ceux de Pompéi, au Ier style et dans la nécropole de Muṣṭafa Pacha, à Kawm ash-Shugafa à Alexandrie. On les trouve aussi au chantier Finney, daté du IIe siècle ou du tout début du Ier s. av. J.-C.; c'est un critère de datation haute pour Lauter et pour Pensabene, opinion que je rejoindrai volontiers[14]. En effet, plus tard, leur représentation dans la peinture du IIe style en fait des cubes presque carrés[15], alors que le rapport hauteur-largeur est à Pétra bien conforme aux modèles anciens. Cependant, il pourrait s'agir d'un trait d'archaïsme, et ce critère ne serait pas pertinent pour Pétra car on constate les mêmes denticules à Bayḍa (Sīq al-Bārid), audessus de peintures qi peuvent difficilement être aussi anciennes que les stucs me semble-t-il[16].

- *Les rais-de-coeur.* Ils sont très arroundis à deux lunules pleines. Si on les compare à des rais-de-coeur peints à plat au IIe style, en Campanie ou ailleurs (Ier siècle av. J.-C.), ou à des exemples très précoces comme ceux d'Olynthe (IVe siècle av. J.-C), ils sont différents. En revanche ils sont proches de ceux de la salle h de la maison du lac sacré de Délos[17], ou de ceux de Cnide[18]. D'après J. McKenzie, la superposition de la *cyma reversa*, ou talon, entre denticules et larmier, ou corona, se trouve également au temple des Lions ailés et au Khazna[19].

- *Corniche lisse en tore et doucine.* Elle portait des rinceaux disparus et sa courbe bien prononcée est difficile à

11 Cf. liste établie par A. Barbet, rapport inédit 1982, et celle de F. Zayadine, *loc. cit*, p. 131-134.

12 Mustafa Pacha, A. Adriani, *Annuaire du monde gréco-romain,* La nécropole de Mustafa Pacha, Alexandrie, 1936, PL. C.

13 Cf. J. McKenzie, *op. cit*, sur le groupe A.

14 H. Lauter, 'Ptolemaïs in Libyen ein Beitrage zur Baukunst Alexandrias', *JDAI* 86 (1971).

15 Cf. N. Avigad, *Discovering Jerusalem*, Cambridge (Ont.), 1983, FIG. 172, à comparer avec l'exemplaire en stuc de la FIG. 156.

16 Nous reviendrons ultérieurement sur la datation des peintures de Bayḍa, le *biclinium* de Sīq al-Bārid, qui posséde une corniche à denticules et des rangs d'appareil isodome. Notons seulement pour l'instant qu'un décor plus ancien en stuc peut coexister avec un décor peint plus récent, comme c'est souvent le cas à Pompéi, où les lourdes et belles corniches du Ier style ont été conservées au-dessus de décors refaits par la suite.

17 *Mon. Piot*, 14, PL. VIb.

18 *AJA* (1972), p. 399, FIG. 4, et FIG. 18, PL. 62.

19 J. McKenzie, *op. cit*., PL. 23a.

comparer, car elle est rarement conservée ailleurs.

- *Caissons.* Quant aux caissons ils sont très enfoncés, à deux ressauts obliques plats et cadre à rainure centrale, de 12cm de profondeur restituée. La photo des fragments en fouille publiée par F. Zayadine, montre que le fond était carré et coloré en sombre (sans doute en rouge ou en marron?); malheureusement ils se sont ensuite détériorés, puisque nous n'avons pas retrouvé le bloc intact[20]. Ils n'ont pas de parallèls exacts ailleurs, et ceux de la maison des Griffons à Rome, datés du tout début du Ier siècle av. J.-C., sont beaucoup plus plats.

En conclusion, les thermes de Pétra, dont ce petit secteur seulement a été exploré, est un bon exemple d'un revêtement de style structural sur la cage de l'escalier, d'une qualité certaine, mais dont l'archaïsme des caractères interdit de le dater trop haut. Quant aux stucs de la salle ronde, pour J. McKenzie ils font partie du groupe le plus précoce de Pétra dont la datation reste à discuter. Pour F. Zayadine, la première moitié du Ier siècle av. J.-C. doit être retenue; c'est une hypothèse qui paraît plausible, et correspondrait à ce qui est qualifié, en Occident, de IIe style pompéien.

Le prestige de l'établissement de bains[21], ou du palais dont nous ignorons tout actuellement, est nettement marqué par ce décor, dont il convient de dissocier peut-être la cage d'escalier en "proto-Ier style" des stucs de la coupole de "IIe style"; nous y verrions un caractère public plutôt que privé. S'il y a de nombreuses mentions de stucs dans toute la région, il s'agit ici d'un ensemble exceptionnel et unique par son état de conservation, avec toute cette riche structure modelée en stuc coloré épousant une architecture novatrice; en effet, la coupole sur pendentifs n'est attestée que sur des monuments beaucoup plus tardifs. Cet ensemble s'insère bien dans la production artistique du monde gréco-romain, où il tient une place tout à fait originale. En conséquence, il serait très utile d'assurer la restauration de ces stucs, de réétudier l'ensemble avec les propylées voisins et d'établir les différents états de la construction en même temps que le contexte et l'architecture d'un monument qui reste pour l'instant mal exploré.

Quant aux références aux styles connus en Occident, elles sont ambigües, même s'il est avéré que les modes repérées dans le monde hellénistique, tant en Grèce qu'à Rome, se sont bien répercutées dans d'autres pays du pourtour de la Méditerranée, avec un rôle non négligeable d'un circuit oriental qui, de la Macédoine à Alexandrie a emprunté les chemins des conquêtes d'Alexandre par l'Asie Mineure. Il n'est que de voir les stucs encore accroachés à la falaise d'al-Ḥabīs, et qui se rattachent bien à ce qu'il est convenu d'appeler le style structural grec, très proche des modèles déliens.

Replacer la production de Pétra dans l'ensemble de la création artistique du monde gréco-romain, et en même temps dégager sa spécificité, oblige à un exercice périlleux. Car l'histoire de l'architecture et de la sculpture interférant, celle de la peinture et du stuc en est encore à ses balbutiements. Mais des jalons de plus en plus nombreux apparaissent. qui permettront un jour, nous l'espérons, de caractériser des écoloes régionales.

**Tableau.** Chronologie des stucs et des peintures de Pétra.

| *Site* | *Datation d'après F. Zayadine* | *Observations d'après A. Barbet* |
|---|---|---|
| 'Iraq al-Amīr | début IIeme s. av. J.-C. | |
| Falaise al-Ḥabīs | début Ier s. av. J.-C. | IIeme s., début Ier s. av. J.-C. |
| Les Bains | 1ere moitié du Ier s. av. J.-C. | cage d'escalier: IIe s. début 1er s. av.J.-C.; coupole: 1ere moitié du Ier s. av. J.-C. |
| Temple des lion ailés | 2éme moitié Ier s. av. J.-C. | |
| Sīq al-Bārid | 1ere moitié Ier s. av. J.-C. | deux états de décor à revoir de près |
| Qaṣr al-Bint | fin Ier s. av. J.-C. | extérieur 30 av.J.-C.; intérieur 10 av. J.-C. |
| Wādī aṣ-Ṣiyyagh | Ier s. av. J.-C.? | deux états de décors à revoir de près |
| Tombe du *triclinium* Farasa | 2éme moitié Ier s. ap. J.-C. | |
| Tombe Br 676 nécropole Naṣāra | 2éme moitié Ier s. ap. J.-C. | |

[20] F. Zayadine, *loc. cit.*, FIG. 19 p.140.

[21] J. McKenzie, *op. cit.*, fait le rapprochement avec la coupole des bains de l'Hérodeion, datée des années 24-15 av. J.-C.

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# The Activity of the Mosaicists of the Diocese of Mādabā at the Time of Bishop Sergius in the Second Half of the Sixth Century AD

According to dated archaeological discoveries, the most intense ecclesiastical building activity in the diocese of Mādabā occurred at the time of Bishop Sergius, between AD 575 and 598.

The first mosaic inscriptions mentioning the name of Bishop Sergius were copied at Mādabā in June 1897 by Fr. Giuseppe Manfredi, the parish priest of the local Latin community, in the mosaic floors decorating the upper church and the lower crypt of the prophet Elias along the paved Roman road (FIG. 1).[1] In the inscription of the upper church, Sergius is called "the friend of God, the curator, who had gathered the gifts".[2] In the inscription the Bishop is called φροντιστησ, curator, as noted by P.-L. Gatier, and not the *contemplative*, as ordinarily translated by earlier scholars.[3] The Greek term is related to the care with which Bishop Sergius collected the funds to build the new sanctuary along the Roman paved road of Mādabā, which in my view included the church of the Prophet Elias and the church of the Virgin Mary.

In April 1902, Father Manfredi had the chance to excavate the church of the Apostles on the southern slope of the *tall*, built during the episcopate of Sergius and mosaiced by the mosaicist Salaman in AD 578/79 (FIG. 2).[4]



1. Mādabā. The crypt of the Church of Saint Elias (AD 595/96).



2. Mādabā. The Church of the Apostles by the mosaicist Salaman (AD 578/79).

[1] G. Manfredi, 'Piano generale delle antichità di Madaba,' *Nuovo Bollettino delle Antichità Cristiane* 5 (1899), p. 157.

[2] P.-M. Séjourné, 'L'elianée de Madaba,' *RB* 6 (1897), pp. 648-656.

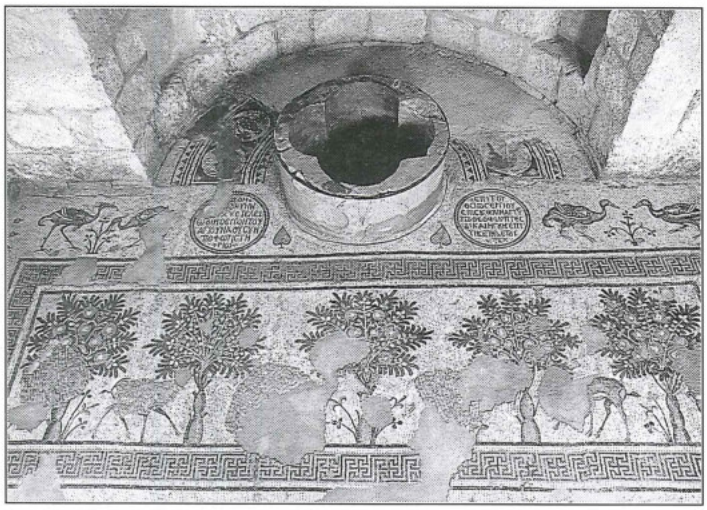
[3] P.-L. Gatier, *Inscriptions de la Jordanie, Tome 2, Région centrale (Amman, Hesban, Madaba, Ma'in, Dhiban). IGLS* 21. Paris (1986), pp. 141 f.

[4] H. Vincent, 'L'église de SS. Apôtres à Madaba,' *RB* 11 (1902), p. 599.

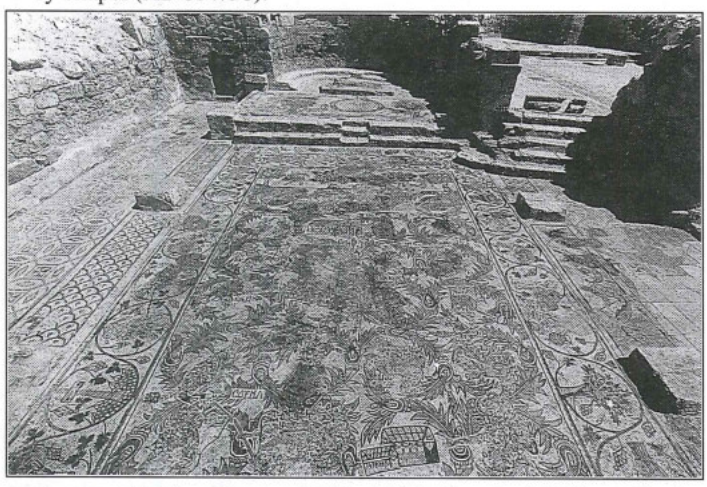
The mosaicist signed the medallion of the Sea in the central nave of the church.

In 1933, Fr. Sylvester Saller, Director of the Franciscan archaeological mission at Mount Nebo, read the name of Bishop Sergius two times in the baptistry chapel of the Memorial of Moses (FIG. 3).[5] The church represented the most important building program in the diocese. The primitive church built in the fourth century became a three-aisled basilica with the baptistry chapel on the south wall, and the long diakonikon chapel on the north wall. Unfortunately, the decoration of the main nave of the basilica was totally destroyed.

In 1979 we could read the name of the bishop in a long inscription in the courtyard of the so-called cathedral church of Mādabā, in the southern quarter of the city.[6] Bishop Sergius completed in 575/76 the renovation works already started by Bishop John, his predecessor. The works of Sergius deserved the admiration of the people of Mādabā, as written in the Greek dedicatory inscription on the east side of the mouth of the cistern in the courtyard, and in the Semitic inscription transcribed in Greek on the west side of the mouth.[7]



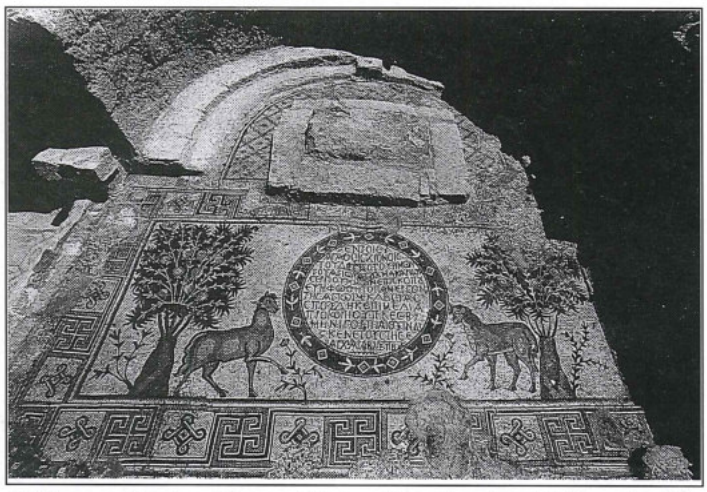
3. Mount Nebo - Ṣiyāgha. The mosaic floor in the apse of the baptistry chapel (AD 597/98).



4. Umm ar-Raṣāṣ - Kastron Mefaa. The Church of Bishop Sergius (AD 587/88).

Thanks to the excavations at the site of Umm ar-Raṣāṣ - Kastron Mefaa in the southern territory of the diocese in progress since 1986 by the Department of Antiquities in collaboration with the Franciscan Archaeological Institute, and by the Max Van Berchem Foundation since 1988, new evidence of this building activity has been brought to light. There, at least four churches were built and mosaiced at the time of Bishop Sergius. In 1986, we excavated the church of Bishop Sergius, as we have named the north church of the large complex of Saint Stephen on the northern edge of the ruins (FIG. 4).[8] The church was built and paved with mosaics "in the good times of our lord, the most holy and most blessed Bishop Sergius...on the sixth indiction of the year 492 of the Province of Arabia (AD 587)", as it is written in the medallion between two lambs in front of the altar (FIG. 5).[9]

In 1989 the Max Van Berchem Foundation uncovered the church of the Rivers inside the castrum. In our opinion, the church was mosaiced by the same team of mosaicists working at the time of Bishop Sergius at Umm ar-Raṣāṣ. We base that statement on the similarity of style and of the decorative program of its mosaic floor with that of the church of Bishop Sergius. Therefore, we



5. Umm ar-Raṣāṣ - Kastron Mefaa. The Church of Bishop Sergius. The sanctuary.

[5] S. Saller, *The Memorial of Moses on Mount Nebo, I.* Jerusalem, 1947, p. 247.

[6] M. Piccirillo, 'La "cattedrale" di Madaba,' *LA* 31 (1981), pp. 308 f.

[7] "All were saying in admiration: A cistern within a cistern. Oh! How marvellous!" [in the inscription of the courtyard on the east side of the mouth of the cistern, *LA* 31 (1981), pp. 308f.]. The expression of wonderment is repeated in Semitic transcribed in Greek on the west side of the mouth of the cistern: "Goubba bagoubba (a cistern within a cistern)...gushing for the Madabites..."[*LA* 31 (1981), pp. 310 f.].

[8] M. Piccirillo and T. 'Attiyat, 'The Complex of Saint Stephen at Umm er-Rasas - Kastron Mefaa. First Campaign, August 1986,' *ADAJ* 30 (1986), pp. 341-351.

[9] M. Piccirillo, 'Le iscrizioni di Um er-Rasas - Kastron Mefaa in Giordania, I (1986-1987),' *LA* 37 (1987), pp. 204-206.

propose to choose AD 593/4 as the 12th indiction year given by the inscription near the entrance of the church.

In 1989-90 we could read again the name of Bishop Sergius in the mosaic floor of the church of the Lions in the outer quarter of the city (FIG. 6).[10] The eighth indiction year given together with the name of Bishop Sergius in the inscription in the main nave, enables us to choose the year 588/89 for this outstanding work of the mosaicists of the city.

In 1990-91, together with Mr. Taysir 'Attiyat, we brought to light the church of the Priest Wā'il built and mosaiced in the year 586 (FIG. 7).[11]

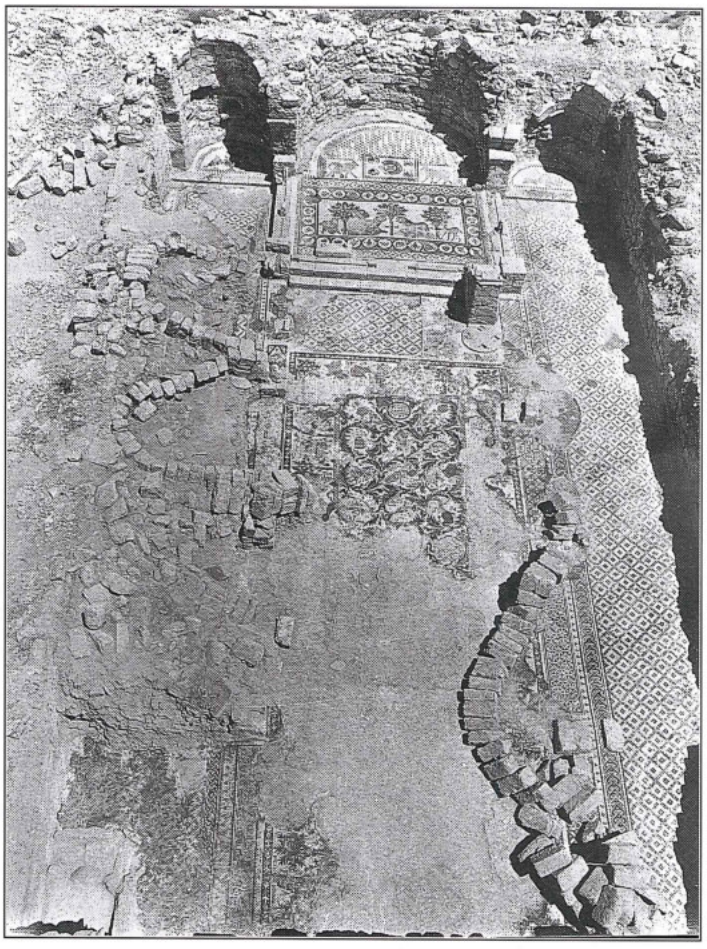
Thus since 1897 to the present, archaeological excavations have brought to light the following projects built during the episcopate of Bishop Sergius of Mādabā:

- the northern sector of the western courtyard in the Cathedral complex (AD 575/76);
- the church of the Apostles with its northeast chapel (AD 578/79);
- the church of the Priest Wā'il at Umm ar-Raṣāṣ (AD 586);
- the church of Bishop Sergius at Umm ar-Raṣāṣ (AD 587/88);
- the church of the Lions at Umm ar-Raṣāṣ (AD 588/89);
- the church of the Rivers at Umm ar-Raṣāṣ (possibly AD 593/94);
- the crypt of the Prophet Elias and possibly the Church of the Virgin Mary, along the Roman road (AD 595/96);
- the three aisled basilica with the southern baptistry chapel at the Memorial of Moses on Mount Nebo - Ṣiyāgha (597/98).

We are, therefore, able to study a group of mosaics laid down during the long episcopate of Bishop Sergius, from 575 to 598, in the territory of Mādabā, which for that period remains the most representative centre in Jordan of the mosaic art.[12] From an inscription in the Cathedral complex we know that Bishop Sergius was succeeded by Bishop Leontius by 603 at the latest.[13]

**The New Churches at Umm ar-Raṣāṣ - Kastron Mefaa**

At Umm ar-Raṣāṣ, so far six churches with mosaics have been excavated. At least four of them were built and mo-



6. Umm ar-Raṣāṣ - Kastron Mefaa. The Church of the Lions (possibly AD 588/89).



7. Umm ar-Raṣāṣ - Kastron Mefaa. The Church of the Priest Wā'il (AD 586).

[10] In M. Piccirillo, 'Umm er-Rasas - Kastron Mefaa. Quinta campagna 1990.' P. 465 in 'Ricerca storico-archeologica in Giordania: X-1990,' *LA* 40 (1990), pp. 453-484.

[11] In M. Piccirillo, 'Sesta campagna a Umm er-Rasas - Kaston Mefaa.' Pp. 522-526 in 'Ricerca storico-archeologica in Giordania: XI-1991,' *LA* 41 (1991), pp. 497-546.

[12] M. Piccirillo, *Chiese e Mosaici di Madaba*. Jerusalem, 1989.

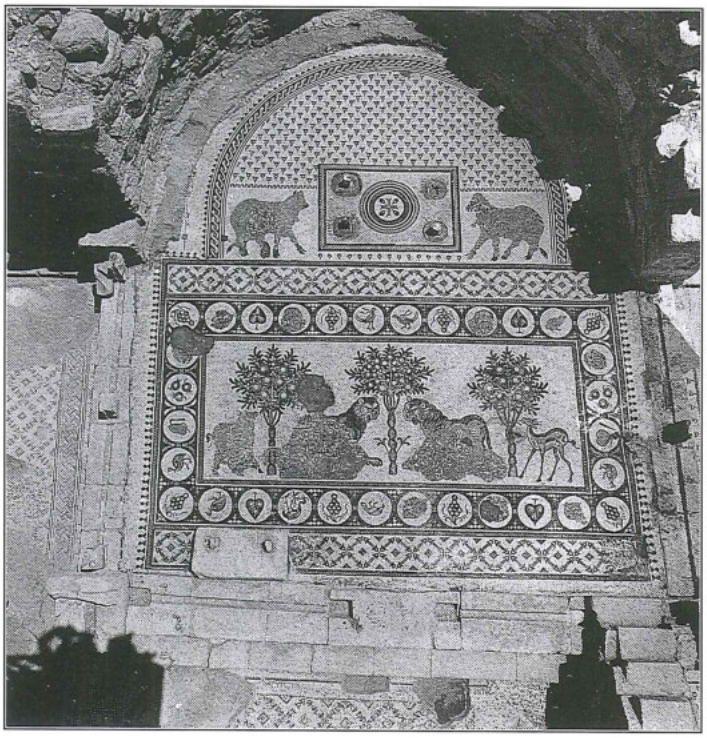
[13] M.-R. Savignac, 'Nouvelle inscription grecque de Madaba,' *RB* 8 (1911), pp. 437-440.

saiced at the time of Bishop Sergius of Mādabā in the territory of which Kastron Mefaa was located. Three have been excavated in the last few years.

*The Church of the Lions* (AD *573/74 or* AD *588/89)* (FIGS. 6, 8)

The church is located in the southern limit of the area outside the northeast corner of the walled castrum, on the north side of an alley that crosses the ruins in an east-west direction. Its excavation has revealed another outstanding artistic work of the mosaicists active in Jordan during the Byzantine period. Unique so far in the diocese of Mādabā, this church is triapsidal, with niches built in the centres of the side apses. The church was built at the time of Bishop Sergius, as stated in a medallion of the central nave: "At the time of the most pious Bishop Sergius was completed this holy temple in the month of Desios of the seventh indiction" (AD 573/74 or 588/89).

The floor was paved with mosaics showing good craftsmanship and fine taste in its general composition and figurative details. The area of the presbytery was divided into two main panels (FIG. 8). A semicircular panel with flowers enclosed in a guilloche decorated the area of the apse behind the altar. The rectangular frame of the altar was decorated with a cross of flowers in a medallion. Two bulls, each with a bell attached to its neck, were depicted on the sides. In the inner frame of the rectangular panel decorating the area in front of the altar, birds alternated with fruits in white medallions on a black background. Two gazelles and two lions facing trees loaded with fruits were represented in the panel.[14] A series of benefactors with their names written near the head were portrayed in the area along the step of the chancel screen. A hunter, accompanied by his dog, shooting arrows with a bow at an unidentified prey, was figured near the base of the pulpit built on the south side. A continuous series of fruit bearers alternating with trees loaded with fruits was depicted in the border frame of the carpet in the main nave. The medallion with the inscription followed by chase and fowling scenes filled the acanthus scrolls of the carpet. Birds were depicted on the sides of an amphora in the semicircular panels of the side apses. Geometric motifs decorated the side aisles and the long intercolumnar panels still visible. The city plan of Kastron Mefaa was added in the east intercolumnar panel of the north row.



8. Umm ar-Raṣāṣ - Kastron Mefaa. The Church of the Lions. The sanctuary.

The main peculiarity of this mosaic floor is the way in which the iconoclasts have intervened in the figures of the presbytery, after destroying all the human and animal figures of the main nave. There, they defaced the two bulls on the sides of the altar, one of the two gazelles, the bodies of the two lions, and some birds of the border frame. However they spared the heads of the two lions, the gazelle on the right side and some birds. This is a strange peculiarity to be added to the dossier of the iconoclastic movement in Jordan.

*The Church of the Priest Wā'il* (AD *586)* (FIG. 7)

The small church was part of a larger ecclesiastical complex, not yet explored, outside the northwest corner of the walled castrum. A door in the eastern wall of the south aisle joined it with the main church to the east. The church was built in the year 586 as stated in the dedicatory inscription in the central carpet: "At the time of the most pious Bishop Sergius, was built and completed this holy temple by care of the priest Wā'il (Walesos, in Greek), in the month of Dios of the fifth indiction of the year 481 (AD 586). This is the priest and his servant".

The western section of the mosaic floor was partially repaired with white tesserae independent of the iconoclastic damage of the figures. The presbytery was decorated with a composition of intersecting and adjacent octagons, forming squares and oblong hexagons in the curb of the apse. The area of the chancel protruding into the nave was decorated with a rectangular panel closed in a polychrome undulating ribbon. Three zebus were figured facing a thick clump of acanthus leaves in the centre from which sprang vine shoots with grapes and tendrils.

[14] The whole decorative programme is paralleled in the mosaic floor of the chapel of the Virgin Mary in the Memorial of Moses on Mount Nebo (M. Piccirillo, *Mount Nebo*. Amman, 1988, pp. 52 f.).

The central carpet in the nave was enclosed in a narrow frame with a continuous series of white medallions on a black background, filled with jars on the corners, flowers, isolated fruits, baskets, a cage, and birds that have been disfigured. A free composition on different layers is represented in the carpet. As written in the inscription, in the first east scene was portrayed the priest Wā'il standing with his arms extended to receive a small branch from a figure (his servant?) seated on the back of a stag. Two other figures each holding a stick were portrayed on the opposite side. It followed a travel scene with a red carriage drawn by a horse proceeding among highly stylized flowers. In the third scene several hounds pursued an unidentified beast. In the bottom scene there remains part of a big-game chase with a horseman spearing a wild beast which was pursued by a dog, while a second horseman followed behind.

In the east intercolumnar space of the southern row, was portrayed a standing figure facing east, dressed in a red mantle with a whip in his left hand. On the opposite intercolumnar spaces there was a sea monster with a twisted body, followed by a Nilotic scene with two boats floating on the water with fish and aquatic flowers. The naked fisherman with a hat is the only figure in the whole composition spared by the iconoclasts. In the fourth intercolumnar space the mosaicists depicted four busts of half naked women holding cornucopias in their left arms, from which water poured out, next to a high building with a red roof, an open door, and three towers with open windows, and smaller houses. Of the fourth woman, only part of the elbow is left.

The two side aisles of the church were decorated with a continuous series of acanthus scrolls filled with living motifs, like sheep, goats, a stag, and a horseman. The eastern end of both aisles was decorated with an isolated square panel with a pomegranate tree on the south, and a palm tree on the north.

*The Church of the Rivers* (AD *578/79 or 593/94)*

Inside the walled castrum explorers have identified four ecclesiastical buildings. The twin churches built against the eastern wall of the castrum have been excavated by the archaeologists of the Max Van Berchem Foundation, starting in 1988.

The semicircular area in the apse in the presbytery of the northern church of the complex was decorated with a field of flowers and two lambs facing the altar. The later construction of a fixed altar caused the destruction of the heads of the two animals. Three trees decorated the rectangular area in front of the altar with figures that have been disfigured by iconoclasts. A man seated on a stool with a flower in his hand can be identified in the first figure to the right. A second figure was harvesting fruit from the tree on the left side beside which a sheep was grazing. The empty area between the chancel screen and the panel was filled with geometrical motifs on the sides, with two pair of partridges facing a bunch of grapes, as well as a pair of peacocks on the west side.

Winged animals facing bunches of flowers decorated the nave along the step of the chancel screen, as in the church of Bishop Sergius. The central carpet was decorated with acanthus scrolls starting with a sea animal in the first row to the east, like the Abyss in the church of Bishop Sergius. The outer frame was decorated with scrolls of vine shoots coming out from the jars held by the four Rivers in the corners. An elongated jar on a pedestal was represented in the central scroll of the east side. Although iconoclasts disfigured the animated motifs of the composition, some intact figures remain, like the River in the southwest corner with a reed in his right hand, followed by a harnessed horse, and a bear-trainer with beard and moustache who held the bear by a rope. In the acanthus scrolls of the carpet one can see the portrait of the same benefactors depicted in the mosaic floor of the Bishop Sergius church.[15] Among the geometrical motifs with which the aisles and the intercolumnar spaces were decorated, was a remarkable medallion with a winged griffin (?) that decorated the area in front of the northern sacristy.

**Analysis**

In the church building program in the city of Mādabā and throughout the region, we have historical evidence of the developing economic welfare of the Christian population of the diocese in the second half of the sixth century. At the time of Bishop Sergius we witness a luxurious building project of new churches and the beautification of old ones with mosaic floors and painted or mosaiced walls, with clergy, rich families, and government officials involved. In Mādabā the large basilicas were built using the architectonic elements of the previous monuments of the Nabataean and Roman periods, thus changing the urban view of the city. It was the end of the Roman pagan city and, at the same time, the final new monumental look of the Christian city of Mādabā. The singular building activity of the time, in which Bishop Sergius was involved, is mentioned in the inscription of the upper church of the Prophet Elias, as we have seen, and in the inscription of the west courtyard of the Cathedral church.

All those sacred buildings were paved with mosaics. The most frequently attested mosaicist of the period is Salaman, who signed the superb medallion of the Sea in the Church of the Apostles (FIG. 2). The pavement of the Church of the Apostles preserves one of the most beauti-

[15] M. Piccirillo, *The Mosaics of Jordan*. Amman, 1993, pp. 240-242.

ful and interesting works of the mosaicists of Mādabā. Even if it is difficult to determine up to what point the hand of the mosaicist Salaman, who signed the central medallion, is to be seen in the whole of the decoration, it is undeniable that in the entire composition, and in its many figurative details, the guidance of a master craftsman is evident in the choice of themes and composition.

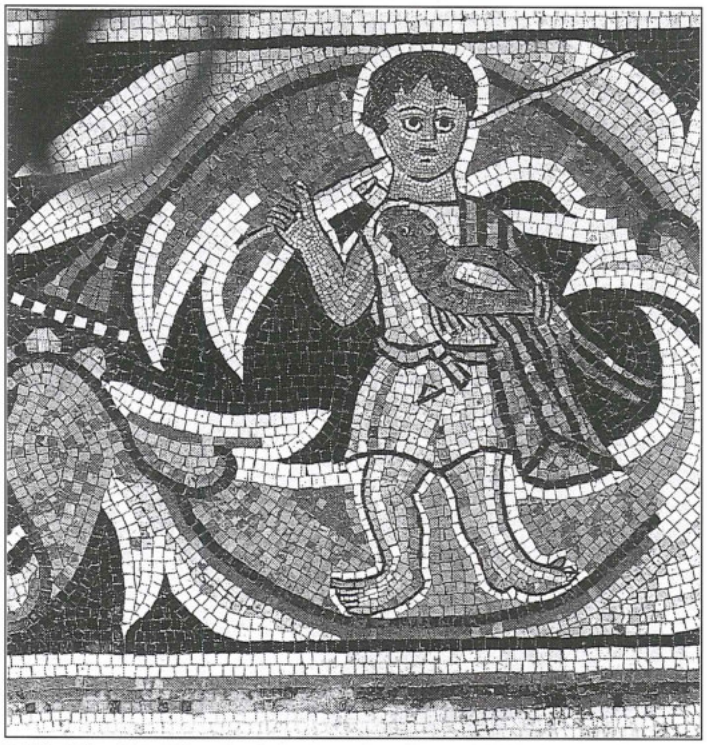
The composition of the carpet rotated around the central medallion with its personification of the Sea, which was superimposed on the grid, covering the nave, was obtained by the systematic repetition of pairs of long-tailed parrots or pheasants facing each other (FIG. 2).[16] The motif, somewhat artificial and methodical, was enlivened on the whole by the insertion of flowers, fruits, and leaves — also repeated with patterned regularity. Among the fruits, one can see pomegranates, melons, bunches of grapes, and pears. Among the flowers, there were anemones and bunches of flowers between a pair of leaves, and what appear to have been the buds of acanthus flowers.

In colour and composition, the richest part of the work was the animated acanthus border that enclosed it, notable for the variety of its iconographic motifs as well as for the technique of its execution. Although the south side has been lost, the other three sides are well-preserved. The corner scrolls of acanthus were decorated with four foliate masks with wide-open eyes, pronounced eye-brows in black continuing down to the line of the nose. The shadings of the face was obtained by using layers of tesserae of different sizes, all in red of different tones, varied according to shape and size to produce the desired effect.[17]

The acanthus scrolls, fifteen of them on the long sides and seven on the short sides, were formed of two leaves that had their origin in a central tuft with buds alternating above and below and repeated after each medallion. The background of the border was of a dark colour, ornamented from time to time with florets in white tesserae. In the central medallion on each side of the border, there was a boy intent on some game (FIG. 9). In all three of the medallions that are still extant, the boy, while barefoot, wore a short white tunic bound at the waist with a red mantle thrown over his shoulders. On the west side, the scene was developed in two medallions: the boy stood on a rudimentary wagon with four wheels drawn by a pair of pheasants or parrots; he had the reins in his left hand and a whip in his right, in a gesture of inciting the birds to race.[18]

In the other scrolls, we have a series of very singular motifs, taken from compositions of much more wide-ranging narrative. On the west side there was figured a crouching cat next to a bird and, on the other side of the boy with the wagon, a bull with a long tail. On the north side, there follow two scenes narrated in two continuous pairs of medallions: one scene was of a wolf advancing toward a bunch of grapes and the other was composed of a brooding hen with her chicks, one of which has jumped up on her back. A pomegranate branch and a bird perched on the bloom of a flower were on each side of the central medallion, followed by a cat in motion and by two gazelles, one standing and the other lying down. Alternating with plants there were a basket filled with fruits and a melon with a knife. In the central scroll, the boy had a stick in his right hand, while holding a parrot with the left hand (FIG. 9). On the eastern side, there were two fruits shaped like elongated squash, and two pairs of parrots, now vanished, accompanying the medallion with the boy and a windmill.[19]

Stylistically, if compared with the earlier mosaics done at the time of Bishop John, such as the pavements



9. Mādabā. The Church of the Apostles. Boy with bird and stick.

16 A motif that parallels contemporary mosaic floors of the region (cf. R. Farioli Campanati, 'Considerazioni sui pavimenti musivi cristiani della Giordania.' Pp. 157-162 in M. Piccirillo, *I Mosaici di Giordania*, Rome).

17 For the historical evolution of this classical motif in the Byzantine period see A. Mazza, 'La maschera fogliata: una figura dei repertori ellenistico-orientali riproposta in ambito bizantino,' *Jahrbuch der Österreichischen Byzantinistik. XVI Internationaler Byzantinistenkongress. Akten. Wien 4-9 Oktober 1981*. Vienna, 1982, pp. 5, 23-32.

18 The scenes of the small circus at Piazza Armerina (A. Carandini, *Filosofiana*, Palermo, 1982, p. 283). Cf. K. M. D. Dunbabin, *The Mosaics of Roman North Africa. Studies in Iconography and Patronage*. Oxford 1978, pp. 88-108.

19 See P. Testini, 'Gli animali tra apparato decorativo e simbologia.' Pp. 135-142 in M. Piccirillo, *I mosaici di Giordania,* Rome, 1986.

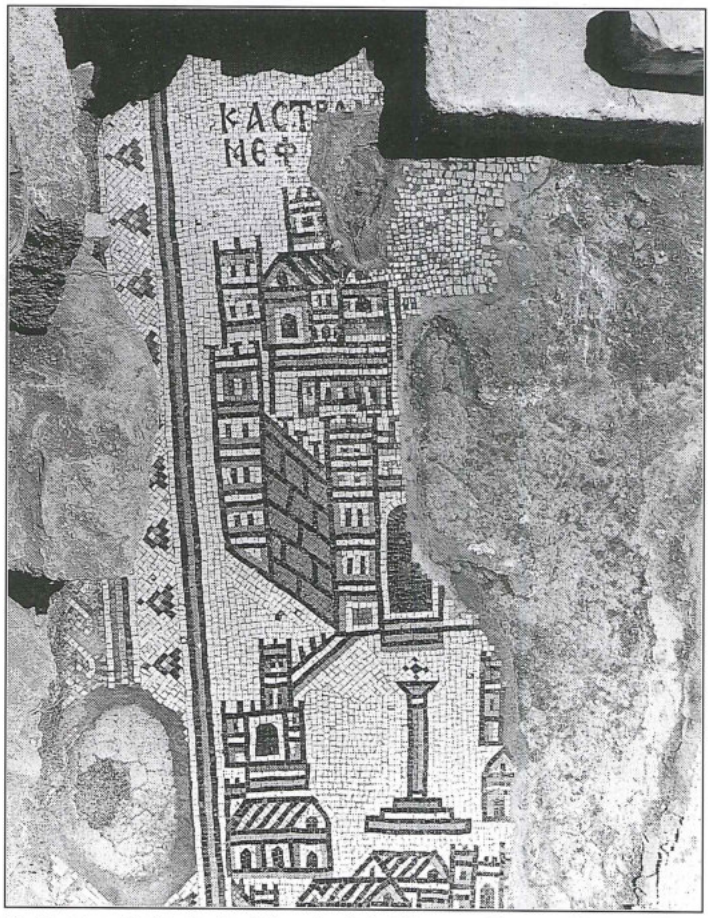
of the church of Saints Lot and Procopius, the upper chapel of the Priest John at al-Mukhayyaṭ, and the chapel of Saint Theodore at Mādabā, the work has lost the organic quality of the whole, namely, the compositional equilibrium that was the greatest merit of the preceding works, a quality that we can still enjoy in the baptistry chapel of the Cathedral, the first work of this period. If we linger to observe the superb medallion of the Sea at the centre of the nave, the bulls and rams solidly constructed at the entrance of the church, and the compositional delicacy of the border, we might forget some of the monotonous and somewhat artificial composition of the grid of the nave. Salaman with his personality, in my view, brought a new floral style to Mādabā that gave more emphasis to gigantic botanical motifs. This is not the case of the leaves, the pumpkins, the watermelons, and the melons of the composition found also in the baptistry of the Cathedral church, and in the diakonikon of the Memorial of Moses at Nebo.[20]

It is stylistically interesting to examine the four contemporaneous pavements of Umm ar-Raṣāṣ, where we can detect at least two teams of mosaicists at work. The team responsible for decorating the church of the Lions was particularly skillful in the rendering of the animals and trees in their geometric setting. The other team was responsible for the decoration both of the church of Bishop Sergius and of the church of the Rivers where the same patterns were used with the same rendering of design and colour. On the basis of this identity, the 12th indiction year, still readable in the destroyed dedicatory inscription near the door of the church of the Rivers, can be fixed to the year 578/79 or 593/94, at the time of Bishop Sergius. To them we can add the mosaic of the church of the Priest Wā'il, more naive and inaccurate, but using the same technique in rendering colour.

From the comparison between those programs and the mosaic floors of the churches in Mādabā and in the Memorial of Moses on Mount Nebo, we can deduce that several mosaic workshops were working in the diocese of Mādabā at the same time. They used the same sketch book circulating among them, although they differentiate from each other in the final result. The best example of this sketch book is the gazelle that we can see in the church of the Lions at Umm ar-Raṣāṣ and in the chapel of the Virgin Mary in the Memorial of Moses on Mount Nebo.[21]

The iconographic motifs used in the mosaic programs are a continuation of the inspired classical artistic and cultural renaissance of the Justinianic era. Most frequent are the scenes of flocks grazing, of agriculture, of vintage, of the chase, together with isolated motifs of flora and fauna, and architectonic representations of church buildings and cities, a common motif in the mosaics of Jordan. Unusual is the travel scene with a carriage drawn by a horse among stylized plants in the church of the Priest Wā'il at Umm ar-Raṣāṣ.[22] To the scenes of the terrestrial world, are added the classical personifications, typical of the epoch, like the Sea in the church of Apostles, the Abyss, the Earth, and the Seasons in the church of Bishop Sergius and in the church of Priest Wā'il, and the Rivers in the church inside the castrum.[23]

Of historical and artistic importance is the city plan of Kastron Mefaa that decorates the northern intercolumnar space of the church of the Lions (FIG. 10). Thanks to this discovery, we can compare this plan with that of the same city found in the church of Saint Stephen and dated to the Umayyad period (FIG. 11).[24] The plan of Kastron Mefaa in the church of Saint Stephen is more schematic




10. Kastron Mefaa in the Church of the Lions at Umm ar-Raṣāṣ - Kastron Mefaa (possibly AD 588/89).

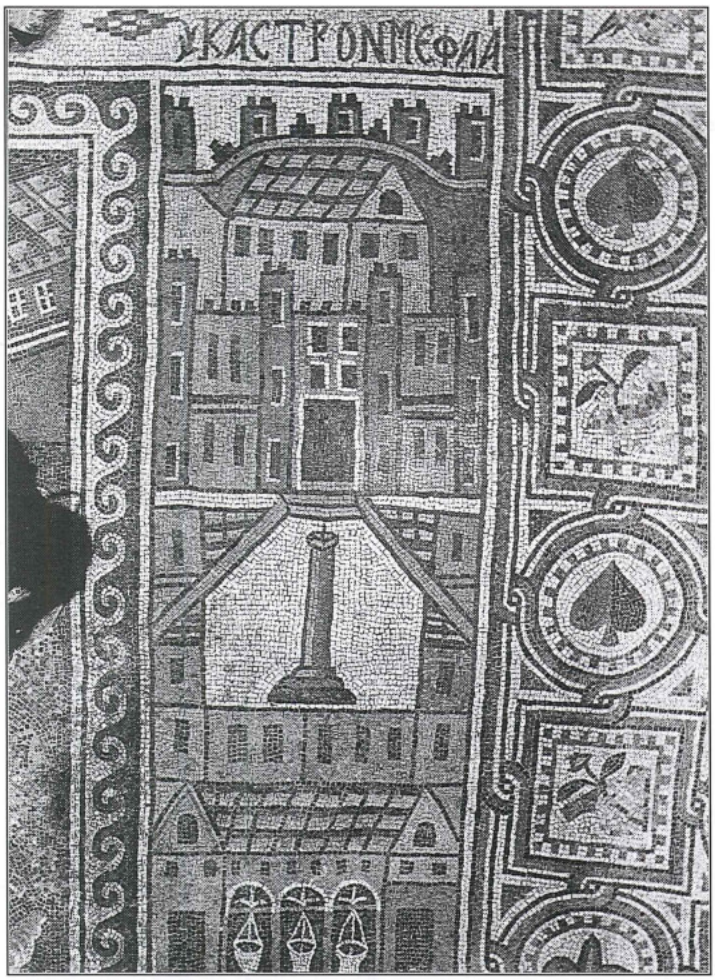
[20] S. Saller, *The Memorial of Moses, II*. Jerusalem 1941, PLS. 99-101.

[21] Piccirillo, *Mount Nebo*, p. 54.

[22] A quite similar scene exists in the north aisle of the Michaelion at Huarte in Syria, see P. Canivet and M. T. Canivet, *Huarte. Sanctuaire chrétien d'Apamène (IVe - VIe s.)*. Paris, 1987, I, 216-220; II, PLS. 120.

[23] The personifications of the rivers of Paradise decorate the four corners inside the carpet in the chapel of S. Theodore in the Cathedral church of Mādabā, see M. Piccirillo, 'La "cattedrale" di Madaba,' *LA* 31, (1981), p. 304, PL. 78-79.

[24] M. Piccirillo, *Chiese e mosaici di Madaba*, p. 294.




11. Kastron Mefaa in the Church of St. Stephen at Umm ar-Raṣāṣ - Kastron Mefaa (eighth century AD).

compared to this new plan. Here we can see clearly the intention of the mosaicists to depict Kastron Mefaa in its urban identity, with the walled castrum and the northern quarter outside the walls. A church and a smaller building of an unidentified nature are depicted inside the castrum. The outer quarter also is walled, like the town, and is united to it by a wall of a small size. Four churches are depicted inside the perimeter of the quarter, where, as in the plan of Saint Stephen, an open space with a column raised on a step platform was depicted. Here, a cross is added to the capital on the top of the column. Given the realistic rendering of the city, we have to imagine a real votive column standing in the middle of the ruins, the nature of which is still unknown.

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# Inscriptions grecques des carrières de Ḥallābāt

A 4 km environ au sud/sud-ouest du Qaṣr al-Ḥallābāt se trouve un site de bancs rocheux calcaires parallèles, en pente douce du sud vers le nord. On distingue des traces d'extraction de blocs. Trois groupes de textes grecs[1], A, Ba et Bb, et C, côtoient des inscriptions en arabe[2]. Les quatre inscriptions grecques sont gravées sur la partie plate des rochers, de telle manière que le visiteur, qui les lit toutes le visage tourné vers le sud, peut les piétiner. Le texte A est le plus au sud, B à 40 m environ, et C à une trentaine de mètres de B.

– A. Dimensions: 35 x 244; h.l., 9-11 (FIG. 1).

† Ἐν τῷ καμ[...] τούτῳ μνησθῆ
Θεόδωρος ὁ διάκ(ονος) (καὶ) ἐπιμελητής.

«Dans ce ... , que soit commémoré Théodore, diacre et épimélète.»

Notes critiques: Lettres rondes sauf un *sigma* carré, l. 1. Abréviation, l. 2, par un trait diagonal coupant le pied de *kappa;* le sigle S remplace le καὶ. Μνησθῆ pour Μνησθῇ banale confusion de voyelles.

Il faut à la l. 1 restituer soit un formulaire, soit la désignation du lieu où se trouve l'inscription.

– B, a) et b). Deux inscriptions au voisinage l'une de l'autre, superposées (FIGS. 2, 3).

Dimensions: a) 165 de largeur; h.l., 12-14.
b) h.l., 12-14.

a) † Θεοδώρου, ἐπιμελητοῦ ἁγ(ίου)
Ἰωάννου, τοῦ κυαίστορος.
Κ(ύρι)ε, σύνπραξον· ἰνδ(ικτιῶνος) θ',
μη(νὶ) Μαΐου.

«De Théodore, épimélète de Saint-Jean, questeur. Seigneur, viens à (son) aide; 9e année de l'indiction, au mois de mai.»

Notes critiques: Lettres rondes. Abréviations, par le sigle S à la fin de la l. 1, par le trait diagonal coupant le pied du *delta* l. 3, par



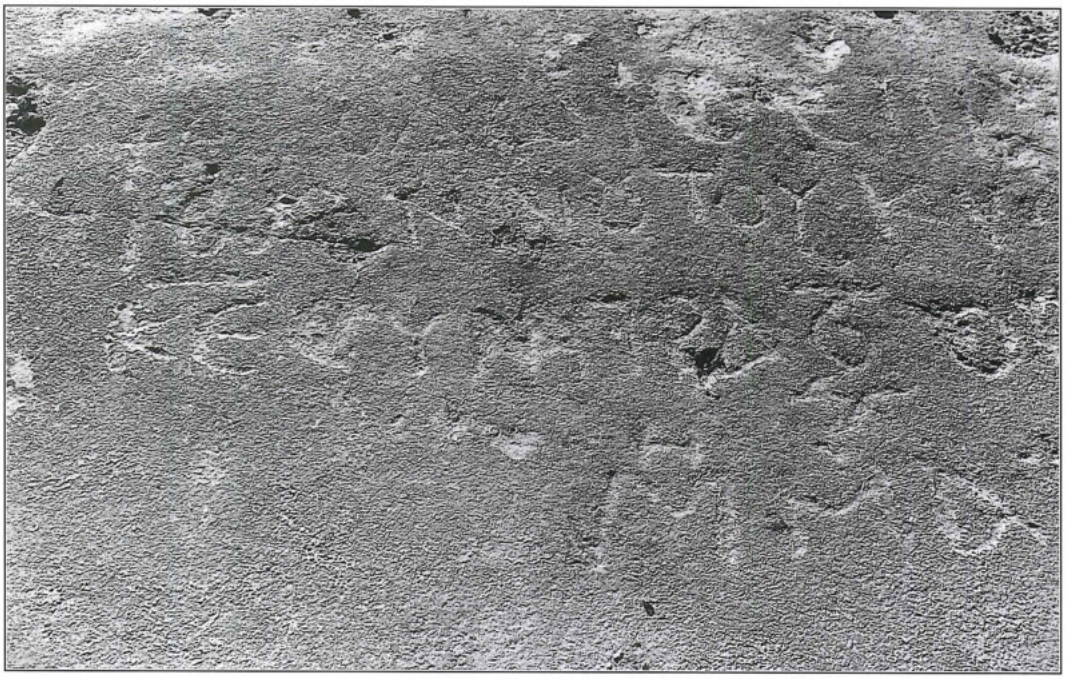
1.

[1] Le regretté Jean Marcillet-Jaubert m'avait signalé le site et m'avait invité à m'y rendre. Je remercie M. M. Ghazi Bisheh et François Villeneuve qui m'ont fourni des renseignements et des photos et m'ont accompagné sur place.

[2] Et peut-être en une autre langue.



2.



3.

réduction du *èta* au-dessus du *mu* l. 4. Ligature de la diphtongue ου à la fin des noms propres l. 1 et 2. Tilde sur l'abréviation de K(ύρι)ε, l. 3, et sur le chiffre.

L'auteur de ce texte ne se soucie guère des articles. Il est difficile de déterminer si Théodore est questeur ou si l'on parle de «saint Jean le Questeur». Ce saint n'étant pas connu par ailleurs, la vraisemblance paraît en faveur de la traduction «Théodore, épimélète..., questeur».

b) † Σέργις Καστρικίου.

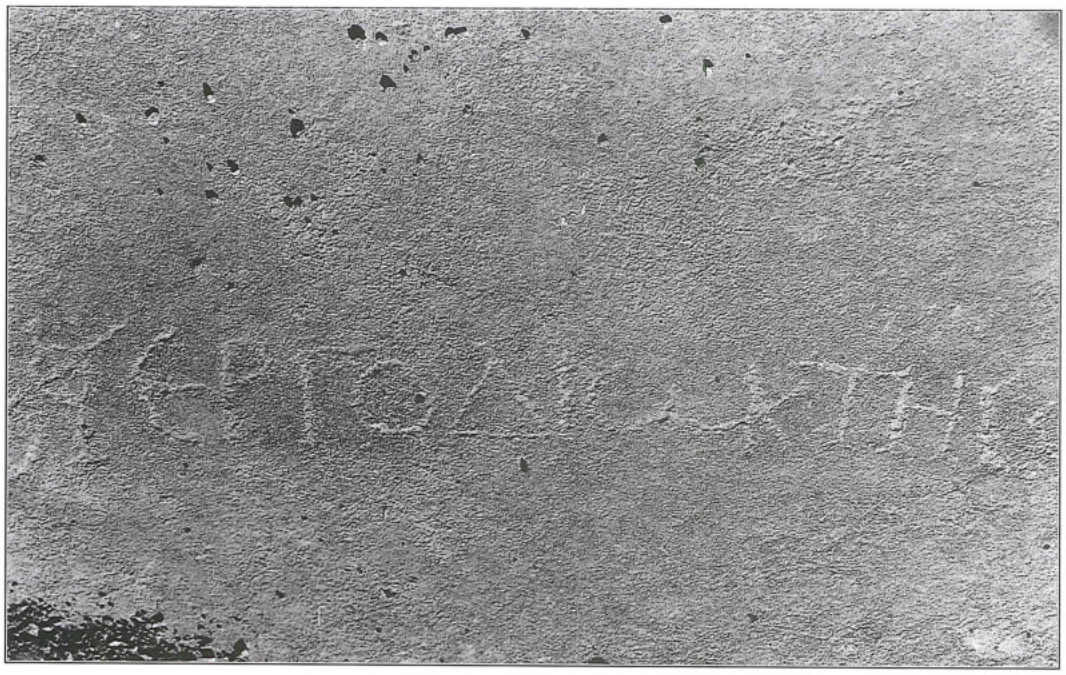
«Serge fils de Castricius.»

Note critique: Un nom propre semble beaucoup plus approprié que le terme de *castricius,* très rare pour désigner un militaire. Les difficultés de la lecture des lettres finales n'empêchent pas que le second *kappa* soit bien lisible. On doit donc éliminer les hypothèses de type *castrensis* ou *castrensianus.*

- C. Dimensions: 277 ; h.l., 12 (FIG. 4).

Μνησθῇ Ζήνων Πορφ(υρίου) ἐργοδιώκτης φυλῆς Ἀθηνᾶς του[ - - ].

«Que soit commémoré Zénon, fils de Porphyre, chef du chantier de la tribu d'Athéna ...»



4.

Notes critiques: Écriture légèrement différente de celle des autres textes, avec des *sigma* carrés et de nombreuses ligatures (*mu-éta*, dans le premier mot; *éta-sigma* dans le cinquième; *oméga-kappa; éta-nu* dans le sixième mot). La barre d'abréviation diagonale coupe le *rho* et le *phi* ostensiblement.

Le mot qui suit le premier nom ne me paraît pas pouvoir être autre chose qu'un nom propre, bien qu'il ne soit pas très courant de les abréger. Un adjectif ethnique, appliqué à Zénon, ou une précision concernant la fonction de chef de chantier me semble impossible[3].

Ces textes brefs sont destinés à commémorer la présence en ce site de trois personnages, Théodore, Serge et Zénon. Sans qu'il soit possible de le prouver, je penserais, vu la modestie des traces d'extraction, qu'il s'agit de trois personnes qui ont participé à la même opération. La carrière a donc servi, de manière occasionnelle, à fournir des matériaux de construction, à l'époque byzantine puis plus tard. La présence des croix, au début de trois des quatre textes, la datation par l'indiction et le mois latin, et surtout les fonctions mentionnées permettent, approximativement, de dater ces inscriptions de la période du 5e au 7e s.[4].

Théodore, présent dans deux textes, paraît le personnage le plus important du groupe. Les inscriptions qui le mentionnent sont développées et l'on remarquera la belle ordonnance de l'inscription B a), qui demande pour lui le secours divin. C'est lui le responsable de l'opération d'extraction des blocs, à n'en pas douter pour le sanctuaire dont il est épimélète. Cette fonction, héritée directement des usages des cités de l'époque impériale, est intéressante à l'époque chrétienne. Il s'agit donc de la responsabilité, d'abord financière, d'une opération de construction. Le diacre Théodore est chargé de gérer des fonds et de superviser des travaux de réparation ou de construction d'un bâtiment consacré à saint Jean (le Baptiste ou l'Évangéliste[5]). La mention de la fonction de questeur est très précieuse. Puisqu'il ne peut s'agir des hautes dignités de «questeur du sacré palais» ou de *quaestor exercitus,* il ne reste plus que la magistrature municipale. Le terme appartient au vocabulaire latin et a été simplement transcrit en grec[6], montrant une forte influence des institutions romaines. La fonction est financière et l'on comprend que le diacre Théodore ait été choisi comme responsable des travaux du sanctuaire de saint Jean, puisqu'il était questeur de la cité où, selon toute vraisemblance, se trouvait ce bâtiment.

La situation de al-Ḥallābāt, à proximité de trois cités, Philadelphie au sud-ouest, Gérasa au nord-ouest et Bostra au nord, est assez claire. Les sites de Samra et Riḥāb, à l'ouest de al-Ḥallābāt, et à l'est de Gérasa, appartenaient au territoire de Bostra, comme le montrent leurs inscriptions. Le choix ne peut donc se faire qu'entre Philadelphie-ʿAmmān et Bostra-Buṣrā. On préfèrera Bostra, en dépit de son éloignement (40 km environ). Le titre

[3] Bien sûr, on penserait à la mention du «porphyre» ou d'une pierre rouge, mais il s'agit, dans cette carrière, de calcaire blanc, et un mot formé sur la racine «porphyre» pour désigner tout type de carrier n'est pas connu.

[4] La période islamique est exclue, à cause d'abord des fonctions et aussi des croix; le quatrième siècle, où les constructions chrétiennes sont rares, serait étonnant.

[5] En Arabie, dans les cités qui entourent le secteur de Hallabat, la seule église connue dédiée à l'un des saints Jean est Saint-Jean-Baptiste à Gérasa.

[6] On trouve κυαίστωρ comme ici, ou κουαίστωρ.

de colonie a été, en effet, attribué à Bostra par Alexandre Sévère et des questeurs y sont mentionnés dans deux inscriptions[7]. Philadelphie, en revanche, a conservé ses institutions grecques sans recevoir le statut colonial.

Le rôle de Serge, fils de Castricius, est indéterminable. Au contraire, celui de Zénon, fils de Porphyre, est bien défini par le terme d'ἐργοδιώκτης , c'est-à-dire chef de chantier ou contremaître. Il s'agit du responsable technique de l'opération d'extraction et de taille, chargé de diriger les ouvriers[8]. La mention de la tribu d'Athéna, à la suite de l'indication de fonction, est plus qu'un complément d'état-civil. La tribu a donc participé en tant que telle aux travaux. On peut penser que le chantier de Saint-Jean a été confié à la tribu d'Athéna ou, et c'est l'hypothèse la plus vraisemblable, que les travaux ont été partagés entre plusieurs tribus. Il me paraît probable que le cadre de la tribu a été utilisé pour le recrutement de la main d'œuvre.

On connaît une série de textes, inédits, où sont mentionnées les tribus civiques de Gérasa; la tribu d'Athéna n'y figure pas. Les noms de divinités s'appliquent aux tribus civiques, non aux tribus indigènes[9], dont les noms sont clairement sémitiques (sobriquets, noms dérivés d'un ancêtre commun ou d'un toponyme). C'est de nouveau vers Bostra, en l'absence de tout renseignement pour Philadelphie, qu'il faut s'orienter. La tribu d'Athéna est certainement l'une des composantes du corps civique, à côté de la tribu de Zeus, de la tribu Romana et de quelques autres, encore inconnues. La popularité de la déesse Athéna-Allat à Bostra rend tout naturel cet usage de son nom[10].

Ces textes, brefs et d'apparence pauvre, fournissent quelques renseignements sur l'exploitation de la carrière. Ils montrent qu'un chantier temporaire, confié à une équipe d'ouvriers — peut-être recrutés dans l'une des tribus de Bostra — a été dirigé par Zénon et supervisé financièrement par le questeur et diacre Théodore. Le lien entre l'extraction des pierres et les travaux de construction ou d'aménagement est direct; on prépare des matériaux quand on en a besoin et pour un bâtiment bien précis. La participation de la cité aux travaux d'un édifice religieux me paraît démontrée. Ainsi on n'hésite pas à ouvrir une carrière à une quarantaine de kilomètres de Bostra. La raison principale est certainement la qualité de la pierre. On avait sans doute besoin de telle ou telle sorte de calcaire pour Saint-Jean. Bostra, ville presque totalement construite en basalte, possède quelques monuments en calcaire[11]. La carrière a été exploitée, à l'époque byzantine, bien avant la construction du Qaṣr al-Ḥallābāt sous les Omeyyades.

Ces textes fournissent l'attestation nouvelle d'une tribu, qui a gardé le nom d'une divinité païenne, et mentionnent la fonction de questeur, manifestant à l'époque chrétienne la permanence des institutions politiques de la période impériale. Ils montrent également que Bostra possédait un vaste territoire dans la zone steppique au sud de la ville[12].

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[7] M. Sartre, *Bostra des origines à l'Islam*, Paris, 1985, p. 76-77 et 81; cf. *IGLS*, 13, 9029 et 9112 (daté de 325-326).

[8] *Septante, Exode*, 3, 7; 1 *Esdras*, 5, 56; cf. 2 *Chron.*, 8, 10. Il y a dans ces textes l'idée de direction d'un groupe de personnes. Le nom et la fonction voisins d' ἐργοδότης, fréquents dans les carrières, en particulier en Egypte, sont analysés par H. Cuvigny, 'Inscription inédite d'un ἐργοδότης dans une carrière du Mons Claudianus', *Itinéraires d'Egypte, Mélanges Maurice Martin*, Le Caire, 1993, p. 73-88, avec p. 82, un exemple de confusion volontaire entre les deux mots par Grégoire de Naziance (*PG* 36, 644 A) à partir d'*Exode*, 3, 7.

[9] M. Sartre, 'Tribus et clans dans le Hawran antique', *Syria*, 59, 1982, p. 77-91.

[10] M. Sartre, *Bostra des origines à l'Islam*, Paris, 1985, p. 59-60.

[11] Renseignements oraux de Maurice Sartre, que je remercie: quelques inscriptions sont gravées sur du calcaire; quelques colonnes, dans la rue près du théâtre, sont en calcaire.

[12] Denis Feissel me signale que tous les fragments connus de l'«édit d'Anastase» ont, ainsi, été trouvés sur le territoire de Bostra (Bostra, Imtān, Ṣalkhad, Umm al-Jimāl, Ḥallābāt).

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# Inscriptions et espaces d'écriture au Palais d'al-Kharrāna en Jordanie

Depuis 1987, la Mission Française d'épigraphie islamique en Jordanie a entrepris de constituer un Corpus des Inscriptions Arabes de Jordanie. Ce Corpus réunit à ce jour plus d'une centaine d'inscriptions, uniquement pour la région centrale, al-Balqā'. Les palais du désert (*quṣūr*) tiennent dans ce Corpus une place de choix par le nombre important d'inscriptions et de graffiti qui y ont été relevés. Les palais d'al-Mushattā et d'al-Kharrāna sont, à ce titre, dignes de mention. En 1987 et 1988, lors de la prospection systématique d'al-Mushattā plus de 30 inscriptions et graffiti furent recensés[1]. A Qasṭal al-Balqā', à quelques kilomètres de là, une nécropole islamique d'époque umayyade et abbasside fut mise à jour en 1985, et livra 17 stèles funéraires[2]. Le palais d'al-Kharrāna demeure néanmoins le plus riche en inscriptions peintes et gravées.

Le palais se trouve à environ 55 km à l'est d'Amman, et à 30 km du petit village d'al-Muwaqqar sur la route d'al-Azraq. Il est bâti sur un petit monticule qui domine le Wādī al-Kharrāna, affluent du grand Wādī as-Sirḥān. Le *qaṣr* occupe dans la plaine une position stratégique; de plan rectangulaire, il se compose de deux étages. L'entrée principale se situe au sud de l'édifice; des tours de contrefort marquent les quatre angles tandis que deux autres (semi-circulaires) sont placées au milieu des façades est et ouest. Les 61 pièces s'organisent autour d'une cour centrale; on en compte 25 au rez-de-chaussée et 36 à l'étage.

Qaṣr al-Kharrāna fut passablement étudié par Gray Hill en 1896, puis par A. Musil qui le mentionna au sujet de Quṣayr 'Amra en 1907. La première étude sérieuse fut celle de Jaussen et Savignac, en 1922, qui tentèrent de discerner les diverses influences perses et syriennes, mais sans nettement trancher. J. Sauvaget le compta au nombre des palais umayyades, mettant un terme aux spéculations sur son appartenance à l'époque anté-islamique; seul Creswell le tint encore pour sassanide. En 1987, S. Urice publia une étude très complète où il fit le point sur les diverses théories de datation, penchant lui-même pour une datation umayyade de l'ensemble[3].

Il semble que l'étude du palais soit indissociable de celle de son inscription majeure, un graffito à l'encre noire de onze lignes, daté de 92 h./ 710. Son importance au sein des hypothèses de datation n'a échappé à personne. Il fut relevé pour la première fois par B. Moritz au début du siècle[4], qui n'en déchiffra qu'une infime partie. C'est en 1911 que Jaussen et Savignac portèrent leur attention sur ce graffito et fournirent le premier fac-similé ainsi qu'une lecture[5] qui, bien que fautive car n'étant pas l'œuvre de spécialistes, eut le mérite de servir de base aux travaux qui allaient suivre. Nabia Abbott, en 1946, en fournit une lecture quasi complète[6]. Le fait que l'on se soit focalisé sur cette inscription, considérée à juste titre comme un jalon dans l'histoire de l'écriture arabe, a occulté la présence de nombreuses autres inscriptions gravées et peintes à l'encre. Certes, elles sont d'un moindre intérêt mais une mission épigraphique se devait de les relever.

Nous présentons ici un choix de 20 inscriptions peintes et gravées parmi les plus intéressantes. Beaucoup d'entre elles sont en fort mauvais état de conservation et notamment les inscriptions à l'encre. Celles que Jaussen et Savignac déchiffraient au début du siècle sont aujourd'hui partiellement effacées.

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1 F. Imbert et S. Bacquey, 'Sept graffiti au palais de Mushatta', *ADAJ* 33 (1988), pp. 259-267.

2 F. Imbert, 'La nécropole islamique de Qasṭal al-Balqā' en Jordanie', *Archéologie islamique* 3 (1992), pp. 17-59.

3 Pour les études sur al-Kharrāna, on pourra se référer aux publications suivantes: Gray Hill, *PEFQS* (1896); A. Musil, *Kusejr 'Amra*, Wien, 1907; Jaussen et Savignac, *Mission Archéologique en Arabie, III*, Paris, 1922; J. Sauvaget, 'Remarques sur les monuments umayyades, I : Châteaux de Syrie', *Journal Asiatique* (1939); K. A. C. Creswell, *Early muslim architecture*, I, Oxford, 1969; H. Gaube, 'Amman, Ḥarāne und Qasṭal, Vier Frühislamische Bauwerke in Mittel Jordanien', *ZDPV* 93 (1977); S. Urice, *Qaṣr Kharrāna in the Transjordan*, American Schools of Oriental Research, Durham, 1987.

4 B. Moritz, 'Ausflüge in der Arabia Petraea', *M.F.O.*, 1914-21, T.3, fasc. 1, p. 442.

5 Jaussen et Savignac, *op. cit.*, p. 100-102 et PL. LVIII.

6 N. Abbott, 'The Ḳaṣr Kharāna inscription of 92 h. (710 A.D.), a new reading', *Ars Islamica* 11-12 (1946), pp. 190-195.

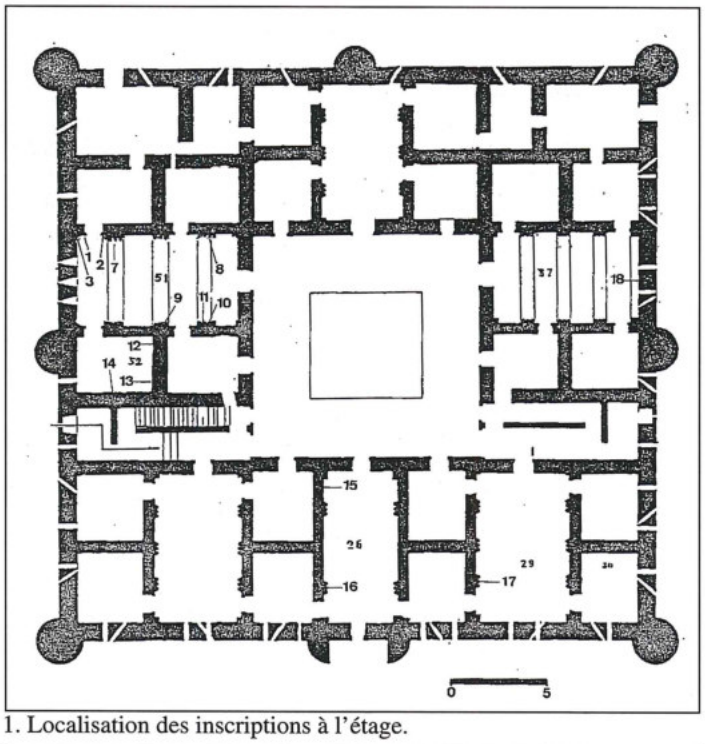
**Les inscriptions** (FIG. 1)
Dans le catalogue qui va suivre, les inscriptions ne sont pas classées chronologiquement pour de réels problèmes de datation, mais selon leur situation dans le palais. Nous avons pris comme point central la salle 51 (selon la numérotation des salles de Jaussen et Savignac reprise par S. Urice). Cette salle est la plus riche en inscription et tient la place la plus importante au sein du palais. Les salles sont ensuite classées selon leur degré d'éloignement de la salle 51. Le rez-de-chaussée, moins riche en inscriptions est cité en fin de catalogue.

## I- LES INSCRIPTIONS PEINTES À L'ENCRE

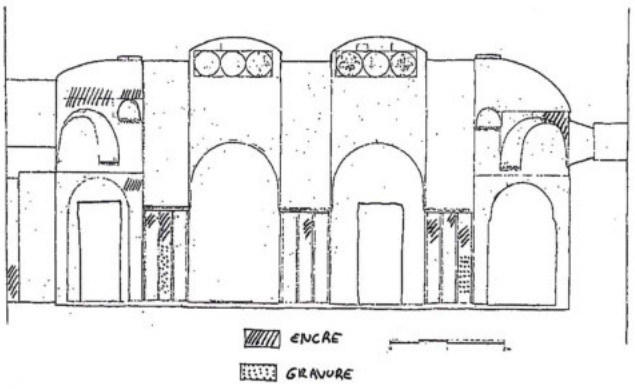
### a) Salle 51 (FIGS. 2, 3)

*1- Graffito daté (92/710)* (FIG. 4)
Cette inscription à l'encre datée est sans nul doute la pièce maîtresse du palais d'al-Kharrāna. N. Abbott en donna la première lecture scientifique[7]. Elle ne travailla, pendant la seconde guerre mondiale, qu'à partir de photographies et des relevés lacunaires de Jaussen et Savignac. Jamais elle ne se rendit sur le site.
*Localisation*: sur le mur nord de la salle 51, au-dessous de l'écoinçon de droite, au-dessus de la porte, à 246 cm du sol.
*Description*: 11 lignes d'une écriture coufique archaïque d'époque umayyade à l'encre tracée à l'aide d'un pinceau ou d'un *qalam* fin. La partie droite est très effacée, ainsi que les trois dernières lignes. Des tâches sombres apparaissent à plusieurs endroits. Nous attirons l'attention sur le fait que cette célèbre inscription à l'encre est en train de se détériorer rapidement par disparition de la pigmentation de l'encre sur le mur.
*Dimensions*: surface écrite: 60 X 26 cm.
*Publications antérieures*: B. Moritz, 'Ausfülge in der Arabia Petraea', *M.F.O.*, 1914-21, T.3, fasc. 1, p. 442; Jaussen et Savignac, *Mission archéologique en Arabie, III*, Paris, 1922, pp. 100-102; N. Abbott, 'The Ḳaṣr Kharrāna inscription of 92 h. (710), a new reading', *Ars Islamica* 11-12 (1946), pp. 190-195; *R.C.E.A.*, 1/18, N° 20; S. Urice, *Qaṣr Kharrāna in the Transjordan,* ASOR, 1987, p. 7 et n. 2-3, p. 22.

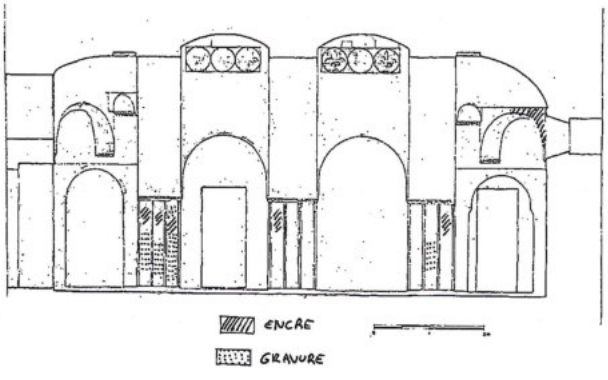
١) اللهم أرحم عبد [ا]لملك ابن (sic) عمر واغفر له
٢) ذنبه ما تقدم منه وما تأخر وما أسر وما أعلن
٣) وما أنت أعلم به هو ...فا ... لك إلا تغفر لي وترحمني
٤) أكن من الخسرين (sic) رب تمن عليّ فإنك أنت المنان وترحم
٥) عليّ فإنك أنت الرحمن اللهم إني أسـ(ـأ)لك (sic) أن
٦) تقبل منه د[عاءه ؟] وصلاته ... آمين رب العلمين (sic) رب
٧) موسى وهرون رحم الله من قرأه ثم قال آمين آمين رب
٨) ... العزيز العظيم وكتب عبد الملك بن عمر يوم



1. Localisation des inscriptions à l'étage.

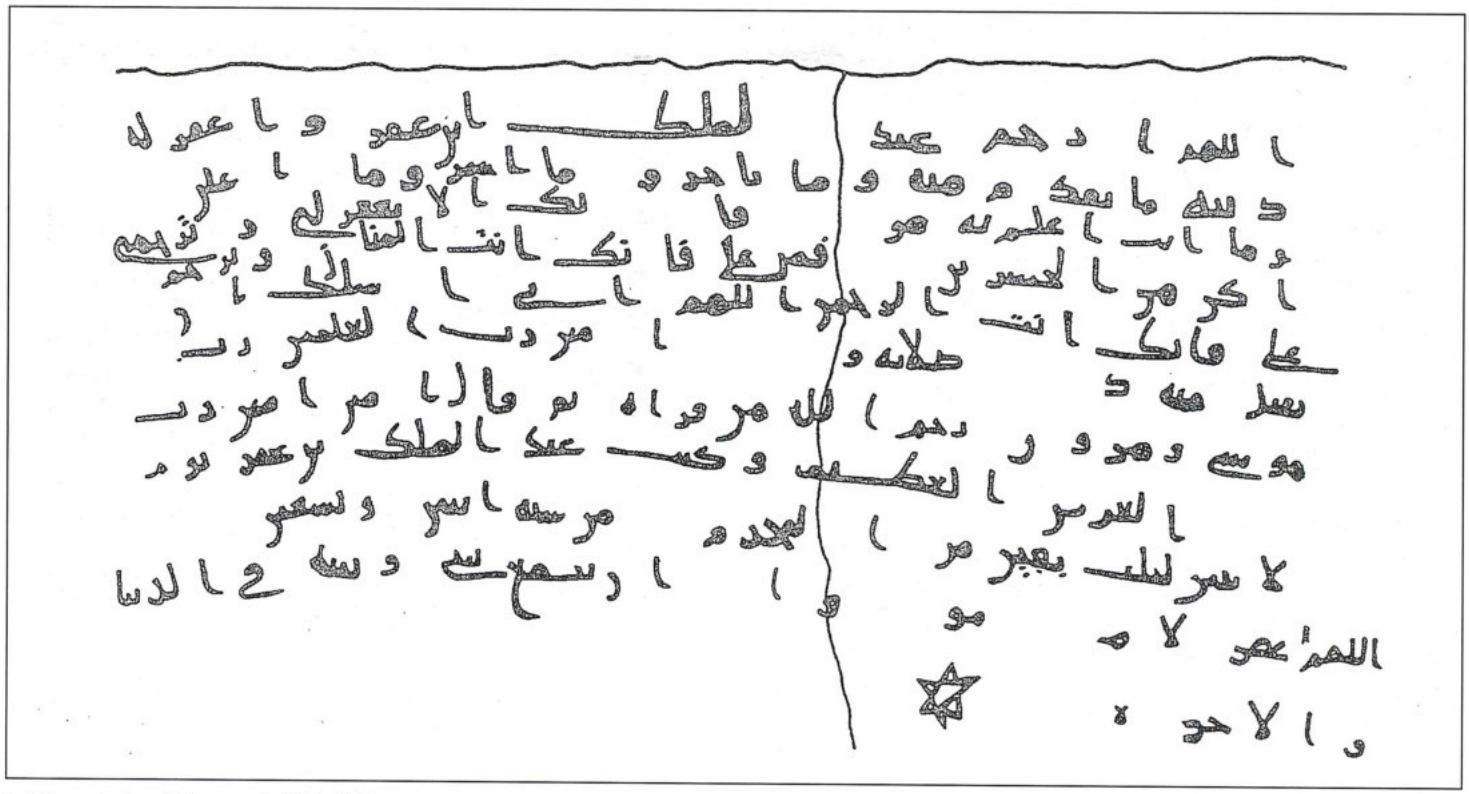


2. Encre et gravure sur le mur nord, salle 51 (d'aprés Urice).



3. Encre et gravure sur le mur sud, salle 51 (d'aprés Urice).

[7] *Idem.*



4. L'inscription à l'encre de 92 h. 710.

٩) الإثنين لثلث (sic) بقين من المحرم من سنة إثنين و تسعين
١٠) اللهم اغفر لأم مو ... وا ... ان تجتمع بنبي ونبيه في الدنيا
١١) والآخرة

1) *O Dieu, accorde ta miséricorde à 'Abd al-Malik b. 'Umar et pardonne-lui*
2) *ses péchés, passés et à venir, cachés ou déclarés*
3) *et ce que toi seul connaît ... Si tu ne me pardonnes pas et si tu ne m'accordes pas ta miséricorde*
4) *je serais au nombre des perdants. Seigneur, tu m'accordes tes bienfaits, tu es certes le Bienfaiteur et tu m'accordes ta miséricorde*
5) *car tu es le Miséricordieux. O Dieu, je te demande*
6) *d'accepter (sa supplication ?), sa prière et ... Amen! Seigneur des mondes, Seigneur*
7) *de Moïse et d'Aaron. Que Dieu fasse miséricorde à qui l'a lu puis a dit Amen! Amen! Seigneur*
8) *(des mondes?) le Puissant, l'Auguste. 'Abd al-Malik b. 'Umar a écrit*
9) *lundi, trois nuits avant la fin de Muḥarram de l'année 92 (Lundi 24 novembre 710)*
10) *O Dieu, pardonne à Umm ? ... faire rencontrer mon Prophète et le sien, en ce monde*
11) *et dans l'autre.*

*Ligne 1:* nous confirmons la lecture du nom du personnage 'Abd al-Malik b. 'Umar proposée par N. Abbott et corrigeant celle de Jaussen et Savignac ('Ubayd).

*Ligne 2*: وما أسر (ce qui est caché) et non *min mā asarra*, comme le proposait N. Abbott. S. Urice, en 1987, avait déjà relevé cette "erreur mineure"[8]. La façon dont l'invocation est exprimée est conforme au verset coranique (Cor. **2**, 77) dont elle est une inspiration.

*Ligne 3*: وما أنت أعلم به (ce que toi seul connais); cette partie du formulaire s'inscrit directement à la suite de l'invocation qui a précédé. N. Abbott proposait de lire *"wa mā aḥad kāna min nafsi-hi"* dont le sens est peu clair. L'inscription est très effacée à cet endroit. Au milieu de cette ligne, deux mots sont actuellement illisibles. La lecture qu'en donnait Abbott (*qābil la-ka)* paraît caduque du fait de notre nouvelle lecture du début de la ligne. A la fin de la ligne, le pronom affixe employé est celui de la 1ère personne du singulier: وترحمني تغفر لي et non celui de la 3ème personne (*tagfir la-hu*): le *yā'* final se développe sous la ligne de base vers la droite, comme c'est généralement le cas dans les graphies coufiques de cette époque. A preuve qu'il s'agit du début du verset coranique (Cor. **11**, 47) "Si tu ne me pardonnes pas et si tu ne me fais pas miséricorde, je serai au nombre des perdants".

*Ligne 4:* أكن من الخاسرين suite du verset sus-cité et non lu par N. Abbott.

*Ligne 5:* علىّ (sur moi); le *yā'* final se développe sous le mot comme à la ligne 3.

[8] S. Urice, *Qaṣr Kharāna in the Transjordan*, redonne la traduction de N. Abbott et fait quelques commentaires; p. 7, notes 2 et 3, p. 22.

*Ligne 6:* le degré d'effacement est tel que nous ne pouvons confirmer ou infirmer le terme *hiyāba* lu par Abbott. Toutefois, son sens de "respect mêlé de crainte" ne paraît pas s'intégrer aisément avec les mots qui le précèdent, "prière" et "supplication". Ce dernier terme (دعـاء) n'est restitué, en contexte, que grâce à sa première lettre, un *dāl* isolé.

*Ligne 8*: العظيم (l'Auguste); N. Abbott avait lu *al-'azīz* (le Puissant).

*Ligne 10-11*: Il faut sans doute considérer ces deux dernières lignes comme un second graffito que l'on aurait ajouté (à la même époque?) sous l'inscription principale. L'alignement du début de ligne n'est plus respecté; il y a, de surcroît, reprise des invocations après la mention de la date, qui généralement clôt ce type de textes. Ces dernières lignes sont les plus effacées. La ligne 10 débute par le terme اللهم (O Dieu), et non par le verbe *šahāda* (a attesté) comme l'indiquait Abbott. Cet appel à Dieu débute une série d'invocations. Ces invocations seraient adressées à une femme si l'on se réfère à notre lecture du troisième mot de la ligne 10: أم (mère), terme usuellement employé dans les *kunya* de femmes. Le nom qui suit est illisible. Le texte s'achève par une étoile à six branches.

Le personnage qui apparaît par deux fois dans ce long graffito à l'encre n'est pas connu des sources arabes que nous avons consultées. Nous n'excluons pas l'hypothèse soulevée pas Moritz, selon laquelle le Calife Al-Walīd b. 'Abd al-Malik se serait arrêté à al-Kharrāna au retour de son pèlerinage de 91/709. Un personnage de sa suite se serait appelé 'Abd al-Malik b. 'Umar[9].

Paléographiquement, l'invocation de 'Abd al-Malik b. 'Umar représente un jalon digne d'intérêt dans l'histoire de l'écriture arabe. Il nous faut la considérer comme l'un des plus anciens textes à l'encre, daté sur un support autre que le papyrus ou le parchemin.

Le registre des caractères rappelle indéniablement celui de certaines écritures coraniques, ou autres textes manuscrits de haute époque. Les caractères reflètent plus les tendances de l'écriture manuscrite que celles de l'écriture monumentale ou funéraire. N. Abbott soulevait, à juste titre, la question de savoir s'il ne s'agissait pas d'un style de graphie non identifié, car non précisément répertorié[10], une sorte de coufique manuscrit utilitaire d'époque umayyade. Pourtant, il semble que nous puissions rapprocher cette graphie de certaines écritures coraniques du groupe Ḥijāzī[11]: cette écriture n'offre pas une parfaite homogénéité et se distingue par la rigidité de sa ligne de base et son allure géométrique. C'est une graphie aux formes globalement courbes et non strictement anguleuses. Les *alif* sont penchés vers la gauche avec départ plus ou moins long et effilé; les *jīm/ḥā'/hā'* sont représentés par un segment oblique coupant la ligne de base, les *dāl* sont de forme quadrangulaire très courte, se distinguant bien du *kāf*, de même forme, mais allongé; les *rā'* sont semi-circulaires, dessinant une courbe de faible amplitude, forme bien distincte de celle des *nūn*, de grande amplitude et nettement incurvés; ou retrouve également des *'ayn* ouverts à deux branches (en V) et d'autres triangulaires fermés, le *yā'* se développe vers la droite, parallèlement à la ligne.

Enfin notons la présence de traits diacritiques, clairement peints au dessus des *tā'* (deux traits superposés, ligne 4), *fā'* (un trait au-dessus, ligne 4), *qāf* (un trait au-dessous, ligne 9), *nūn* (un trait au-dessus,ligne 4) et *yā'* (deux traits superposés au-dessous, ligne 9). La position de ces signes varie considérablement selon les époques, les lieux et les scribes. Ils furent utilisés sporadiquement durant les deux premiers siècles de l'Hégire; on en retrouve dans des lettres datées de 22/463[12].

*2- Graffito - invocation (92/710)* (FIG. 5)

*Localisation:* située immédiatement à droite de la précédente, sous un écoinçon, à 268 cm du sol.

*Description:* 3 lignes d'une fine écriture coufique, sans doute contemporaine de l'inscription de 92/710. La troisième ligne reste indéchiffrable.

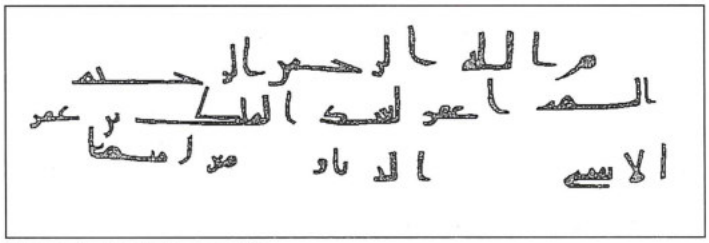
*Dimensions*: surface écrite: 40 X 15 cm.

*Publications antérieures*: Jaussen et Savignac, *Mission archéologique en Arabie, III*, Paris, 1922, p. 102; *R.C.E.A.*, 1/19, n° 21.

١) [بسم] الله الرحمن الرحيم
٢) اللهم اغفر لعبد الملك بن عمر
٣) ...

*1) Au nom de Dieu le Bienfaiteur, le Miséricordieux;*
*2) ô Dieu, pardonne à 'Abd al-Malik b. 'Umar*
*3) ...*

Cette invocation s'adresse à 'Abd al-Malik b. 'Umar, personnage cité dans la grande inscription de 92/710. La graphie y est clairement apparentée; nous pouvons donc la dater sans hésitation du 1er/8ème siècle. Elle ne fut pas déchiffrée par N. Abbott.



5. Inscription à l'encre n°2.

9 B. Moritz, 'Ausflüge in der Arabia Petraea', p. 422.

10 N. Abbott, 'The Ḳaṣr Kharāna inscription', p. 195.

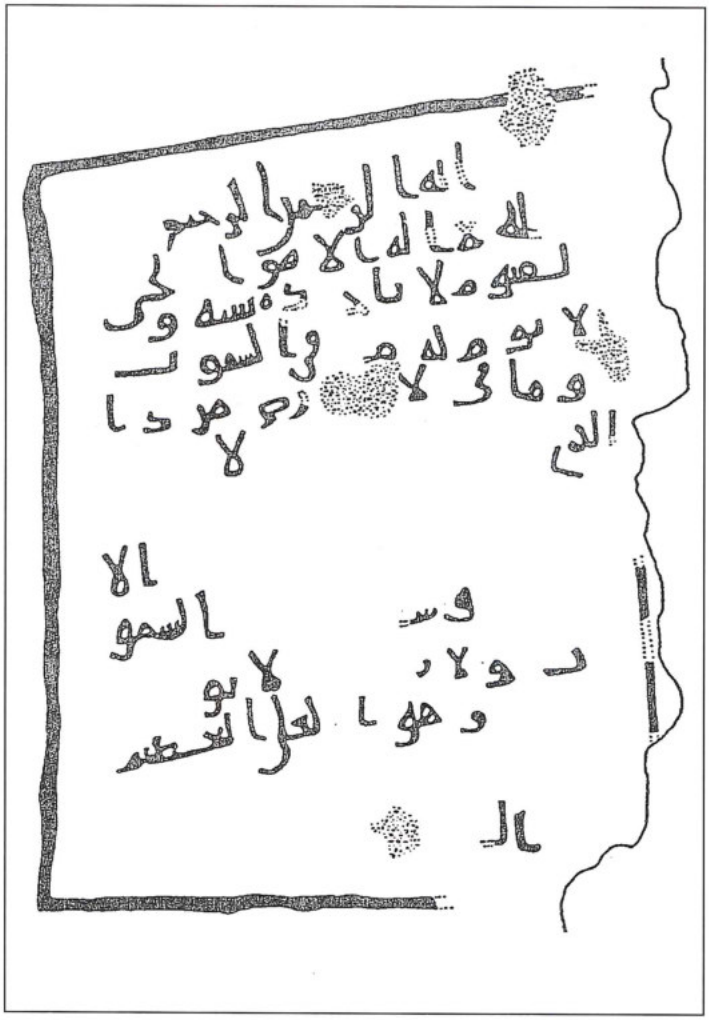
11 F. Deroche, *Catalogue des manuscrits arabes, les manuscrits du Coran,* Bibliothèque Nationale, Paris, 1983, pp. 35-36 et PL. V.

12 Y. Rāgib, 'L'écriture des papyrus arabes aux premiers siècles de l'Islam', *Revue du Monde Musulman et Méditerranéen* 58/4 (1990), pp. 14-18.

*3- Verset coranique (fin Ier/VIIème siècle)* (FIG. 6)
*Localisation*: dans la salle 51, sous l'inscription à l'encre de 92/710, à droite du mur, à seulement 42 cm du sol.
*Description:* l'inscription est entourée d'un cadre rectangulaire tracé à l'encre. L'inscription est extrêmement effacée et par endroits illisible.
*Dimensions*: cadre: 25 X 18,5 cm; surface écrite: 17 X 22 cm.

١) [بسم] الله الر[حـ]من الرحيم
٢) [الـ]له لا إله إلا هو الحي
٣) [ا]لقيوم لا تأ[خـ]ذه سنة و
٤) لا نوم له مـ[ـا] في السموت (sic)
٥) وما في الأرض من ذا
٦) الذي [يشفع عنده إلا بإذنه
٧) يعلم ما بين أيديهم وما خلفهم
٨) ولا يحيطون بشيء من علمه إلا
٩) بما شاء] وسع [كرسيه] السمو
١٠) ت (sic) والأر[ض] ولا يؤ[ده
١١) حفظهما] وهو العلي العظيم

*Coran* **2**, *255 dans sa totalité.*



6. Cor. **2**,255 (Ayat al-kursi) à l'encre (salle 51).

Le registre des caractères de ce verset coranique dit "*Āyat al-kursī*" est coufique et semblable à celui des deux inscriptions précédentes qui s'apparentent aux graphies d'époque umayyade sur parchemin ou papyrus.

**b) Rez-de-chaussée**

*4- Graffito daté (708/1308-1309)*
*Localisation:* dans le couloir d'entrée menant à la cour, sur le mur de droite à 102 cm du sol.
*Description:* 3 lignes d'une écriture fine et partiellement diacritée. La partie centrale est presque totalement effacée et recouverte par un graffito moderne.
*Dimensions*: surface écrite: 25 X 5 cm.

١) اللهم صلي (sic) عليه
٢) اللهم اجمع ... ابن (sic) إبراهيم غلام إلى السبط بن علي
٣) و أرحم المولى ( المؤمن ؟) ... سنة ثمان وسبعمائة لهجرة الأمان

*1) O Dieu, bénis-le.*
*2) O Dieu rassemble ... b. Ibrāhīm Ġulām et al-Sibṭ b. 'Alī*
*3) et accorde ta miséricorde au Maître ? (au Croyant ?) ... en l'année 708 /1308-1309 de l'Hégire du Salut.*

Il s'agit d'une invocation où l'on demande à Dieu que deux personnages soient réunis. Le premier, ... b. Ibrāhīm est qualifié de *ġulām* terme aux multiples aspects qui peut avoir le sens de "serviteur-esclave", de "garde-esclave ou affranchi". Il est sans doute fait allusion à des soldats en garnison temporaire à al-Kharrāna.

*5- Graffito - mention de passage (VIIème/XIIIème - VIIIème/XIVème siècle)*
*Localisation:* dans le couloir d'entrée à droite, au niveau de la troisième voûte, sur une pierre de taille grossièrement aplanie, à 104 cm du sol.
*Description:* cette petite inscription à l'encre est actuellement très endommagée par un éclat sur la pierre dans la partie centrale. Nous comptons environ 9 lignes d'une écriture cursive ayyoubide-mamelouke. Si l'on mêle notre lecture à celle de Jaussen et Savignac (entre crochets) qui l'avaient déjà relevée, nous pouvons alors restituer une partie de ce texte.
*Publication antérieure:* Jaussen et Savignac, *Mission archéologique en Arabie, III*, Paris, 1922, p. 103, n° 11 et 104, n° 12.

١) حضر في هـ[ذه (sic) المكان المبارك] محمد
٢) بن إسرافيل
٣) بن محمد الهميلي من [أحد الكرك ليحرسه غفر] الله له ووالديه (sic)
٤) ولجميع الـ[مسلمين]
٥) ...
٦) [أبعدنا] الوطن ؟
٧) [يا عيني فيضي] عسا الرحمن يرحمني
٨) رب العرش يرحمني
٩) ... في الدنيا [والآخرة] ؟

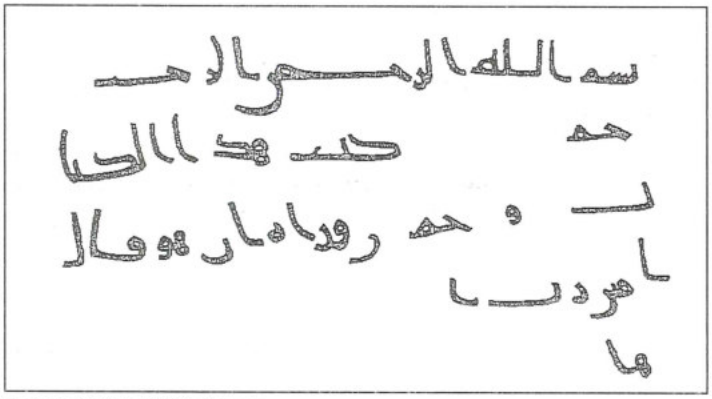
*1) A été présent en ce lieu béni [Muḥammad*
*2) b. Isrāfīl]*
*3) b. Muḥammad al-Humaylī ? [des environs d'al-Karak pour le garder], que Dieu lui pardonne, ainsi qu'à ses parents*
*4) et à l'ensemble [des Musulmans]*
*5) ...*
*6) [Nous sommes loin de notre terre natale]*
*7) [O mon œil, pleure ?] Peut-être le Bienfaiteur m'accordera-t'il la miséricorde.*
*8) Le Seigneur du Trône m'accorde la miséricorde*
*9) ... dans ce monde [et dans l'autre].*

Ce graffito aux élans parfois pathétiques est donné sous toute réserve, en ce qui concerne les parties lues par Jaussen et Savignac, que nous ne pouvons vérifier sur la pierre. Ligne 6, il faut entendre le terme *waṭan*, non pas comme "patrie", sens qu'il prendra plus tard, mais plutôt avec son acception de "pays natal, domicile, région d'origine". peut-être notre personnage fut-il soldat de garnison, vers le XIVème siècle, chargé de veiller à la sécurité de ce palais sur l'une des voies importantes d'al-Balqā'.

*6- Graffito - invocation (IIème/VIIIème siècle)* (FIG. 7)
*Localisation*: sur le montant droit du dernier arc du couloir menant à la cour, à plus de 2 m du sol.
*Description:* inscription d'environ 6 lignes dont la partie inférieure gauche est totalement effacée. Le registre des caractères est semblable à celui des inscriptions à l'encre de la salle 51, sans doute d'époque umayyade.
*Dimensions:* surface écrite: 33 X 23 cm.

١) بسم الله الرحمن الرحيم
٢) [اللهم أر]حم من كتب هذا الكتا
٣) ب [ومن] قرأه إن هو قال
٤) آمين رب [العالمين رب موسى و]
٥) هر[ون] ...
٦) في ...

*1) Au nom de Dieu le Bienfaiteur, le Miséricordieux,*



7. Inscription n°6 à l'encre.

*2) O Dieu, accorde ta miséricorde à qui a écrit cette*
*3) inscription ainsi qu'à celui qui l'a lue s'il a dit*
*4) Amen! Seigneur des Mondes, Seigneur de Moïse*
*5) et d'Aaron ...*
*6) en ...*

Notons la formule au conditionnel *"in huwa qāla āmīn"* (s'il a dit Amen) relativement rare dans ce type de graffito. La formulation générale de cette invocation ressemble à celle de la grande inscription de 92/710 (salle 51), avec la reprise du verset coranique (Cor. **7**,122).

### c) Autres inscriptions à l'encre

Nous avons noté, dans beaucoup de salles du palais, des bribes d'écriture à l'encre, voire des inscriptions entières de plus de 10 lignes parfois. Ces invocations sont malheureusement rendues illisibles par le temps. Seuls un ou deux mots peuvent être déchiffrés:
*Salle 51*: sur l'écoinçon de l'angle sud-ouest, 19 lignes d'une grosse écriture (caractères d'1,5 cm d'épaisseur). Dans l'angle nord-est, 3 longues lignes (surface écrite: 64 X 29 cm). Sur le pilier 2, on déchiffre des caractères nettement coufiques archaïques[13]. Des traces d'encre sont également visibles sur les piliers 1-5-7-8-9-10-11-12-13-18.
*Salle 29:* pilier 6 et 9.
*Salle 33:* (couloir de la cage d'escalier) au-dessus de la fenêtre (une ligne).
*Salle 37:* piliers 2-11-12-15.
*Salle 55:* Au-dessus de la fenêtre.

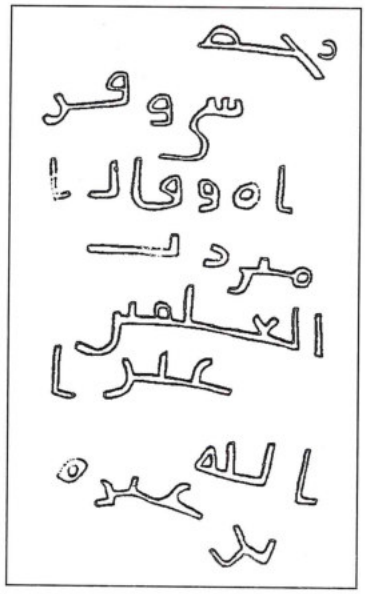
## II- LES INSCRIPTIONS GRAVÉES

### a) Salle 51

*7- Graffito - signature (IIème/VIIIème siècle)* (FIG. 8)
*Localisation:* sur le pilier 2 de la salle 51, à 62 cm du sol.
*Description:* elle débute l'étude des inscriptions gravées sur les piliers de la salle 51. Nous devons au Dr Ghazi Bisheh de nous avoir montré ces gravures en 1986. Le pilier 2 est en bon état de conservation et son inscription peut être lue aux 3/4. Huit lignes gravées en coufique anguleux archaïque.
*Dimensions:* surface écrite: 23 X 18 cm.

١) رحم ...
٢) ... وقر
٣) اه وقال آ
٤) مين رب
٥) العلمين (sic)
٦) عبد
٧) الله

[13] Il s'agit des groupes de 3 piliers, présents dans de nombreuses salles de l'étage, surmontés d'une ligne en dents de scie, supportant la retombée des grands arceaux. Nous avons numéroté chaque pilier dans chaque salle (généralement 18). Le pilier 1 est toujours au fond de la pièce, à droite; le 18ème, au fond à gauche.



8. Inscription n°7 gravée sur un pilier (salle 51).

٨) بن (sic) عبدة

*1) ...pardonne*
*2) ... et à qui l'a*
*3) lu et a dit*
*4) Amen ! Seigneur*
*5) des mondes*
*6) 'Abd*
*7) Allāh*
*8) b. 'Abda / 'Abada*

Il s'agit d'une invocation doublée d'une signature si l'on considère que le nom 'Abd Allāh b. 'Abda / 'Abada n'est introduit par aucun verbe ni formule. Le *ism* 'Abda / 'Abada est attesté[14].

*8- Graffito - signature (Fin Ier/VIIème - début IIème/ VIIIème siècle)* (FIG. 9)

*Localisation:* sur le pilier 9 de la salle 51, à 70 cm du sol.

*Description:* peut-être 11 lignes d'une écriture d'un registre coufique archaïque. La partie supérieure est recouverte par un graffito moderne qui ampute le texte. Des éclats de stuc ont sauté dans la partie inférieure. Seules les dernières lignes et le nom du lapicide ont pu être déchiffrés.

*Publication antérieure:* Gh. Bisheh, 'Mulāḥaẓāt mutafarriqa ḥawla iktišāfāt umawiyya ḥadīṯa', *ADAJ* 30 (1986), pp. 10-12 et PL. 45, 46, p. 8-9.

– وكتب
– عمر
– بن الو

– [ليد]

*- a écrit*
*- 'Umar*
*- b. al-Wa-*
*- līd.*

Le personnage 'Umar b. al-Walīd a signé, au palais, trois autres inscriptions gravées sur trois piliers de la même salle 51. Il ne serait autre que le fils du calife al-Walīd b. 'Abd al-Malik (m. 96/715) qui aurait été gouverneur du *jund al-Urdun* sous le califat de son père[15]. Il semble important de préciser que al-Kharrāna ne faisait pas partie, sous la dynastie umayyade, du *jund al-Urdun,* mais bien du *jund Dimašq* avec l'ensemble d'al-Balqā'[16]. Notre personnage aurait été surnommé "l'étalon des Marwanides"... Il aurait, selon les chroniques, été le père de 90 enfants dont 60 se déplaçaient couramment avec lui[17].

Il est possible qu'il ait résidé quelques temps à al-Kharrāna, comme le propose Gh. Bisheh[18]. Le palais représente un passage obligé pour qui veut, depuis al-Balqā', se rendre vers le Wādī as-Sirḥān puis vers l'Arabie. La répétition de cette signature sur trois autres piliers nous porte à croire que le personnage devait résider au palais pendant des périodes plus ou moins longues et non uniquement pour de courtes étapes.

L'écriture est fine et par endroits trop abîmée pour permettre le déchiffrement. Les allongements de caractères sont courants; les *bā' / tā' / ṯā'* finaux sont ouverts, les *dāl* et *kāf* sont quadrangulaires, les *alif* ont un départ orthogonal, les *yā'* un retour rigoureusement parallèle au mot, vers la droite, sous la ligne de base; les *hā'* sont triangulaires à deux cavités, les *rā'* bien différenciés des *nūn.* Les caractéristiques et le mouvement d'ensemble très rigide nous font pencher sans hésitation pour une graphie d'époque umayyade, sans doute de la fin du Ier/VIIème siècle.

*9- Graffito - signature (Fin Ier/VIIème - début IIème/ VIIIème siècle)* (FIG. 9)

*Localisation:* sur le bas du pilier 13, à 50 cm du sol.

*Description:* environ 10 lignes; seule la partie centrale est intacte.

*Publication antérieure:* Gh. Bisheh, 'Mulāḥaẓāt mutafarriqa ḥawla iktišāfāt umawiyya ḥadīṯa', *ADAJ* 30 (1986), pp. 10-12 et PL. 45, 46, p. 8-9.

– ... الله كل ...
– ...
– على عرب حي بكر

14 'Abda (nom masculin) est attesté chez Ibn Sa'd, *al-Ṭabaqāt al-Kubrā*, index. Ibn Mākūlā fournit de nombreuses variantes de lecture à partir de ce ductus: 'Abda, 'Abada, 'Ubda, 'Ubbada et 'Ubada; Ibn Mākūlā, *Ikmāl*, 6/28.

15 S. D. al-Munajjid, *Mu'jam banī umayya*, Beyrouth, 1970, p. 135; al-Ṭabarī, *Tārīḫ al-umam wal-mulūk* , ed. A. F. Ibrahim, le Caire, 1964, 6/496; al-Ya'qūbī, *Tārīḫ al-Ya'qūbī*, ed. Dār Ṣādir, Beyrouth, 2/291, 2/336.

16 Le Strange, *Palestine under the Moslims, a description of Syria and the Holy Land*, Beyrouth, 1965, pp. 32-35. Yāqūt, *Mu'jam al-buldān*, 1/489.

17 Ibn 'Abd al-Rabbi-hi, *Al-'iqd al-farīd*, Beyrouth, s.d., 3/399.

18 Gh. Bisheh, 'Mulāḥaẓāt mutafarriqa', p. 12.



9. Les piliers gravés de la salle 51 (de gauche à droite: insc. 11, 10 et 9).

– ... له اهل ...
– كتب عمر بن ا
– لوليد

*- ... Dieu tout ...*
*- ...*
*- sur les Arabes du campement de Bakr ?*
*- ...il a ... famille ?*
*- a écrit 'Umar b.*
*- al-Walīd.*

Nous sommes ici en présence du même personnage et de la même graphie que dans l'inscription précédente. Le terme *ḥayy*, en contexte tribal, peut indiquer un endroit (terre ou pâturage) où la vie est possible, mais également une tribu et son campement. Il nous en difficile de préciser de quelle tribu Bakr il peut être question si notre lecture, dans ce contexte très pauvre en information s'avère exacte.

*10- Graffito - signature (Fin Ier/VIIème - début IIème/ VIIIème siècle)* (FIG. 9)

*Localisation:* sur le bas du pilier 17, à 128 cm du sol.

*Description:* environ 8 lignes subsistent. La partie supérieure se perd dans un gros éclat de stuc. Seules les 3 dernières lignes sont encore déchiffrables.

*Publication antérieure:* Gh. Bisheh, 'Mulāḥaẓāt mutafarriqa ḥawla iktišāfāt umawiyya ḥadiṯa', *ADAJ* 30 (1986), pp. 10-12 et PL. 45, 46, p. 8-9.

– ... وكتب

٣) قرأه وقال آمين

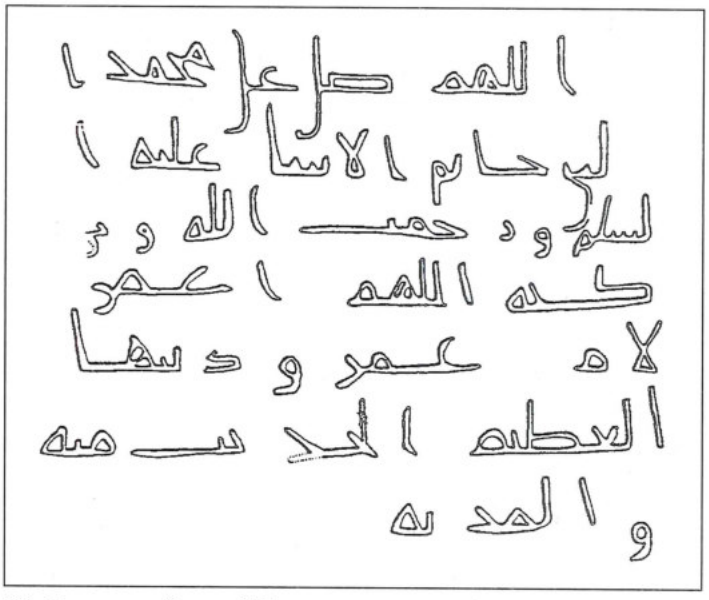
*1) Que Dieu soit satisfait de*
*2) Qāsim et de celui qui*
*3) aura lu et dit Amen !*

Il n'est pas possible d'identifier le personnage (Qāsim) mentionné par son seul *ism*. L'écriture est bien équilibrée; toutes les hampes penchent nettement vers la gauche; les caractères sont bien proportionnés et les espacements entre les mots et les lignes sont réguliers. Toutefois, nous envisageons une datation un peu plus tardive (IIème/VIIIème - IIIème/IXème siècle) que les gravures où apparaît 'Umar b. al-Walīd: le mouvement d'ensemble est moins anguleux, ce qui est notables dans les *rā', ṣād* et *nūn*. Les appendices finaux sont de plus faible amplitude et compressés sous la ligne de base; il n'y a plus d'étirements des caractères.

*13- Graffito - invocation (IIème/VIIIème - IIIème/IXème siècle)* (FIG. 10)
*Localisation:* sur le même mur que la précédente, à sa droite, à 125 cm du sol.
*Description:* 7 lignes d'une écriture fine. L'inscription, intacte, ne doit sa sauvegarde qu'à l'obscurité de la salle.
*Dimensions:* surface écrite: 28 X 23 cm.

١) اللهم صل على محمد ا
٢) لنبي خاتم الأنبيا (sic) عليه ا
٣) لسلام ورحمت (sic) الله وبر
٤) كته اللهم اغفر
٥) لأم عمرو ذنبها
٦) العظيم الحديث منه
٧) والقديم

*1) O Dieu, bénis Muḥammad*
*2) le Prophète, sceau des Prophètes, que*



10. Gravure coufuque n°13.

- عمر بن
- الوليد

*- a écrit*
*- 'Umar b.*
*- al-Walīd.*

Il s'agit du même personnage et la même graphie que les deux inscriptions précédentes.

*11- Graffito - signature (Fin Ier/VIIème - début IIème/ VIIIème siècle)*
*Localisation:* Gravée sur le pilier 18 de la salle 51, à 74 cm du sol.
*Description:* 10 lignes; un gros graffito cache la partie centrale supérieure. Beaucoup de crevasses abîment cette belle écriture et la rendent partiellement indéchiffrable.

١) كتب
٢) ...
٣) لمن ...السلام
٤) ... قال ا
٥) نني على
٦) ...
٧) رحيما و
٨) كتب
٩) عمر بن الو
١٠) ليد

*1) a écrit*
*2) ...*
*3) à qui ... la paix*
*4) ...a dit je*
*5) suis sur ...*
*6) ...*
*7) miséricordieux et*
*8) a écrit*
*9) 'Umar b. al-Wa-*
*10) līd.*

Hormis les trois dernières lignes, les autres mots sont donnés sous toute réserve vu l'état du support en stuc. Il s'agit du même personnage et de la même graphie (coufique anguleux archaïque) que les inscriptions 9-10-11.

**b) Salle 52**

*12- Graffito - invocation (IIème/VIIIème - IIIème/IXème siècle)*
*Localisation:* sur le mur est, à 52 cm du sol.
*Description:* 3 courtes lignes qui sont restées intactes du fait de leur localisation dans une salle très sombre.
*Dimensions:* surface écrite: 54 X 30 cm.

١) رضي الله عن
٢) قاسم وعن من

*3) Dieu répande sur lui paix, miséricorde et*
*4) bénédiction. O Dieu pardonne*
*5) à Umm 'Amr ses graves*
*6) péchés, passés*
*7) et à venir.*

Notons, ligne 3, l'archaïsme dans l'écriture du mot *raḥma* (miséricorde) en position d'annexion (*muḍāf*) qui est écrit avec un *tā'* ouvert et non avec un *tā' marbūṭa*, marquant le féminin en arabe. La personne invoquée dans l'inscription est une femme, Umm 'Amr, dont la généalogie n'est pas donnée. Dans la même salle, une autre gravure est dédiée à une femme. La salle 52 est une petite salle faisant partie du système autonome des *bayt* de la grande salle 51; elle en dépend directement dans la mesure où l'on ne peut y accéder que par la salle d'audience. Peut-on, dans ce cas, la considérer comme un appartement privé peut-être exclusivement réservés aux femmes ou à la famille proche de l'hôte du palais?

La graphie est très fine; certains caractères sont arrondis (base d'un *lām-alif*, les *mīm* et *hā'* médians). Notons la présence d'un *'ayn* en "V". Ces quelques traits nous permettent de proposer la fourchette de datation suivante: IIème/VIIIème - IIIème/IXème siècle.

*14- Graffito - invocations (IIème/VIIIème - IIIème/IXème siècle)*
*Localisation:* dans la salle 52, sur le mur qui fait face à la porte, à 100 cm du sol.
*Description:* 4 lignes de coufique anguleux. Etant plus visible que les autres elle a souffert de dégradation, principalement dans sa partie médiane. La dernière ligne est pratiquement effacée.
*Dimensions:* surface écrite: 248 X 40 cm.

١) اللهم اغفر لـ ... ـة ما تقدم من ذنبها وما تأخر
٢) وصل عليها و ... رضوانك لها ... وارحمها إن رحمتك ...
٣) لها نبيها اللهم ... بينها وبين المؤمنين في الجنة اللهم ا
٤) ... و لا خوف عليهم و كتب الـ ...

*1) O Dieu, pardonne à ... ses péchés passés et à venir*
*2) et bénis-la ...Ta satisfaction à son égard ... et accorde-lui ta miséricorde. Certes ta miséricorde ...*
*3) à elle ...son Prophète. O Dieu ... entre elle et les Croyants au Paradis. O Dieu ...*
*4) ... et ils n'éprouveront aucune crainte. A écrit al- ...*

Cette invocation est destinée à une femme si l'on considère l'accord au féminin singulier des pronoms affixes au sein de ce formulaire. Le nom, quant à lui, est totalement effacé; il était constitué d'un seul nom terminé par un *tā' marbūṭa* (marque du féminin). La graphie est certes moins soignée que celles présentes dans la même salle mais le formulaire est plus développé et moins archaïque que l'ensemble de ceux relevés au palais. Notons la reprise d'une partie d'un verset coranique, ligne 4 (Cor. **2**/37 entre autres).

**c) Salle 26**

*15- Graffito - décor? (fin IIème/VIIIème - IVème/Xème siècle)* (FIG. 11)
*Localisation:* sur le mur ouest de la salle 26, sous la dernière arcade à droite, à 150 cm du sol.
*Description:* il ne s'agit pas d'une inscription à proprement parler, mais d'un décor utilisant l'écriture. Une ligne dont la partie médiane se développe en arc de cercle au-dessus de la ligne
*Dimensions:* surface écrite: 105 X 26 cm; amplitude de la boucle: 25 X 25 cm.

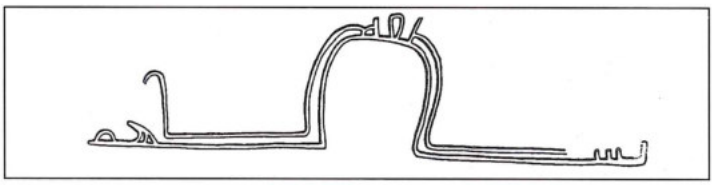
١) بسم الله اللهم

*1) Au nom de Dieu, ô Dieu.*

Ce décor est, à notre connaissance, unique. Aucune invocation ne suit directement le terme *Allāhumma*, ce qui expliquerait que nous soyons ici en présence d'une fantaisie de lapicide ne visant qu'à la décoration, ce qui est plutôt rare à cette époque où la graphie rigide est de mise. Il est vrai que la décoration n'interviendra qu'à l'époque abbasside, à partir des caractères, mais rarement à partir de la forme donnée à la ligne de base[19]. Il n'y a pas, semble t-il, de réelle intention de perpétuer un message par une inscription lisible au premier abord.

Nous remarquerons, dans les caractères particuliers, les deux *lām* du mot *Allāh* se rejoignant en boucle, ainsi que le *lām* de *Allāhumma* se terminant en crochet vers la gauche. Le registre de ces quelques caractères est coufique comme le montre le *hā'* médian triangulaire à deux cavités ou le *mīm* rond à appendice final horizontal. Nous pouvons avancer une fourchette de datation assez large pour cette écriture: fin IIème/VIIIème - IVème/Xème siècle.

*16- Graffito - invocations (IIème/VIIIème - IIIème/IXème siècle)*
*Localisation:* gravée à la base du pilier 2.
*Description:* 6 lignes d'une écriture fine coufique anguleux archaïque, gravée superficiellement. Une entaille



11. Inscription-décor n° 15.

19 A Bidā (Arabie Saoudite), sur la route égyptienne du pélerinage, ont été relevés des graffiti sur rocher d'époque abbasside (IIIème/IXème - IVème/Xème siècle) qui présentent des ébauches de décors en forme de boucle, au sein du mot Allāh. Cf. A. I. Hamed, *Introduction à l'étude des deux routes syrienne et égyptienne de pélerinage,* Thèse de Doctorat, Aix-en-Provence, 1988, vol. II, pp. 516-517 et PL. 243 à 245 (graffiti 15 et 16).

dans le pilier ampute la fin du texte.

١) اللهم اغفر
٢) لـ ... لا ...
٣) ... بن جمعة ؟ ما تقد
٤) م من ذنبه وما تأ
٥) خر وكتب عبد ا
٦) ... اللهم

*1) O Dieu, pardonne*
*2) à ...*
*3) ... b. Jam'a / Jim'a ses péchés*
*4) passés et à venir;*
*5) a écrit 'Abd ...*
*6) ... ô Dieu ...*

Il paraît illusoire de vouloir identifier le personnage cité dans cette invocation traditionnelle. Ibn Jam'a est le seul élément que nous arrivons à tirer de la gravure du nom du personnage. Le *ductus* permet une double interprétation Jam'a / Jim'a[20]. La graphie est coufique, exécutée assez maladroitement (l'ensemble penche vers la droite). Au vu de quelques caractères tels le *dāl* quadrangulaire, le *hā'* à deux cavités, nous pouvons proposer, comme datation de ce graffito, le IIème/VIIIème - IIIème/IXème siècle.

**d) Salle 29**

*17- Graffito - invocations (IIème/VIIIème siècle)*
*Localisation:* dans la partie supérieure du pilier 2 de la salle 29.
*Description:* environ 7 lignes d'écriture coufique archaïque assez semblable à celle des piliers gravés de la salle 51. La partie supérieure de l'inscription a disparu dans une crevasse.

١) اللهم ...
٢) ...[عمـ]ر ؟ بن الو
٣) [ليد] ما تقدم
٤) من ذنبه وما
٥) تأخر ... احفظ
٦) له ...

*1) O Dieu ...*
*2) ...*
*3) ... 'Umar ? b. al-Walīd*
*4) ses péchés passés*
*5) et à venir ...*
*6) garde-le*
*7) en ta protection.*

Cette invocation, si notre lecture du nom est correcte, s'adresse à 'Umar b. al-Walīd, personnage que nous avons déjà identifié dans les graffiti des colonnettes de la salle 51 (inscriptions n° 8 à 12). C'est à partir d'indices que nous avons réussi à retrouver le nom de ce personnage: tout d'abord un *rā'* final qui sort de la crevasse (ligne 3) et se place avant le mot *ibn*; le *nasab*, ensuite, débute clairement par un article suivi d'un *wāw* qui peut être le début du mot "al-Walīd". Remarquons que l'invocation est adressée en faveurdu personnage et que ce n'est plus lui qui signe l'inscription.

**e) Salle 37**

*18- Graffito - invocations (IIIème/IXème siècle)*
*Localisation:* gravé sur le mur est de la salle, à 146 cm du sol.
*Description:* une seule ligne en style coufique anguleux archaïque gravée en gros caractères. Cette ligne est perdue au milieu de graffiti anciens et modernes dont nous ne pouvons rien tirer.
*Dimensions:* surface écrite; 160 X 7 cm.

١) ليمد له الدهر آمين رب العلمين (sic) رب موسى [و هرون]

*1) Qu'il lui prolonge l'existence. Amen ! Seigneur des mondes, Seigneur de Moïse et d'Aaron.*

Aucun nom n'est cité dans cette brève invocation dont le formulaire ancien n'est pas sans rappeler celui de l'inscription du chapiteau d'al-Muwaqqar: *madda la-hu fi-l-'umr*[21]. Le petit nombre de caractère ne nous permet pas de faire une analyse paléographique approfondie. En comparaison avec d'autre graffiti du palais, nous proposons de dater celui-ci du IIIème/IXème siècle.

**f) Rez-de-chaussée**

*19- Graffito - invocations (Fin IIème/VIIIème - début IIIème/IXème siècle)*
*Localisation:* dans l'arc qui se trouve au-dessus de la porte d'entrée du château, à droite. L'inscription n'est accessible qu'à l'aide d'un échafaudage.
*Description:* l'inscription se compose de deux parties, toutes deux en fort mauvais état. La première, en haut à droite est très abîmée et nous ne pouvons pas la lire; la seconde, sur toute la largeur de l'arc est gravée en grosses lettres.
*Dimensions:* surface écrite: 96 X 50 cm.

١) اللهم أصلح الأمين ؟ ابن (sic)
٢) أمير المؤمنين

*1) O Dieu, rends vertueux al-Amīn ? fils*
*2) du Commandeur des Croyants.*

Cette inscription revêt un caractère exceptionnel au sein du palais d'al-Kharrāna du fait de la mention du titre du calife *Amīr al-Mu'minīn* (Commandeur des Croyants).

[20] E. Littmann, *Beduinen und Drusen Namen aus dem Ḥawrān Gebiet*, Bonn, 1920, p. 7.

[21] L. A. Mayer, 'Note on the inscription from al-Muwaqqar', *QDAP* 12 (1946), pp. 73-74.

Il s'agit précisément d'une invocation en faveur du fils d'un calife. La partie de l'inscription comprenant le *ductus* du nom du fils est malheureusement très abîmée et nous ne sommes pas parvenus à le déchiffrer avec certitude. Elle a sans doute été rayée après avoir été gravée. Nous ne distinguons qu'un article suivi de deux lettres, puis une dent et un *nūn* final, peut-être al-Amīn.

Si cette lecture s'avère exacte, ce que nous ne pouvons pas avancer avec certitude, il s'agirait peut-être du fils du calife Hārūn al-Rašīd (170/786 - 193/809), l'*Amīr al-Mu'minīn* de notre graffito.

Comment faut-il comprendre une invocation en faveur du prince al-Amīn, successeur au califat, depuis longtemps désigné par son père, dans un lieu aussi reculé qu'al-Kharrāna? Si Hārūn al-Rašīd porta un certain intérêt aux provinces du nord de la Syrie, il n'en fut pas de même pour son héritier qui ne s'y rendit jamais[22]. La Syrie du IIème/VIIIème siècle, encore marquée par la chute des Umayyades, n'était pas globalement favorable aux Abbassides; quelques révoltes illustrent bien cette situation, notamment celle de 195/811 en faveur d'un descendant umayyade qui tint têtes aux troupes califales à Damas[23].

Al-Amīn ne prit ses fonctions de calife qu'à la mort de son père en 193/809. Le graffito serait donc antérieur à cette date si nous retenons cette hypothèse. Rappelons qu'à al-Kharrāna, le nom d'un fils de calife est cité en la personne de 'Umar b. al-Walīd, qui signa les piliers de la salle 51, à l'étage. Nous excluons, pour des raisons paléographiques et onomastiques, qu'il soit le personnage cité dans notre graffito du rez-de-chaussée.

Le registre des caractères est anguleux mais non rigide; on ne note pas ici une grande rigidité de la ligne de base et les caractères sont souvent disproportionnés (*ṣād, lām* et *wāw*).

*20- Graffito - mention de passage (770/1368-69? 790/1388?)*

*Localisation:* au rez-de-chaussée, sur le mur sud-ouest de la cour. Il est gravé en hauteur, à plus de 3,50 m du sol.
*Description:* 3 lignes d'une écriture nashī ayyoubide-mamelouk, non diacritée. Grosses lettres.
*Publication antérieure:* Jaussen et Savignac, *Mission archéologique en Arabie, III*, Paris, 1922, p. 104, n° 13.

١) حضر في هذا المكان المبارك
٢) عمر بن كامل الهداوي
٣) تسعين / سبعين ؟

*1) A été présent en ce lieu béni*
*2) 'Umar b. Kāmil al-Haddāwī*
*3) ... soixante-dix / quatre-vingt-dix ?*

C'est une mention très courante de passage; ce formulaire est très répandu en Jordanie, sur les murs des monuments ou sur les rochers. Notre lecture diffère légèrement de celle proposée par Jaussen et Savignac: pour ce qui est du nom, nous lisons 'Umar b. Kāmil al-Haddāwī au lieu de 'Umar b. Ḥāmid al-Mahdāwī. Les explorateurs avaient relevé une bribe de datation dans une 4ème ligne aujourd'hui disparue. Il n'y a aucune raison de la mettre totalement en doute; paléographiquement nous sommes en présence d'une graphie nashī ayyoubide-mamelouke datable du VIIIème/XIVème, sur laquelle nous nous basons pour affiner la datation à la lumière des données de Jaussen et Savignac. Ainsi nous proposons de dater ce graffito de 770/1368-69 ou de 790/1388.

## ESPACES D'ÉCRITURE À AL-KHARRĀNA

L'étude des inscriptions, mais surtout leur localisation sur les murs ou les piliers, nous amènent à émettre quelques hypothèses concernant le palais lui-même:

- 5 inscriptions ont été relevées au rez-de-chaussée, 17 à l'étage. Cette inégalité dans la répartition montre que, quelle que soit l'utilisation que l'on ait fait du palais, on a toujours préféré loger en haut. Les pièces centrales y sont claires et l'aération assurée en permanence. On doit avoir utilisé le bas comme entrepôt, réserve et écurie; seuls quelques gardes et personnels de l'intendance devaient résider au rez-de-chaussée. On n'y compte que trois inscriptions à l'encre, dont deux (inscriptions n° 4 et 5) sont sans doute l'œuvre de soldats de garnison de passage au palais; aucune de cette sorte n'a été trouvée à l'étage.
- Dans la salle 51, à l'étage, nous avons recensé 5 grandes inscriptions à l'encre. De surcroît, sur les 18 piliers que compte la salle, 5 mêlent encre et gravures (piliers 2, 9, 10, 12, 13). Si l'on fait le total de toutes les inscriptions, plus de 30 espaces d'écriture sont répertoriés pour une seule salle! Il semble qu'à al-Kharrāna, la répartition encre/gravure se fasse selon des critères précis (FIGS. 2 et 3).

Dans le tableau ci-dessous, nous avons noté les hauteurs auxquelles nous trouvons les inscriptions, sur les piliers où coexistent l'écriture à l'encre et la gravure: l'encre occupe généralement le haut du pilier, tandis que la gravure est réservée au bas. Les inscriptions à l'encre dans la salle 51 sont localisées dans un espace compris entre 85 cm et 153 cm (la fourchette pour l'ensemble du palais est comprise entre 80 cm et 157 cm). Quant aux gravures, elles s'étendent entre 50 et 150 cm sans jamais empiéter sur l'espace réservé à l'encre; une exception est à noter: le pilier 12 de la salle 51 montre deux espaces d'écriture qui s'interpénètrent; la gravure débute à 150 cm alors que l'encre s'achève à 125 cm. Cela est d'au-

[22] D. Sourdel, 'La Syrie au temps des premiers califes abbassides', *REI* 48 (1980), p.169.

[23] *Ibid*, p. 171.

| salle | pilier | Hauteur des encres (cm.) | | Hauteur des gravures (cm.) |
|---|---|---|---|---|
| 51 | 1 | 110 | | |
| | 2 | 90 | + | 62 |
| | 3 | 107 | | |
| | 5 | 140 | | |
| | 7 | 125 | | |
| | 8 | 122 | | |
| | 9 | 130 | + | 70 |
| | 10 | 125 | + | 112 |
| | 11 | 85 | | |
| | 12 | 125 | - | 150 |
| | 13 | 153 | + | 50 |
| | 14 | | | 146 |
| | 15 | 150 | | |
| | 16 | | | 138 |
| | 17 | | | 128 |
| | 18 | | | 74 |
| 26 | 2 | 152 | | |
| | 5 | 157 | + | 52 |
| 29 | 6 | 123 | + | 103 |
| | 7 | | | 130 |
| | 9 | 116 | | |
| | 16 | | | 143 |
| 37 | 2 | 127/145 | | |
| | 5 | 114 | | |
| | 10 | 117 | | |
| | 11 | 116 | | |
| | 12 | 80 | | |
| | 13 | 121 | | |
| | 14 | 125 | | |
| | 15 | 105 | | |

tant plus intéressant que dans ce cas unique, l'inscription coufique est gravée sur l'encre ce qui nous permet de conclure que l'encre est antérieure à la gravure.

Les espaces d'écriture hauts placés (généralement à hauteur d'homme) révèlent des écritures à l'encre dont beaucoup sont apparentées graphiquement à la grande inscription datée de 92/710. Ces graphies peintes auraient utilisé les premiers espaces libres sur les piliers; la gravure aurait, plus tard, utilisé les espaces restant, ceux du bas des piliers. Les gravures de 'Umar b. al-Walīd (inscriptions n° 8 à 11) seraient donc postérieures aux traces d'encre dans cette salle.

Remarquons, enfin, dans la salle 51, la trace d'un pigmentation nettement sombre sur les piliers (1 à 5) du mur nord. La coloration sombre atteint la partie supérieure de ces piliers à partir de leur exacte moitié (80 cm); dans la partie inférieure, la coloration est celle du stuc. Cette pigmentation semble trop régulière pour être due à un phénomène naturel de dégradation des murs. La partie inférieure du mur a dû être recouverte et protégée à une époque qui a précèdé les incriptions. Y avait-il une décoration, par tentures ou décors mobiles par exemple? Quant aux piliers du mur sud, ils ne présentent pas de coloration, mais une fissure sur l'ensemble des piliers à 80 cm également. Tout semble bien confirmer que cette salle était le cœur du palais, la grande salle d'audience.

**Le palais des écritures**

Al-Kharrāna est sans conteste le palais du désert qui est le plus associé à l'acte et à l'art d'écrire. A ce titre, il représente un jalon digne d'intérêt dans l'histoire de l'écriture arabe, non seulement lapidaire, mais également manuscrite à l'encre. La seule présence d'un exemplaire d'écriture à l'encre daté du premier siècle de l'Hégire, suffit à justifier cet intérêt. Toutefois, nous ne pouvons entreprendre une analyse épigraphique fiable que dans la mesure où l'ensemble des graffiti, quels que soient leur valeur, est pris en compte à la lumière des théories les plus récentes.

Gh. Bisheh, en 1986, considérerait al-Kharrāna comme l'un des premiers caravansérails *(ḫān)* de l'Islam[24], sur la route du Wādī as-Sirḥān. Il a pu remplir cette fonction, mais il n'est pas exclu qu'il ait également servi de lieu de contact, à l'époque umayyade, avec les tribus arabes bédouines supportant le pouvoir. De cette manière, les palais d'al-Mushattā, al-Mushāsh et Qaṣr Burqū' servirent de lieu de rencontre où furent reçus les grands chefs bédouins[25]. Maintenir un contact avec ces tribus arabes représentait un acte crucial pour le pouvoir umayyade. C'est ainsi qu'Abū Sufyān résida en al-Balqā' en un lieu nommé Biqinnis[26] qu'il donna en succession à son fils le calife Mu'āwiyya. Après lui, Yazīd b. 'Abd al-Malik rèsida en al-Balqā', à al-Muwaqqar et son fils le calife al-Walīd b Yazīd autour de Qasṭal al-Balqā'[27]. Al-Walīd b. 'Abd al-Malik, alors prince, aurait, selon une inscription de 81/700-701, résidé à Qaṣr Burqū' sur les terres des Banū Kalb. Nous pouvons avancer l'hypothèse que l'un de ses fils, 'Umar b. al-Walīd, titulaire des inscriptions 8 à 11, ait séjourné à al-Kharrāna lors du califat de son père. Qaṣr al-Kharrāna, en territoire des tribus Judām (supportant les Umayyades[28]) aurait joué le rôle de point de rencontre et peut-être d'entrepôt.

S. Urice proposait de dater la première phase de construction du palais entre 661 et 684 sous les Umayyades Sufyānides, datation qui paraît plus que raisonnable[29].

[24] Gh. Bisheh, 'Mulāḥaẓāt mutafarriqa', p. 12.

[25] G. R. D. King, 'Settlement patterns in Islamic Jordan: the Umayyads and their use of the land', *Studies in the History and Archaeology of Jordan*, IV, Amman 1992, pp. 369-372.

[26] Yāqūt, *Mu'jam al-buldān*, 1/472.

[27] Al-Iṣfahānī, *Kitāb al-Aġānī*, ed. al-Ibyārī, le Caire 1969, 6/113; al-Ṭabarī *Tārīḫ*, 7/217. Cf. également F. Imbert, 'La nécropole islamique de Qasṭal al-Balqā' en Jordanie', *Archéologie Islamique* 3 (1992), pp. 56-59.

[28] *E.I. 2*, 'Djudhām'; H. Lammens, 'Le califat de Yazīd 1er', *M.F.O.B.* Beyrouth, pp. 621-622; U. R. Kaḥḥāla, *Mu'jam qabā'il al-'arab*, Beyrouth, 1982, 1/174-75.

[29] S. K. Urice, *Qaṣr Kharāna in the Transjordan*, pp. 85-87.

De plus, il optait largement pour une utilisation périodique des lieux à des fins de réunions politiques. Cette structure monumentale, n'étant pas équipée pour une occupation prolongée, aurait accueilli les différents partis, logé dans des *bayt* respectifs. L'épigraphie vient corroborer ces théories: vers 90 h. l'intérieur du palais aurait commencé à être dégradé progressivement. Occupé irrégulièrement et sans doute d'une manière saisonnière, voire uniquement lors de ces rencontres politiques, le palais aurait été laissé aux mains de personnes qui auraient couvert progressivement les murs de leurs invocations.

Pourquoi ne pas imaginer que certains de ces graffiti auraient été gravés ou peints lors de ces rencontres par des personnages des délégations ou des proches des hôtes de marque. Même si nous avons montré que les inscriptions sur piliers utilisent des espaces d'écriture répondant à une certaine logique de répartition, la présence de tant d'inscriptions, graffiti et signatures laissent une impression d'anarchie graphique. Comment comprendre qu'un palais récemment bâti fut soumis, quelques années après, à une dégradation de son intérieur due à l'utilisation de l'écriture. Il faut considérer la prolifération de l'écriture non comme un élément de décoration, mais bien comme un acte "sauvage", sans doute accompagné d'une dégradation du rôle que tenait le palais. Cette dégradation prit de l'ampleur dès le début de l'époque umayyade marwānide et se poursuivit tout au long des IIème/VIIIème et IIIème/IXème siècles.

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# Milestones with Uninscribed Painted Latin Texts

One of the impressive aspects of Roman civilization was the imperial road system, the basic outlines of which are preserved in the documents known as the *Tabula Peutingeriana* and the *Itinerarium Antonini Augusti* (Chevallier 1976: 28-37). One peculiar feature of this 50,000 mile long paved road system was the stone pillars (*milliarium*) set up to mark each mile of the various routes, i.e. at every thousand paces (*mille passus*, abbreviated M.P.), which is equivalent to every 1481.5 m or 4920 ft. The typical form of these stone markers or signposts was a square base, from which a cylindrical or oval-shaped column (2 to 4 m with a diameter of 0.5 to 0.8 m) projected upwards. The regularity of such milestones is evident along the *Via Nova Traiana*, the great trunk highway of the province of Arabia constructed under the Emperor Trajan between AD 111-114 that ran from the provincial capital at Bostra to Aela on the Gulf of 'Aqaba, or "*a finibus Syriae usque ad mare rubrum*", as attested in numerous inscriptions on the more than 350 milestones of the route (Pekáry 1968: 140-142). Approximately 8000 such inscribed milestones from the Roman empire are known either in Greek or Latin, but the finds are not uniform from province to province. More than 2300 are from Africa, 400 from Spain, 600 from Italy, 600 from Gaul and Germany, 100 from the Balkans, and another 100 from Britain (Hirschfield 1907: 165 with Chevallier 1976: 39-47). But only one is known from Sicily and Scotland, and none at all from Egypt in spite of the accumulation of new finds. The remainder are from the Greek provinces of the eastern Mediterranean.

Eventually all of these milestone inscriptions will be recorded in volume XVII of the *CIL* designed exclusively for the "Miliaria imperii Romani" to be published under the directorship of the Seminar für Alte Geschichte und Epigraphik in the Historisches Institut of the Universität Bern and the Academy of Berlin (Walser 1988). The milestone texts for Syria, Mesopotamia, Palestine, and Arabia, will constitute fasicule 6 in this seven part series and volume XXI in the *Inscriptions grécques et latines de Jordanie* being prepared by the Maison de l'Orient at Lyon. At the time that Thomsen compiled his still invaluable milestone corpus for the Levant in 1917, there were slightly over 600 known milestones for the region, but this number has increased significantly in the past 75 years. The inscriptions on these road markers are invaluable, since they provide vital information about the formation and development of routes and the distance in M.P. from the point of departure or terminus (Herzig 1974: 626-648). The typical inscription contains the name of the emperor (normally in the nominative case, but later in the dependent genitive) under whose reign and perhaps at times with whose support the construction or repair of the road took place, the executor of the work, normally an imperial legate but at times the local *civites* (with the emperor's name in the dative case), dated according to the imperial titulary and providing the distance or location on the respective route (Chevallier 1976: 41). Frequently, vestiges of the red paint that was used to emphasize the incised letters are still visible in the crevices of the inscriptions.

But the vast majority of milestones are anepigraphic, which has cast doubt about their nature (Grenier 1934: 72-73) and led to their characterization as either mere remnants of an earlier pre-epigraphic system or hastily erected road-markers of a later period (Chevallier 1976: 41). This interpretation may seem understandable, given the substantial number of epigraphic milestones that exist. But in general, at least in the East, milestones with inscriptions are the exception, rather than the rule, constituting only approximately 25 percent of the existing corpus (Roll 1983: 152). As a consequence, it has frequently been suggested that it is possible that some of the text was merely painted on the milestones, and has subsequently disappeared. For example, Scheidner observed that "Die meisten *m.* haben oben am Schafte eine eingemeisselte Inschrift; Steine ohne jegliche Inschrift finden sich nicht häufig, und wo welche zutage getreten sind....war die Zahl der Meile oder allenfalls des Stadions wohl aufgemalt" (1935: 397). Chevallier also pro-

poses that it was "likely that some wording was painted on" (Chevallier 1976: 41). In contrast to these minimal concessions, others have suggested that uninscribed columns may once have borne entire texts that were merely painted. For example, Butler speculated that the numerous anepigraphic milestones on the Trajanic road in Arabia perhaps once contained "letters on them [that] were originally only painted" (Butler 1911: viii). There are enough cases of merely painted texts on stone monuments to justify these suspicions (Di Stefano Manzella 1987: 142), but it is not just a hypothetical possibility that some milestones had purely painted texts. It has been generally unrecognized that there already exist a few such milestones with texts that are solely painted on the columns. Some of these are recent discoveries, but others have been known for some time, although for the most part unrecognized.

The following list of six such milestones with strictly painted texts in the Palestine-Syria region makes no effort to be comprehensive or complete. Other examples may exist, but inquiry among Roman road specialists outside of the Levant (such as Heinz E. Herzig, David French and Pierre Salama) indicates that they are unfamiliar with any examples in Europe, Turkey or North Africa. A survey of these finds may then be instructive for future discussions and explorations of Roman roads, as they imply that the practice probably prevailed elsewhere.

**1. Ayl.** Just 13 km southeast of Petra, Glueck recorded a fragmented uninscribed milestone (1935: 75 with FIG. 28), which we relocated in the field wall enclosing the reservoir and spring during our initial visit to the site in 1986. In a return visit to Ayl with Thomas Bauzou in 1988, we observed that there were traces of letters in red paint visible on the milestone (Graf 1989) (FIG. 1). It has subsequently been removed to the Petra museum through the cooperation of Dr. Ghazi Bisheh and Dr. Fawzi Zayadine of the Department of Antiquities. Only a few of the 12 lines of the Latin text are visible, but scattered traces of the letters of the other lines are also discernible (FIG. 2).

IMP(eratori) CAE[s]ARI
GAI IULI VERI
[Maxi]MINI A[ug]
[nostri] ET [Gai]
[iuli] VER[i]
[Max]IM[i fili]
[Aug] NO[stri]
[nobi]LI[ssimi]
C[a]ESẠ[ri]
[sub Pomponio]
IULIANO L[eg]
AUGG P[r Pr]

From the vestiges of the text that are visible, it appears that it is to be dated to a Roman legate of Arabia named Julianus who served during the reign of *Augustorum duorum*. The names of the reigning imperial coregents have almost entirely disappeared, except for the initial letters GAI[us]. Based on the current available evidence, the most likely candidate for the governor is Pomponius Julianus, in AD 236 during the reign of [Gaius Iulius Verus] Maximinus Thrax and his son Maximus (Graf fc. b). The latter was elevated to Caesar by May 26 of AD 236, and although never formally obtaining the status of Augustus (Salama 1987: 38), is so designated with his father on occasion in Egypt (Ostracon Viereck 48, *hoi kurioi hêmôn Sebastoi*) and Arabia (at Kafr al-Laḥā, *CIG* III.4585 with p. 1181, *ΣEBB* = Sebastôn, with the sole attestation of Pomponius Julianus as governor in AD 236). The latter lintel dedication reflects the common practice of *damnatio memoriae* for Maximinus, but secondary milestone inscriptions of the emperor on the *Via Nova Traiana* in Arabia show no such signs of erasure (Thomsen 1917: nos. 88d and 97b). Since the *fasti* of the governors of Arabia are rather spotty and Julianus is a common name for Roman officials, other possibilities obviously still exist. Nevertheless, if the present proposal is correct, this is the earliest of the known painted milestone texts.

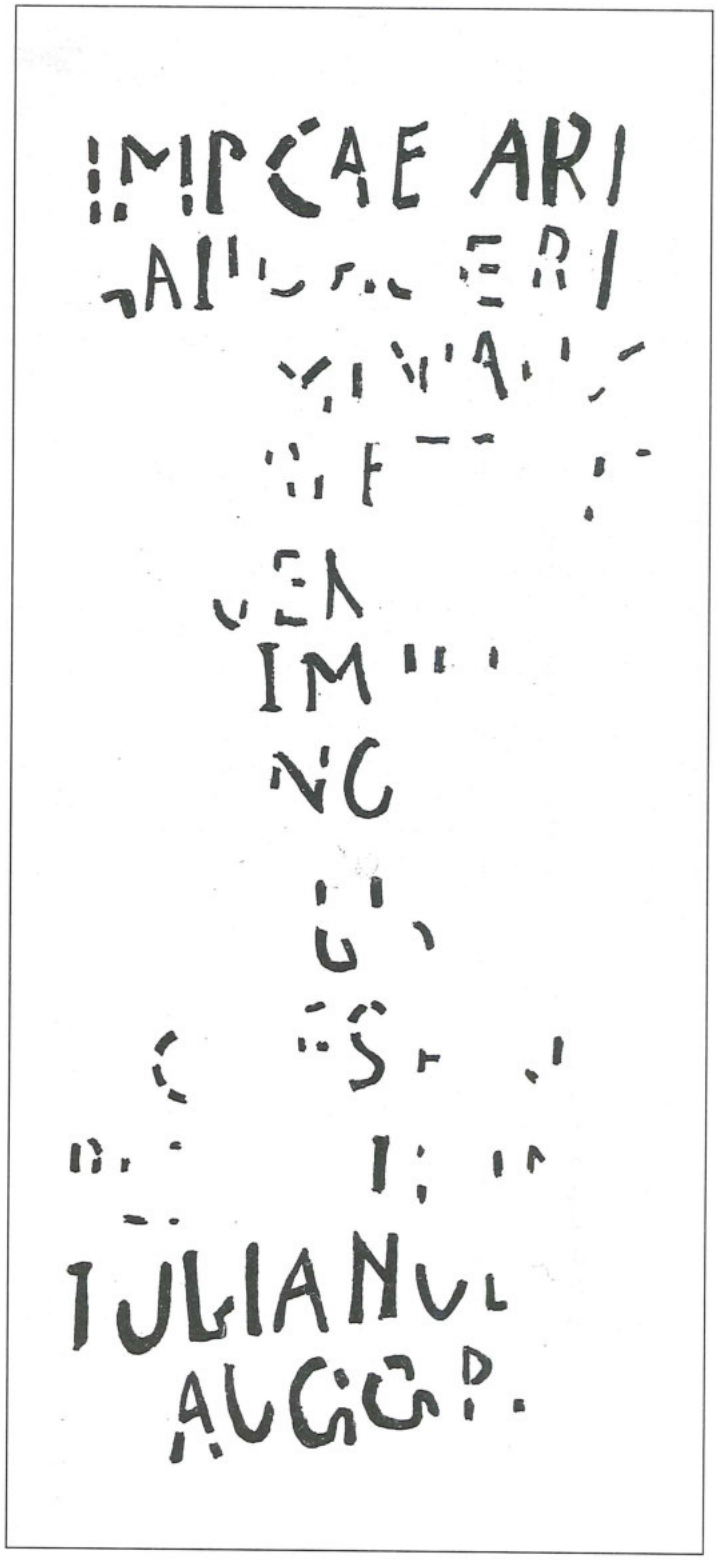
**2. At-Tuwwāna.** On the *Via Nova Traiana* between Petra and 'Ammān, several miles north of at-Tuwwāna, Germer-Durand reported two milestones. One bore a Trajanic inscription indicating it was M.P. 51 from Petra. The other is described as follows: "La seconde colonne est taillée dans un calcaire à gryphées tellement grossier et résistant, qu'il a été impossible de la polir et d'y graver un texte. On s'est contenté d'y tracer les lettres au minium" (Germer-Durand 1897: 580). The initial reading was later partially improved by Brünnow and Domaszewski (1904: 86 = Thomsen 1917: no. 146b = *CIL* III, 1414920). It appears to date to AD 333-337 and reads:

[D(ominis)] N(ostris) CONSTANTINO
ET CONS[tant]INO...[p]RIN[cipibus]...P(iis) F(elicibus)
AUGUSTIS ET...ET CONSTANTI
NOBILI[ssimo Caesari]...NOBILISSIM...BUS N..

Thomsen noted that "Die Buchstaben sind rot geschrichen" (1917: 54 n. 1), but neither his observation nor those accompanying the *editio princeps* were duly registered in the later standard treatments of Roman milestones or roads. Even more of the text may have been readable at the time of Brünnow and Domaszewski's visit, but they were forced by time constraints to continue on with their trip to Petra (1904: 86, notes "Do: ["wegen Zeitmangels unvollständig gelesen"]). In the recent investigation of the at-Tuwwāna region by Dr. Zbigniew T.



1. Ayl milestone with painted Latin text of Maximinus Thrax (no. 1).




2. Drawing of the painted text of the Ayl milestone (no. 1).

Fiema (1992: 5; 1993: 550), this uninscribed milestone with a painted Latin text was relocated, but the only letters now visible are those of CONS[tantine] (FIG. 3). We may now deplore the fact that Brünnow and Domaszewski lacked the time to provide a more complete reading when the text was still fairly legible.

**3. Al-Qarn**. In the Jordan Valley, 4 km south of Pella near the agricultural processing plant at the village of al-Qarn, four or five shattered milestones were found in

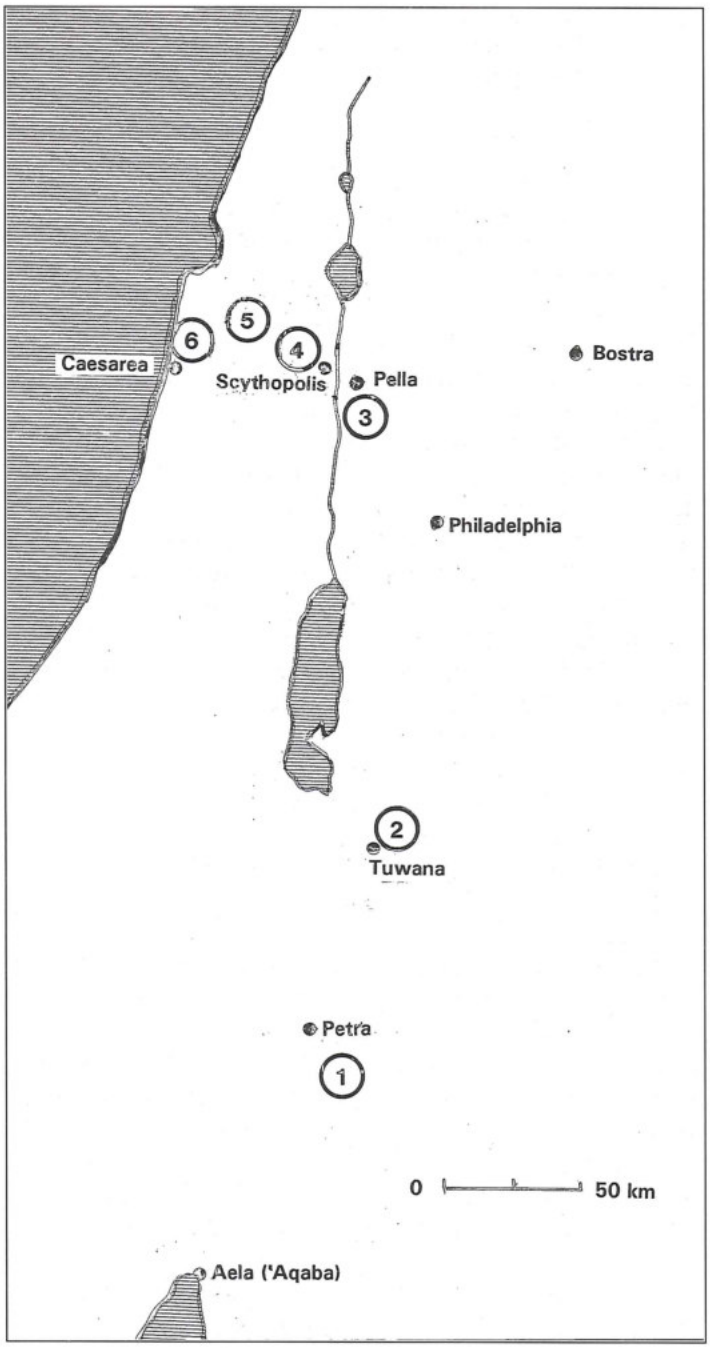


3. Milestone no. 2 with painted text of Constantine, c. 10 km north of at-Tuwwāna (courtesy of Z. T. Fiema).

1990 by Dr. Alan Walmsley of the Australian expedition at Pella and Sultan Shreidah of the Department of Antiquities in Irbid. One of these has been moved to the courtyard of the excavation house at Pella and bears an incised text of three lines.

IMPER(atori) C(a)ES(ari)
FL(avio) VAL(erio)
CONS[t]ANT(ino)

More significantly, two of the other milestones found at al-Qarn bear traces of red painted letters on the columns. Dr. Margaret O'Hea, the epigrapher of the Australian team at Pella, responsible for the formal publication of these finds, indicates that none of the letters appear legible. I want to express my appreciation to Dr. Walmsley of the Department of Semitic Studies at Sydney for bringing this important find to my attention and generously allowing me to mention it in this context. These newly discovered milestones are to be added to the other recent finds of the Roman road that ran parallel to the Jericho-Scythopolis road on the eastern side of the Jordan Valley (Mittmann 1970: 138-151). The previously published milestone texts of this road indicate that it existed at least from the time of Marcus Aurelius,




4. Location of the milestones with painted Latin texts.

demonstrating that the Constantine inscription is merely secondary.

**4. Sarid**. Located on the Roman road between Legio and Diocaesarea in Palestine (FIG. 4), this milestone bore an earlier mostly effaced inscription over which another inscription had been inscribed sometime between AD 333 and 337 (Avi-Yonah 1946: 97 no. 16). This second text consisted of six engraved lines followed by three illegible lines of strictly painted letters. The incised lines read:

dd (= Dominis) nn (= nostris) FL(avio) CONSTANTINO
MAX(imo) P(io) F(elici) IN(victo) AUG(usto) ET
CONSTANTINO ET
CONSTANTIO ET
CONSTANTE
[NOBB(ilissimis) CAESS(aribus)]

Even the engraved lines bore traces of red paint, but it was the completion of the inscription solely in red paint that is noteworthy.

**5. Tall Tumis**. In 1942, a milestone was discovered that designated the first M.P. on the Roman road from Scythopolis west to Legio in Palestine (FIG. 4). It was reported to bear an "inscription in red paint on plaster over the original engraved letters" (Avi-Yonah 1946: 100, no. 25), but the secondary text was merely painted. The inscription beneath the plaster was a bilingual Latin-Greek text from the reign of Septimius Severus, probably of the year AD 198. Of exceptional importance was the discovery between the third and sixth lines of the thirteen-line incised text of some traces of painted letters on the plaster covering. The Latin text dating between AD 324 and 326 was read as follows:

[DD NN] (= Dominis nostris)
[Flavio V]ALERIO CONSTANTI[no]
[Pi]O FEL(ici) CRISP[o]
[e]T FL(avio) CLAVDIO CONST[antino]
[et Fl(avio) Iuli]O CONSTANTIO
[Nobilissi]MIS CAESARI[bus]

Subsequent damage to the plaster prohibits any improvement in the reading (Isaac and Roll 1982: 82 no. 21). Nonetheless, this unique combination of a milestone inscription completed with purely painted letters, originally noted as "a case unique in Palestine" (Avi-Yonah 1946: 102), constitutes now only one more painted milestone text for the region. What is very distinctive is that the incised text is bilingual, perhaps because it designated the initial stage of the road (Isaac and Roll 1982: 74).

**6. Ma'agan Michael**. A group of six milestones were found in the late 1950s 3 km north of Caesarea Maritima on the Mediterranean coast (FIG. 4), with dates ranging from AD 161 to 238, i.e. from Marcus Aurelius to Gordian II (Avi-Yonah 1959-1960 = *AE* 1971: nos. 470-475). It was noted that the milestone of Gordian II dated to AD 238 was different from the rest: "Le texte n'est pas gravé, mais peint à la couleur rouge sur un enduit de plâtre, travail préparatoire qui fut rendu inutile par la nouvelle, survenue entre temps à Césarée, de la mort des deux empereurs" (*AE* 1971, p. 164). It has 11 lines of Latin text which reads:

IMP(eratori) CAES(ari) | M(arco) ANTONIO | GORDIANO |
FILIO AUG(usti) | SEMPRONIANO | ROMANO | AFRICANO |
PIO FEL(ici) AUG(usto) | PONTIF(ici), TRIB(unicia) |
POT(estate) CON(n)S(uli) | PRO[co(n)s(uli)].

It is possible that this milestone was only one of a pair erected to Gordian I and his son Gordian II, since this is the only such known text where the young prince is mentioned alone (Loriot 1978: 72). Even more important, it furnishes another example of a purely painted milestone text in addition to that of the one at Ayl (no. 1), suggesting there may have been a regular practice of merely painting Latin texts on uninscribed milestones in the third century AD. In contrast, the painted texts of later periods (nos. 2 and 4-5) appear to be solely of a secondary nature. This pattern of adding new texts to old milestones has been called a "fourth-century habit," particularly because of the practice of Constantine and his sons (Avi-Yonah 1946: 102; Goodchild 1948-49: 122; Salama 1987: 60-61), but there are abundant examples of such a practice even earlier in Phoenicia, Arabia and Palestine (Thomsen 1917: nos. 9-10, 88b, 263). The procedure in adding a new inscription to an old milestone seems to have varied. There are examples of four and five inscriptions being excised over each other, with the fresh letters painted in red after the stone had been whitewashed; sometimes before the letters were incised and painted, the surface of the stone was plastered to cover the older inscription and provide a fresh surface for the engraver and painter (e.g. Járdányi-Paulovics 1949: 58). The new inscription was evidently highlighted in red paint to make it easier to read. Other milestones may have been treated in similar fashion, but instead of incising the text, it was merely painted on the new plaster covering of the old inscribed milestone (nos. 4 and 5). In addition, many of the so-called anepigraphic milestones perhaps were never inscribed, but simply bore texts of solely painted letters on the whitewashed stone substratum or on a plaster covering that has long since disappeared.

One seeming allusion to this practice in ancient Chinese sources bears reexamination. In the description of *Ta-ch'in* or the Roman East (ch. 78 of the *lieh-chuan*) preserved in the *Hou Han shu* ("History of the Later Han Dynasty"), there is a passage that has been interpreted to read: "the postal stations and mile-stones on the roads are covered with plaster" (Hirth 1885: E6). This observation emanates from the records of the Chinese envoy Kan Ying's embassy of AD 97 to the region of the Persian Gulf, wherein observations are made about the Roman routes leading from Mesopotamia to the Mediterranean (Graf fc. a). However, it is highly unlikely that the characters *yu* ("postal") and *t'ing* ("station" or "office") should be understood separately as two items that were "whitewashed" or covered with "plaster" (*chi o*). Hirth interpreted the character *t'ing* as a separate item referring to "milestones" (1885: 88), but it is preferable to take *yu* ("postal") as a modifier of *t'ing* ("station") re-

ferring to the lodges used by couriers on the official routes (according to my sinologist colleague Professor Edward L. Dreyer). Nevertheless, it is possible to infer from this allusion to the Roman custom of plastering road-stations that the milestones were treated in similar fashion. In fact, painted red texts may have been applied to both in assisting travelers with information about the various stages of a route (cf. Eusebius, *Onomasticon* 136.6-8 and 137.7 with Wilkinson 1981: 104, for the location of Mount Nebo by the *sexto miliario* on the road from Livias to Esbous).

For such a purpose, it seems likely that professional painters were part of a regular corps of technicians and craftsmen of both Roman civil and military administration in a province. Much of the road construction in the provinces was the responsibility of the army, requiring surveyors (*mensores*), stonemasons (*lapidarii*), and the engravers of the milestones (Chevallier 1976: 84-86). In fact, papyri from Egypt indicate that legionaries were engaged in quarrying stone for construction projects in southern Jordan in AD 107, immediately after the annexation of the Nabataean kingdom (*P. Mich.* VIII [1951], nos. 465-466). It is entirely possible that their efforts are to be associated with the construction of the *Via Nova Traiana* (AD 111-114), for which Petra served as the initial *caput viae*. Painters may have been included in the number of military specialists or *immunes* associated with such projects (Lippold, "Malerei," *RE* 14 [1928] 881-898). Some support for this possibility can be found in the stele from Madā'in Ṣāliḥ in al-Ḥijāz that bears a Greek inscription mentioning "Hadrian, painter (*zôgraphos*) with the Third Cyrenaican legion" (Barger 1966: 218; 1969: 139). Such painters were used in the production of painted shields and parade armor at military factories at such locations as Sardis in Asia Minor and Antioch in Syria (Hanfmann 1981: 88). But painters also were required for official texts and various insignia, such as the traces of letters and numerals that survive occasionally on the stone barracks of Roman military camps. The painting of texts on milestones may also have been part of their normal operations.

Vestiges of the red paint used for inscriptions occasionally can be observed in the crevices of the incised letters. According to Pliny, the pigment used was called *minium* in the Latin-speaking world and was comparable to what the Greeks called *miltos* and *cinnabar* (*NH* 33.116). The inorganic variety (mercuric sulphide) was extracted from red ores primarily found in Spain and Asia Minor, but also from other regions including the East, where red pigment was produced from a variety of sources (W. Kroll, *RE* 15 [1932] cols. 1848-1854). For example, the so-called Indian cinnabar (*dracaena cinnabari* or "dragon's blood") was exported from Socatra to Roman Egypt in the first century AD (*Periplus Mari Erythraei* 30). In general, painters used cinnabar or minium for decorating books and brightening the letters in inscriptions on walls and monuments (*NH* 33.116-118), but there were distinctive and important differences between the various pigments. Minium was better for painting exposed to the elements, although the toxic and poisonous nature of mercuric sulphide known popularly as red lead was recognized as a problem. In particular, Egyptian and African red ochre was especially practical, since it was readily absorbed by plaster (*NH* 35.35) and better for exterior painting, since metallic pigments are more resistant to weathering and sunlight. In contrast, organic pigments are less durable than the inorganic pigments, even if they are initially brighter, cleaner and more vivid. As a result, it was preferable to utilize a combination of both organic and inorganic elements. Thus, the "Syrian" type was frequently mixed with cinnabar (*NH* 35.40) and minium (*NH* 33.120) to improve the quality. By modifying the high viscosity of the inorganic pigments, the mixture provided improved flow and absorptive qualities for binding to the substrate, i.e. the addition of an oil or resin to red ochre was especially helpful for penetration of porous limestone or sandstone. (My appreciation to John D. Graf, Technical Manager of the Chicago branch of Toyo-Dupont International Ink, for his valuable contributions to this discussion).

Of course, painting as a medium for texts in various scripts is not an unknown phenomenon in the Levant. Numerous examples exist from the Iron Age through the Byzantine eras, and the practice must be of long antiquity (cf. *Deut.* 27:2-3), especially as writing systems developed more fluidity and became adaptable for painting as a medium. Among the earliest examples are the recent discoveries of eighth-seventh century BC "Canaanite" texts written in black and red ink on plastered walls at Dayr 'Allā in the Jordan Valley (Hoftijzer and van der Kooij 1976) and Kuntillat 'Ajrūd in the southern Naqab (Meshel 1978). In the Classical era, painted funerary texts became common as early as the Hellenistic period, as is evident from the painted Greek texts found in tombs at Sidon, the product of Seleucid mercenaries serving in the area (Jalabert 1904). Just as prevalent was the use of painted letters on commercial objects. For example, monograms on pottery were frequently just painted, such as those at Tall Jammah, 12 km south of Gaza in Palestine, where a local Hellenistic storage jar discovered has a painted monogram on its shoulder reading *'abum* in South Arabian (Van Beek 1983: 19). In South Arabia, one of the amphorae sherds found in the recent excavations at the ancient Ḥaḍramawt port of Qanā has a reddish-orange painted Greek inscription and another has a monogram reading *l'n* painted in red on its shoulder and a cursive Palmyrene text scratched on its neck (Sedov 1992: 116-118, and discussed by F. Shelov-

Kovedyaev on pp. 136-137). Such examples could easily be multiplied, but these are sufficient to illustrate the widespread nature of purely painted texts and letters.

The region of Petra itself was no stranger to the practice of using paint for both artistic and writing purposes. Nabataean pottery provides a prime example of durable red paint used in the firing process, surviving in the multiple designs and decoration on bowls and other fine ware. This paint was undoubtedly produced from the local ores available in the region (Mason and 'Amr 1993: 207). In fact, vessels found on the floor of the painters' workshop in the western complex of the Winged Lions Temple contained mixed paint in a variety of colors (red, white, black, green, yellow, blue), some blue pigment balls, and fibrous gypsum probably used as a binding agent (Hammond 1987: 130). The same paints and pigments used for the interior walls (Muratoff 1935; Barbet 1985) were readily accessible for writing on plaster, stone or ceramic materials elsewhere. From the rooms adjacent to the same painters' workshop, Aramaic and Greek graffiti were found on plaster fragments and sherds of Nabataean fine red ware that were written with a black inky substance (Hammond 1986: 162). North of Petra, at the entrance to Sīq Umm al-'Aldā on the route leading west to Gaza, there is a Byzantine military Greek graffito painted in large red letters across the base of a Nabataean inscribed cartouche and two pyramids of an incised funerary stele on a rock cliff (Zayadine 1993: 92). Similar black inked Nabataean Aramaic and Greek texts as those at Petra have been discovered in a minuscule script 8-10 mm on the interior plastered temple walls of the Nabataean sanctuary of Allat at Wādī Ramm (Savignac and Horsfield 1935: 263-270). At nearby Hudayb al-Fala, 12 km to the southeast of Wādī Ramm in the Ḥismā desert of southern Jordan, pre-Islamic Thamudic graffiti were painted in a similar black inky substance on a large overhang of an *inselberg* (Jobling 1982: 470). These illustrations of the employment of paint by the local indigenous population suggest it was also probably used extensively for official purposes in the Roman imperial period.

This assumption is supported by several examples of Greek and Latin dedicatory texts of the third century AD in which some lines, words or letters are merely painted, rather than inscribed. One is on an altar discovered at the entrance to the chapel tower of the Temple of Be'l at Dura which bears a Greek dedication to Jarhibol the Palmyrene sun deity by the tribune Scrobonius Mucianus (Hopkins 1931: 90, no. H3). The incised letters of the text are marked in red, but others are merely painted, such as the *rho* in the name Scrobonius, the ending of the word *chiliarchos*, and the words *kata keleusin* in the last line. A similar inscribed and painted Greek text was discovered on an alabaster stone found in a private house in the center of Dura not far from the Roman camp. It bears the nine line epitaph of Julius Terentius, the tribune of an auxiliary cohort in which the last part of line eight and the final line are painted in red, whereas the rest of the text is inscribed. It is possible the red paint was a guide to the stone-cutter and left in an incomplete state, but since the lower part of the stone contains cracks and blemishes, it appears the engraver was probably forced to cease cutting the letters and use mere paint for the remainder of the text (Rostovtzeff *et al.* 1944: 176-182, no. 938). Another example of a partially painted text is the Latin temple dedication of Marcus Celerinius Augendus, a prefect of the *ala Pannoniorum*, which was offered to the *dii campestres* at Gemellae on the confines of the Sahara. The first three lines are engraved, but, after the middle of line four, the remainder of the text is merely painted (Mallon 1955). This use of paint for texts involving Roman military personnel suggests that it had larger administrative purposes, including the supplying of texts for milestones.

Purely painted texts on uninscribed milestones would help explain the existence of so many "anepigraphic" road-markers in the East and perhaps elsewhere (cf. Walser 1974). Such painted texts were probably an economical measure for marking the many stages of a route, saving both time and labor, especially in the more arid regions of the east and during periods of political turmoil. Centuries of exposure and weathering have evidently erased much of the evidence of what appears to have been a widespread procedure of just painting texts on plastered or whitewashed milestones. In tracking Roman routes, piles of milestones are frequently encountered at regular intervals in groups of four to ten. The normal procedure has been to inspect all the columns for any signs of incised letters and ignore those which have only smooth surfaces. The examples cited above suggest each milestone should also be inspected for any traces of paint or plaster. Even illegible traces of red painting on the stone surface may indicate that either the text has deteriorated or represent the residue of the pigment on the stone substratum after it penetrated the absorptive plaster. More importantly, vestiges of a purely painted text may be found on the milestone that will contain additional information about the history of the road. Such careful examination of anepigraphic milestones in other regions of the empire may produce even more painted texts, which at present seem restricted to the Levant.

## Abbreviations and Bibliography

*AE = L'année épigraphique.*

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# Nouvelles gravures rupestres à Pétra: techniques, religion, épigraphie

Au cours de la dernière mission (novembre 1991) de l'ERA 20[1] du CRA (CNRS) à Pétra, des gravures rupestres, accompagnées de quelques signatures et d'une inscription, ont été découvertes dans un secteur périphérique, au nord de la capitale nabatéenne[2]. Contrairement à la majorité des gravures étudiées ou seulement signalées par les explorateurs et les archéologues depuis la fin du XIXe siècle, tant à Pétra que dans l'ensemble du domaine nabatéen[3], le motif principal de ces gravures ne représente ni des animaux (ibex, chameaux), ni des personnages (chasseurs, cavaliers, ...). Ce sont des dessins à la composition relativement complexe dont la signification symbolique et religieuse ne fait pas de doute. Il est étonnant que ce type de gravures, à motifs ni zoomorphes, ni anthropomorphes, dont il existe à Pétra même et à sa périphérie quelques exemples caractéristiques, n'ait jamais fait l'objet d'une étude détaillée. Cela est d'autant plus regrettable qu'elles sont le plus souvent associées à des inscriptions dont le caractère parfois fruste ne doit pas faire oublier l'intérêt qu'elles présentent pour la connaissance de la religiosité du citoyen nabatéen dans la pratique quotidienne de son culte. Cet art rupestre, par la facilité de sa mise en oeuvre, à la fois du point de vue des outils nécessaires à sa réalisation et du point de vue de leur support matériel, est en effet fondamentalement individuel. L'expression du graveur y est suffisamment libre pour que l'on puisse parler de pratique religieuse personnelle et spontanée.

## Localisation et contexte

Le site où ont été découvertes les gravures rupestres dont il est ici question est situé dans la partie sud du secteur de Bayḍā, surtout connu par son site néolithique[4] et par le Sīq al-Bārid, familièrement appelé "petit Pétra" dans les ouvrages de vulgarisation scientifique. Ce dernier est un défilé aux accès limités où sont réunis, dans un cadre ombragé par les parois rocheuses, plusieurs salles de banquet, des citernes et quelques petits monuments à caractère cultuel. Comme cela a été signalé ces dernières années[5], ce secteur possède également d'importants aménagements agricoles (champs en terrasses, citernes, canaux d'adduction d'eau, pressoirs à vin et à huile), dépendant d'une ou deux agglomérations villageoises. Les quelques dizaines de maisons sont trop mal conservées en élévation pour envisager un relevé d'ensemble sans dégagement préalable.

Le secteur de Bayḍā a donc été l'objet, dans l'antiquité, d'une mise en valeur de type agricole associée à une occupation sédentaire dans des agglomérations construites et non rupestres, comme c'est le cas ailleurs à Pétra[7]. F. Zayadine a d'ailleurs récemment[8] mis en évidence le rôle joué par Bayḍā à la fois comme faubourg agricole et comme station caravanière, cette dernière fonction étant confirmée par l'existence probable d'un marché ouvert au débouché du Sīq al-Amṭī par l'importance des aménagements domestiques et hydrauliques destinés à assurer le repos des caravaniers[9]. La dernière mission de

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[1] Archéologie de la Syrie du sud et de la zone de Pétra du chalcolithique à l'avènement de l'Islam.

[2] Ces quelques gravures ont été récemment publiées par Mme D. Tarrier dans la *Newsletter* du Department of Archaeology and Anthropology de l'Université du Yarmouk 13 (1992) sous le titre 'Some Graffiti and Rock-drawings from Petra'. Nous n'avions pas connaissance de cet article au moment de la présentation de notre communication au Colloque d'Irbid en avril 1992 et nous remercions F. Zayadine qui nous en a aimablement signalé la parution et qui nous a communiqué des références bibliographiques complémentaires.

[3] Voir notamment E. Anati, *Rock-Art in Central Arabia*, Vol. I-IV. Louvain, 1968-1974; R. E. Brünnow et A. von Domaszewski, *Die Provincia Arabia*. Strasbourg, 1904-1909; G. Dalman, *Petra und Seine Felsheiligtümer*. Leipzig, 1908; M. Lindner, *Petra. Neue Ausgrabungen und Entdeckungen*. Munich, 1986, p. 101, fig. 3; W. H. Morton, 'Umm el-Biyara', BA 19 (1956), p. 32-36 ; P. J. Parr. 'Rock Engravings from Petra', *PEQ* 91 (1959), p. 106-108; J. Patrich. *The Formation of Nabatean Art. Prohibition of a Graven Image among the Nabateans*. Jérusalem, 1990, p. 157-165.

[4] D. Kirkbride, 'A Short Account of the Excavations at Petra in 1955-1956', *ADAJ 4-5* (1960), p. 117-122.

[5] Voir notamment les travaux de Z. Al-Muheisen, *Techniques hydrauliques dans le Sud de la Jordanie, en particulier à l'époque nabatéenne*. Thèse de 3e cycle, Université de Paris I, 1986.

[7] Voir l'ensemble d'habitat rupestre fouillé dans le secteur qui domine le Wādī Abū'Olleiqah: M. A. Murray et J. C. Ellis, *A street in Petra*. Londres, 1940.

[8] F. Zayadine, 'L'espace urbain du grand Pétra. Les routes et les stations caravanières', *ADAJ* 36 (1992), p. 217-239.

[9] *Ibidem*, p. 223.

l'ERA 20 a permis d'identifier la plupart des vestiges connus à ce jour dans ce secteur périphérique, d'en préciser la localisation et de découvrir, par une prospection quasi systématique des massifs rocheux, un certain nombre d'éléments nouveaux. Tous les vestiges répertoriés dans la partie sud de Bayḍā, qui bordent la route moderne reliant ce site à Pétra, sont présentés dans une brève description, avec un renvoi à la bibliographie récente (annexe A ci-après). En attendant de disposer d'une carte topographique nécessaire au report des vestiges, ceux-ci ont été localisés sur photographie aérienne (FIG. 1, les gravures correspondent au n°103).

Dessins et inscriptions ont été gravés au sommet d'un éperon rocheux, à quelques pas seulement du talus qui domine le wādī, dans le secteur connu sous le nom d'aṭ-Ṭnūb (FIGS. 2, 3). Ils sont isolés de tout vestige nabatéen important mais sont néanmoins situés à quelques mètres d'une petite carrière d'extraction du grès. La gravure de dessins et d'épigraphes, associée à des carrières, est une pratique assez répandue à Pétra et dans ses environs, mais les motifs représentés sont généralement des oiseaux (dessins schématiques en forme de V aux branches concaves), des bétyles rectangulaires simples[10], des palmiers ou des nefesh. Ils sont par ailleurs gravés directement sur le front de taille, de préférence en hauteur (et datent donc du début de l'extraction). Leur lien avec les carrières est donc plus évident que dans le cas qui nous occupe.

## Techniques

*Le support*

La découverte de nos gravures rupestres n'est pas entièrement due au hasard. En effet, au cours de la prospection de ce massif, notre attention a été attirée par une plaque rocheuse faiblement pentue, de couleur marron foncé et d'aspect uniformément lisse. Ses caractéristiques morphologiques sont proches de celles d'autres plaques rocheuses, sur lesquelles nous avions déjà remarqué des gravures typiquement nabatéennes : ibex, plantes de pieds, motifs géométriques, etc. Il est vraisemblable que ces plaques — que nous essaierons de définir d'un point de vue géomorphologique — ont attiré l'attention des graveurs pour leur solidité et surtout pour l'effet esthétique qu'elles permettaient de produire: l'entaille réalisée par le graveur fait en effet ressortir la couleur plus claire du matériau rocheux sous-jacent, donnant ainsi un effet de relief tout à fait inhabituel aux gravures rupestres.

Les grès qui sont recouverts de cette patine foncée appartiennent à l'Ordovicien et présentent dans la masse une couleur blanche, contrairement aux grès cambriens très colorés de Pétra[11]. L'apparition d'un revêtement foncé uniforme sur ces surfaces exposées à l'air libre pose problème et peut s'expliquer ainsi : l'érosion a rendu apparents des joints de stratification (le grès est une roche sédimentaire) qui se sont préalablement enrichis, à l'époque de la sédimentation, en sels métalliques (fer, manganèse, ...). Cet enrichissement résulte de la migration, par ascension capillaire, d'oxydes minoritaires extraits de la roche qui sont ensuite emprisonnés à la surface. En effet, sous climat désertique, la rosée et les rares pluies peuvent imbiber quelques millimètres ou centimètres de la roche poreuse qu'est le grès. Or cette eau contient des radicaux chimiques, empruntés aux sols de surface et/ou aux produits de la décomposition des bactéries et des algues, grâce auxquels les minéraux non siliceux contenus dans la roche sont mis en solution. Enfin, sous l'effet du soleil, les solutions ainsi produites remontent à la surface, l'eau seule s'évapore et les charges contenues dans les solutions restent sur place. C'est de cette manière que se forment, par exsudation et sur roches cristallines, des revêtements colorés, couvrants et protecteurs. En milieu calcaire par exemple, le même processus produit des croûtes ou dalles cimentées.

L'enduit sombre qui couvre ces grès est mince (quelques dixièmes de millimètres) et il repose sur un substrat minéralogiquement appauvri moins cohérent que la roche saine. Lorsque l'enduit se fracture, en raison de son fort coefficient de dilatation (dû à la teinte foncée), le niveau sous-jacent, friable, peut se déliter sous l'effet d'agents climatiques tels que le vent ou du martèlement des pieds de chèvres et le cycle peut recommencer. Si pour l'instant l'existence de ces surfaces aux revêtements si particuliers peut nous guider dans la recherche de nouvelles gravures ou inscriptions, celles-ci sont par ailleurs directement menacées dans la mesure où l'incision même du graveur perfore l'enduit pour s'inscrire dans le niveau fragilisé plus clair.

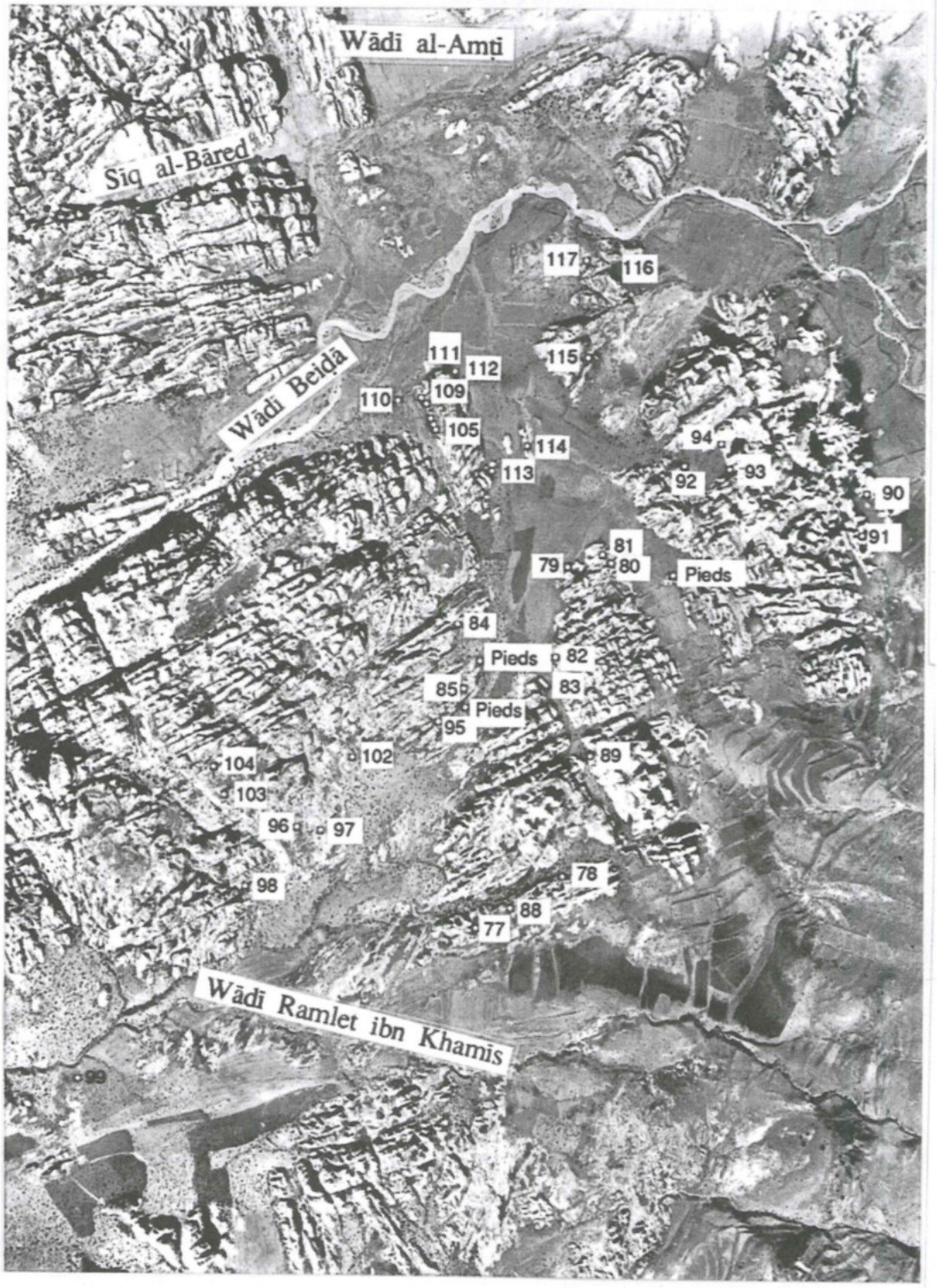
*Les techniques de gravure*

Les techniques de gravure nabatéennes sont relativement simples et peuvent être réduites à deux: celle du piqueté et celle du trait incisé, le premier pouvant être raréfié ou serré et le second incisé plus ou moins profondément en fonction de l'effet recherché. Dans les deux cas, les outils employés doivent être semblables à ceux utilisés par les tailleurs de pierre, notamment le pic. Les deux catégories de techniques ont été employées pour les gravures de notre ensemble: trait fin et homogène pour les dessins A, B et C, piqueté assez serré pour l'ensemble des trois pieds D. Quant au tracé des inscriptions, il est fin et régulier

[10] Voir la description de ce type de représentation bétylique dans M.-J. Roche, *Niches à bétyles et monuments apparentés à Pétra.* Thèse de 3e cycle, Université de Paris I, 1985, n°XXII, 47 et 53, p. 364 et pl. 75-76 dans le Wādī aṣ-Ṣiyyagh ou G. Dalman, *op. cit.*, n°192 c.

[11] Nous remercions vivement M. Jacques Besançon, Professeur à l'Université de Tours, qui nous a aimablement communiqué ces renseignements et ceux qui suivent.

Secteur sud de Bayḍā: location des vestiges.




Cliché IGN 1974, n° 115

1. Photographie aérienne couvrant le secteur où se trouvent les graveurs.



2. Photo de la plaque rocheuse.

dans les trois premières gravures mais grossier dans la dernière dont le texte est d'ailleurs inachevé. Ces éléments permettent de dire avec quelque certitude que ces dessins sont le produit d'au moins deux "mains" différentes.

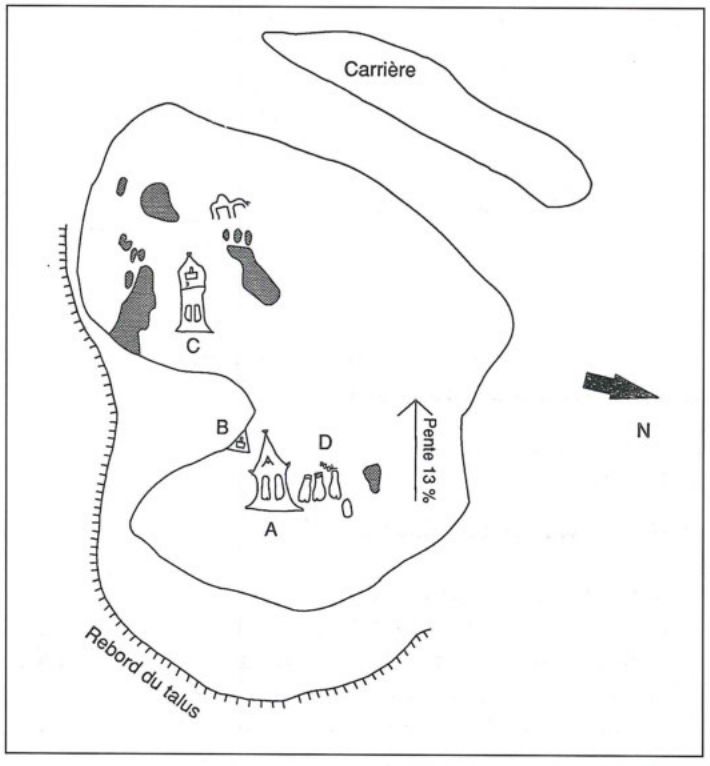
## Les gravures

*Description générale*

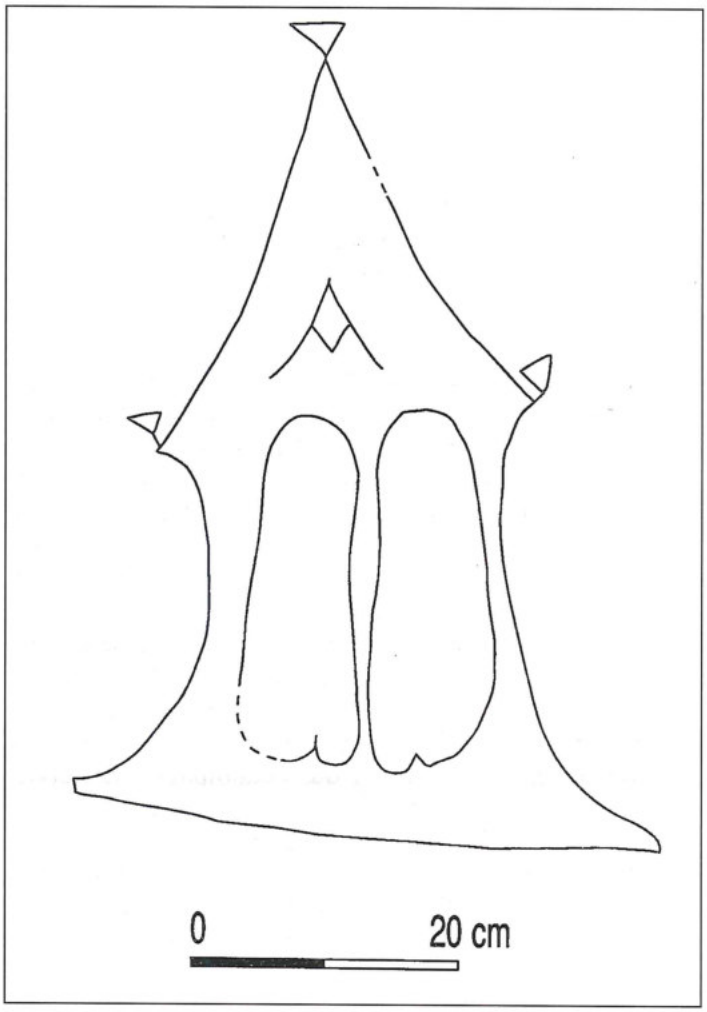
Quatre ensembles de gravures peuvent être individualisés sur la plaque rocheuse (croquis général FIG. 3). Numérotés de A à D, ils se présentent de la manière suivante :

A (FIG. 4): Pyramide en forme de nefesh (hauteur totale = 62,5 cm, largeur à la base = 45 cm). La partie inférieure de la composition présente des parois concaves et s'évase à la base. La partie supérieure, aux contours plus rectilignes, se termine en pointe et est surmontée d'un petit acrotère triangulaire. Ce dernier élément se retrouve, légèrement plus petit, à la jointure saillante entre les registres inférieur et supérieur[12]. A l'intérieur du cadre ainsi défini prend place, dans le registre inférieur, une paire de pieds nus tournés vers le bas, dont seul le gros orteil est marqué. Au-dessus est gravé un A majuscule grec dont la barre médiane est en forme de V.

B (FIG. 5): Cadre triangulaire dont la partie gauche est coupée par une cassure de la plaque rocheuse (hauteur totale conservée = 31 cm, largeur conservée à la base = 36 cm). A l'intérieur, un bétyle rectangulaire au som-

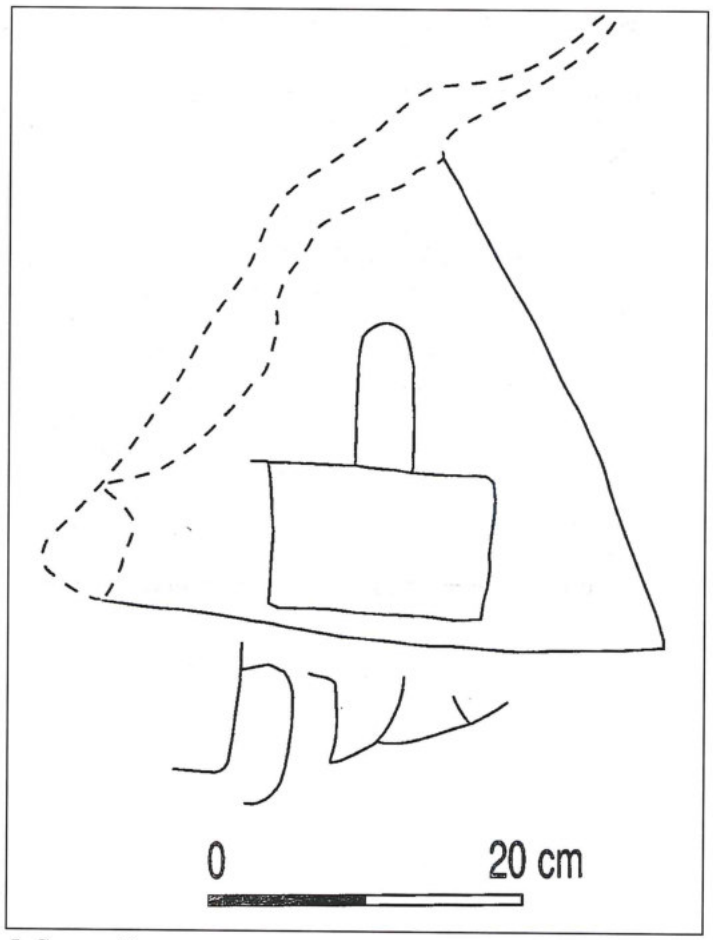



3. Croquis général de la plaque (relevé R. Saupin).




4. Gravure A.

[12] Une nefesh similaire a été taillée sur le chemin du Haut-lieu. Elle nous a été signalée par F. Zayadine qui l'a publiée dans 'A New Commemorative Stele from Petra', *Perspective* 12 (1971), Essays in Memory of P. W. Lapp, p. 57 et suiv. Nous n'avons malheureusement pas pu consulter cette référence à Paris.



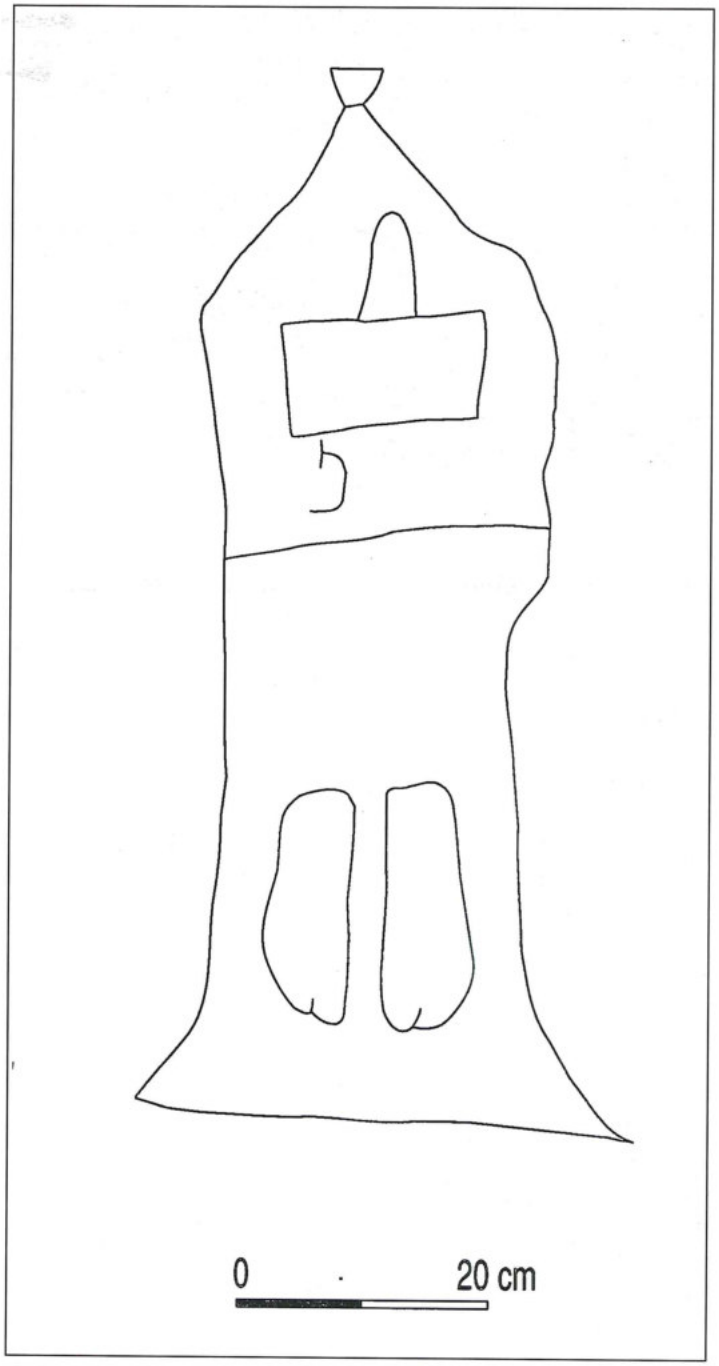

5. Gravure B.

met faiblement arrondi (hauteur = 8 cm) sur un socle également rectangulaire de 10,5 cm de large et 7 cm de haut environ. Sous le triangle, une signature nabatéenne au trait fin: 'bdt = 'Ubdat = Obodas.

C (FIG. 6): Grande figure à deux registres (hauteur totale = 85 cm, largeur à la base = 40 cm). Le premier registre, deux fois plus haut que le second, s'évase légèrement à la base. La partie supérieure de la gravure se présente sous la forme d'un édicule au toit à double pente, surmonté d'un acrotère trapézoïdal. Les objets gravés (une paire de pieds dans la partie inférieure et un bétyle sur son socle dans la partie supérieure) sont en tous points semblables à ceux de la figure B. De l'inscription qui accompagne le bétyle, seule une lettre (un mem), est lisible. Comme en B, il s'agissait sans doute d'une signature.

D (FIG. 7) : Trois pieds aux orteils marqués formant une paire et un pied droit. Ils sont surmontés d'une inscription inachevée: ( Šlm m... = Que soit sain et sauf M...

D'autres pieds isolés et un dromadaire sont également gravés sur la plaque rocheuse mais ils ne feront pas l'objet d'une description détaillée.




6. Gravure C.

*Analyse des différents éléments dessinés*

- Les pieds : La représentation de pieds, chaussés ou nus, est une pratique largement répandue dans l'antiquité. On la trouve aussi bien dans des monuments sacrés (temples, sanctuaires) que profanes (maisons, thermes)[13] et il est évident que sa signification symbolique est différente, non seulement en fonction du con-

[13] Voir une mise au point récente sur ce problème dans K. M. Dunbabin, '*Ipsa deae vestigia*... Footprints Divine and Human on Graeco-Roman Monuments', *JRA* 3 1990, p. 85-109.



7. Gravure D.

texte monumental dans lequel elle se situe mais également en fonction de la taille des pieds représentés, de leur position relative, de leur association à d'autres éléments figurés ou à des inscriptions. Il peut s'agir de pieds divins, de pieds de dédicants, de pieds incitant à suivre un itinéraire particulier ou invitant à se chausser à l'entrée d'un *tepidarium* thermal. Dans le cas des gravures rupestres de Bayḍā, il est quasiment certain que nous avons affaire à des pieds de dédicants. En effet, d'après les critères établis par K. M. Dunbabin[14], leur taille moyenne et surtout leur association à des signatures individuelles permettent de les interpréter sans ambiguïté comme les pieds de dédicants qui souhaitent ainsi immortaliser leur présence face à la divinité symbolisée par un bétyle et perpétuer l'action d'éventuelles prières. Comme le dit L. Castiglione[15] cité par Dunbabin:

« The footprint is a picture-like 'formula' of the proscynemata of the Egyptian temples. It symbolizes the person offering his devotion before the gods and at the same time eternalizes his place and presence in the nearness of the deity ».

- La nefesh : Il est clair que le cadre dans lequel s'inscrivent les pieds du dessin A représente une nefesh, c'est-à-dire le symbole qui dans le domaine nabatéen marque la présence spirituelle d'un défunt et appelle donc sa commémoration, en un lieu qui est très souvent sans aucun lien avec la sépulture proprement dite. Gravées ou taillées dans le rocher, comme le sont les bétyles, elles s'en distinguent cependant à la fois par la forme et la fonction. En effet, la nefesh revêt le plus souvent la forme ld'une base à degrés, d'un corps en forme de dé, souvent plein, d'une corniche surmontée d'une pyramide, laquelle peut comporter un pyramidion terminal[16]», alors que la forme habituelle du bétyle est un bloc quadrangulaire, (parfois arrondi au sommet) et dans quelques cas seulement un bloc ovoïde. Le bétyle peut avoir une fonction commémorative, surtout lorsqu'il est accompagné d'une inscription du type lque soit commémoré Untel fils d'Untel»[17]mais il a surtout une fonction cultuelle (monument votif ou objet du culte), comme l'attestent les alvéoles ou cupules à libations qui l'accompagnent, le rebord ou les gradins taillés en avant de la niche qui servaient au dépôt des offrandes, ce qui est également le cas des mortaises ou trous d'accrochage qui servaient à les suspendre. Par comparaison, les nefesh ne semblent pas avoir fait l'objet d'un culte et leur fonction commémorative est essentielle, à chaque défunt étant associée une seule nefesh[18].
- Le bétyle sur son socle: Le bétyle constitue la représentation traditionnelle de la divinité chez les Nabatéens et le socle sur lequel il repose parfois est appelé dans les inscriptions le *môtab*[19]. Il est vraisemblable que nous ayons affaire ici, comme ailleurs, au bétyle de la principale divinité nabatéenne, *Dūšārā*, que l'on trouve souvent associée dans des inscriptions à des niches à bétyle(s)[20]. Si la représentation du bétyle sur son *môtab* (ou base à bétyles), n'est pas rare à Pétra, elle ne revêt habituellement pas la forme qui est celle de nos gravures[21]. Le *môtab* se présente en effet soit sous la forme d'une simple base légèrement plus évasée ou de même largeur que le bétyle qui la surmonte[22],

14 *Ibidem*, p. 88.

15 L. Castiglione, 'Vestigia', in *Acta Archaeol. Acad. Sci. Hung*. 22 (1970), p. 128.

16 J. Starcky, 'Nouvelles stèles funéraires à Pétra', *ADAJ* 10 (1965), p. 43.

17 D'après E. Stockton, 'Petra revisited: a Review of a Semitic Cult complex', *Aust. J. Biblic. Archaeol*. 1,4 (1971), p. 63, « the desire seems to be to retain a perpetual remembrance of the votary before the presence of the god».

18 Les exemples les plus remarquables de nefesh portant des inscriptions mentionnant un défunt se trouvent à l'entrée du Sīq. Elles ont été publiées par Starcky 1965, *op. cit.*

19 Pour une mise au point récente sur le môtab, son origine, les attestations épigraphiques du terme, les exemples que nous en avons à Pétra et les parallèles qu'on peut lui trouver ailleurs, voir F. Zayadine, 'Les sanctuaires nabatéens', in *La Jordanie de l'âge de la pierre à l'époque byzantine* (la Documentation française). Paris, 1987, p. 95-99. L'article de J. Starcky, 'Pétra et la Nabatène', in *Supplément au Dictionnaire de la Bible*. vol. VII, 1966, col. 1010-1013, reste néanmoins utile. Enfin, sur une comparaison du rôle du môtab avec celui de l'adyton des Grecs, voir Er. Will, 'Du môtab de Dusarès au trône d'Astarté', *Syria* 63 (1986), p. 343-351.

20 Pour une synthèse sur les inscriptions dédiées à Dūšārā associées à des niches ou à des bétyles, voir Roche 1985, *op. cit.*, p. 281-288.

21 Exception faite, à Pétra, d'une gravure du Madhbaḥ (=Brünnow n°93a et Dalman n°198) qui représente un bétyle arrondi sur une base assez haute et élaborée, encadrée de palmiers. On peut également mentionner les deux bétyles, reposant sur une base et insérés dans une niche hellénisante, signalés pas A. Jaussen et R. Savignac, *Mission archéologique en Arabie*, Vol. I. Paris, 1909, p. 431 fig. 221.

22 Voir par exemple Dalman n°695.

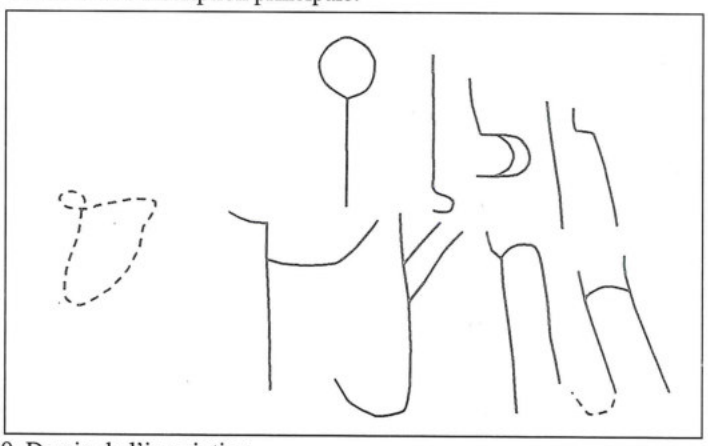
soit sous celle d'un véritable siège, ou trône[23], qui ne porte alors pas de bétyle mais a peut-être fait l'objet d'une dévotion pour lui-même ou pour la présence de la divinité qu'il accueillait symboliquement[24]. Pour ce qui est des cubes à degrés, présents dans de nombreux sanctuaires hypèthres de Pétra[25], il n'est pas certain qu'il s'agisse réellement de môtabs et leur interprétation comme des autels est tout aussi satisfaisante. Seuls les cubes de pierre qui présentent des entailles destinées à permettre l'encastrement des bétyles, peuvent fournir matière à comparaison mais ils sont relativement rares[26] et les bétyles amovibles n'ont jamais été retrouvés en connexion avec la base sur laquelle ils reposaient.

Les représentations les plus proches de celles de nos gravures sont celles qui figurent au revers des monnaies de Bostra et d'Adraa en Syrie du Sud[27]. A titre d'exemple, une monnaie d'Adraa représente un bétyle ovoïde, posé sur une base à degrés et entouré de deux ornements indéterminés, avec la légende ΔΟΥΣΑΡΗΣ ΘΕΟΣ ΑΔΡΑΗ [ΝΩΝ] et l'année 69 = 174 ap. J.-C. Celle de Bostra représente trois bétyles surmontés de rectangles allongés (dont l'interprétation n'est pas encore tranchée), le tout reposant sur une estrade surélevée vers laquelle grimpe un escalier, avec la légende ACTIA DVSARIA COL. METR. BOSTRENORVM[28]. On peut également évoquer le motif central du linteau d'un temple païen à al-Umtā'iyyah, au sud-ouest de Bostra, qui se présente sous la forme d'une base supportant trois bétyles de dimensions différentes[29].

- Les inscriptions: Les inscriptions associées aux dessins sont trois signatures, dont une inachevée et une autre presque entièrement effacée. Seul le nom propre 'Ubdat de la gravure B est bien lisible mais les lettres ne sont pas suffisamment caractéristiques pour fournir des éléments de datation. Cet anthroponyme est attesté à Pétra[30] où il désigne surtout des membres de la famille royale ou un des rois nabatéens qui portent ce nom[31], l'un d'eux, le vainqueur d'Alexandre Jannée et d'Antiochos XII, ayant été divinisé. Cet anthroponyme est plus rarement porté par des particuliers puisque seuls deux exemples ont été publiés[32]. Quant à l'alpha grec de la première gravure, il doit également être interprété comme une signature et le dédicant devait être très fier de pouvoir graver l'initiale de son nom en grec, sans doute la seule lettre qu'il connût.



8. Photo de l'inscription principale.



9. Dessin de l'inscription.

Une quatrième inscription (FIGS. 8, 9) plus longue, est gravée à quelques mètres de notre plaque, sur la partie basse d'un rocher. Il s'agit d'une inscription de deux lignes dont la graphie soulève quelques problèmes d'interprétation[33] (première ligne 18 cm, deuxième ligne, 38

23 Comme celui de la terrasse supérieure de la "maison de Dorothée" dans le secteur d'al-Khubthah (Dalman n°694).

24 Sur le rapport entre le bétyle et son môtab, ou "base" et sur un culte éventuel de la base toute seule à Pétra, voir Roche 1985, op. cit., p. 217-222, à qui il ne "paraît pas qu'à Pétra la base ait été vénérée seule, sans un bétyle" et qui pense que "c'est la présence du bétyle qui confère à la base un caractère divin» (p. 221).

25 Par exemple à Mu'ayṣrah le sanctuaire Dalman n°527i.

26 Le plus connu étant celui du Madhbaḥ ou Haut-lieu.

27 R. Dussaud, 'Le culte de Dusarès d'après les monnaies d'Adraa et de Bosra', *Rev. Numis.* 8, 4e série (1904), p. 160-165; A. Spijkerman, *The Coins of the Decapolis and Provincia Arabia.* Jerusalem, 1978, p. 58-65, pl. 10-11 (Adraa) et 66-89, pl. 12-17 (Bostra).

28 Pour l'interprétation comme un môtab des motifs représentés sur les monnaies de ces sites (Adraa, Bostra, Characmoba), voir G. Bowersock, 'The Cult and Representation of Dusares in Roman Arabia', in F. Zayadine (éd.), *Petra and the Caravan Cities*. Amman, 1990, p. 31-35.

29 H. C. Butler, F. A. Norris et E. R. Stoever, *Syria. Publications of the Princeton University Archaeological Expeditions to Syria in 1904-5 and 1909. Division I. Geography and Itinerary.* Leyden, 1930, p. 87-94. Ce linteau fait partie d'un bâtiment appelé "mosquée", dont la datation et la fonction sont incertaines. Les deux datations proposées sont postérieures à l'annexion du royaume nabatéen par Trajan.

30 Voir J. T. Milik et J. Starcky, 'Inscriptions récemment découvertes à Pétra', *ADAJ* 20 (1975), p. 115-116.

31 CIS II, 354; N. I. Khairy et J. T. Milik, 'A New Dedicatory Inscription from Wadi Musa', *PEQ* 113 (1981), p. 19-26; G. Dalman, *Neue Petra Forshungen und der heilige Felsen von Jerusalem*. Leipzig, 1912, n°73 et 90.

32 J. T. Milik et J. Starcky, op. cit. n° 2 p. 115 et notes 14-15 qui soulignent que cet anthroponyme apparaît seize fois en safaïtique et deux fois en minéen à Dēdān où il s'agit d'un nom nord-arabique; voir aussi *CIS II*, 393 bis.

33 Nous remercions ici M. Joseph Milik pour l'aide qu'il nous apportée et nous lui sommes redevables des solutions proposées.

cm de long, yod ou waw de la première ligne 11 cm de haut) :

dn ṭly/w
ḥt šbr ..h

De la seconde ligne ne subsistent que le nom ḥt š(non attesté à Pétra sous cette forme) et br, tout à fait certains. Le patronyme, en raison de la surface altérée du rocher, est par contre presque illisible. Considérant comme acquise la structure de la seconde ligne (un tel fils d'un tel), on peut envisager pour la première une construction syntaxiquement cohérente avec la suite, à savoir un pronom démonstratif suivi d'un substantif. Le schéma de l'inscription serait donc le suivant: "ceci est un ... appartenant à un tel fils d'un tel". Les lettres daleth et nun final étant sûres, il s'agit sans doute ici du démonstratif proto-arabe dn, attesté dans les inscriptions sinaïtiques[34]. La graphie du substantif est intéressante: si le ṭeth et le lamed sont des lettres nabatéennes tardives[35], la dernière lettre pourrait appartenir, quant à elle, au domaine de la graphie nord-arabe dans la mesure où la haste de la lettre part du milieu du cercle (yod nord-arabe) et non de sa partie droite comme pour un waw nabatéen. Il n'est cependant pas exclu que nous ayons affaire ici à un type de waw nabatéen dont la haste est décalée, fréquent dans les inscriptions sinaïtiques. Dans les deux cas, le substantif ainsi déchiffré, ṭly ou ṭlw, est attesté en palmyrénien avec le sens de "serviteur" mais surtout en arabe et en sud-arabique ancien avec le sens de "jeune gazelle"[36]. L'animal en question devant être sacrifié dans un sanctuaire proche de l'endroit où était gravée l'inscription.

**Interprétation**

Le caractère des symboles représentés sur ces gravures, au moins en ce qui concerne les trois premières, est indéniablement cultuel. Leurs auteurs furent sans doute des carriers qui, au cours de leur activité au sommet de cet éperon rocheux (cf. la carrière à proximité), ressentirent le besoin d'exprimer leur dévotion à Dūšarā au moyen de dessins rupestres. La représentation de motifs à la fois cultuels (bétyle, môtab) et funéraires (nefesh) enlève toute ambiguïté quant à leur interprétation: leur fonction principale est à la fois votive et commémorative et, à notre avis, la présence de la nefesh est à interpréter comme un moyen d'insister sur l'individualité de cette commémoration (elle concerne chaque fois une personne, signalée par la paire de pieds et/ou une signature) plutôt que comme l'indice qu'il s'agit d'une commémoration en l'honneur d'un défunt, à l'initiative de ses proches ou de ses compagnons. L'association des trois éléments: signature, motifs individualisants (nefesh, paire de pieds), représentation de la divinité, permettait à chacun des dédicants de se placer sous la protection de cette dernière, dans un site qui, dominant le paysage environnant, s'y prêtait admirablement. Ce type de site s'insère d'ailleurs tout à fait dans la tradition du haut-lieu si chère aux Nabatéens et aux sémites en général. A cela s'ajoutait la présence d'une surface rocheuse de couleur foncée particulièrement bien adaptée à la gravure. Les graveurs devaient en connaître les qualités esthétiques. En traçant leur nom et les empreintes de leurs pieds, ils pérennisaient leur présence auprès de la divinité et s'assuraient ainsi les bénéfices d'une dédicace permanente et inaltérable.

La connaissance de l'écriture nabatéenne (qui n'est pas un phénomène exceptionnel à Pétra si l'on considère la quantité de signatures individuelles répertoriées) et d'au moins une lettre grecque, ajoutée à un certain degré de réflexion perceptible dans l'agencement des différents motifs et le choix de leur cadre (nefesh, édicule, acrotères) nous permettent de supposer une certaine pratique, dans ce domaine, de la part de leurs créateurs. En outre, ces gravures tendent à confirmer l'importance de l'élément spontané, individuel et quotidien dans la pratique cultuelle du simple nabatéen, que l'existence d'un grand nombre de petits monuments rupestres, à Pétra et en Nabatène, avait déjà permis d'entrevoir.

[34] J. Euting, *Sinaïtische Inschriften*. Berlin, 1891, n°384p. 51 et pl. 21.

[35] Voir le tableau évolutif de l'écriture nabatéenne dressé par H. P. Roschinski, dans 'Sprachen, Schriften und Inschriften in Nordwestarabien', *Bonner Jahrbücher* 180 (1980), p. 172.

[36] L. Koehler et W. Baumgartner, *Hebräisches und aramäisches Lexikon zum alten Testament*. Leiden, 1974; C. F. Jean et J. Hoftijzer, *Dictionnaire des inscriptions sémitiques de l'ouest*. Leiden, 1965.

**Annexe A.** Liste des vestiges du secteur sud de Bayḍā

| n° | Description |
|---|---|
| 77 | Pressoir composé de deux cuves carrées de 3,5 et 1 m de côté respectivement. En contrebas de la seconde, une citerne-bouteille est alimentée par une canalisation qui fait le tour du rocher |
| 78 | Citerne couverte au moyen de deux arcs (Muheisen 1986, p. 110-111) |
| 79 | Chambre rupestre avec porte simple. A droite, une niche bassin et une niche avec bétyle en creux (dim. bétyle = 60 x 40 cm) |
| 80 | Pressoir composé d'une grande cuve carrée et de deux autres cuves qui communiquent entre elles |
| 81 | Plaque rocheuse avec dessins de pieds et de bouquetins et quelques inscriptions |
| 82 | Nefesh gravé sur une paroi rocheuse dont la surface a été égalisée, à faible hauteur du sol (hauteur = 75 cm) |
| 83 | Maison entièrement rupestre, seul le toit étant rajouté sur des arcs construits |
| 84 | Nefesh sur base. En-dessous à droite, trois bétyles. Inscription (Brünnow 1909 n°833) |
| 85 | Tombe à fosse |
| 87 | Citerne (Muheisen 1986, p. 109) |
| 88 | Ferme (Muheisen 1986, p. 110) |
| 89 | Barrage (Muheisen 1986, p. 111) |
| 90 | Stibadium hypèthre |
| 91 | Chambre funéraire avec porte simple. A l'intérieur, au fond, 4 sarcophages creusés dans le sol |
| 92 | Niche avec bétyle en creux (dim. bétyle 30 x 17 cm) |
| 93 | Triclinium couvert, chambre aux parois soigneusement taillées, largement ouverte sur l'extérieur. Dans la paroi du fond, en haut, 3 niches de forme irrégulière |
| 94 | Ensemble de niches |
| 95 | Petite niche avec cupule en-dessous (ou bétyle en creux) Dim. = 35 x 18 |
| 96 | Petite chambre largement ouverte sur l'extérieur. A gauche, une niche bassin est alimentée par une canalisation provenant du rocher au-dessus |
| 97 | Pressoir composé d'une grande cuve quadrangulaire communiquant avec une cuve circulaire au fond de laquelle un escalier de quelques marches permet d'accéder |
| 98 | Triclinium hypèthre (Tarrier 1988, n°862.3) |
| 99 | Pressoir composé de deux cuves quadrangulaires, de 3,50 et 1,20 m de côté respectivement |
| 102 | Pressoir (Muheisen 1986, p. 112) |
| 103 | Gravures rupestres et inscriptions |
| 104 | Inscription |
| 105 | Chambre avec porte simple et auvent, vide |
| 106 | Chambre avec porte simple, vide |
| 107 | Chambre à moitié ouverte sur l'extérieur |
| 108 | Ensemble de niches avec trous d'encastrement entre elles |
| 109 | Chambre largement ouverte sur l'extérieur, très peu profonde (1,5 m) |
| 110 | Pressoir composé d'une grande cuve rectangulaire et d'une autre plus petite (Muheisen 1986, p. 124) |
| 111 | Front de taille de carrière et inscription à environ 5 m du sol |
| 112 | Inscription dans la partie basse d'un mamelon rocheux |
| 113 | Inscriptions |
| 114 | Pressoir composé de deux cuves quadrangulaires. A côté, un bassin |
| 115 | Niche à bétyle (dim. bétyle = 47 x 24 cm) |
| 116 | Front de taille de carrière portant une inscription et un bétyle gravés |
| 117 | Pressoir composé d'une grande cuve et de deux autres plus petites |

**Bibliographie de la liste des vestiges :**

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# 'Ayn Ghazāl: A Comparative Study of the 1983 and 1985 Statuary Caches

## Introduction

The recovery of two caches of lime plaster statues at the PPNB site of 'Ayn Ghazāl in 1983 and 1985 respectively has initiated a welter of activity related to the investigation of the manufacturing techniques, and the identification of materials used in the process, and also, speculation concerning the purpose these figures served and some reflection on the artistry and sophistication of their creators.[1] Running in tandem with these issues has been concern over the preservation of the statues. Research efforts at both the Institute of Archaeology, London and the Conservation Analytical Laboratory of the Smithsonian Institution, Washington, D.C. have been directed towards developing the best possible course of treatment given the present state of the art/science of conservation. The condition of the statues and the materials used in their manufacture pose unique problems for the conservator.

## Condition and Technology

*Plaster*

The location on the site of the two statue caches has had a considerable impact on their condition. Both caches were affected by the construction of a motorway through the site in the mid-seventies (which led to the discovery of the site). Adjacent to the motorway, running along its length, a section was cut out of the slope to create a terrace to accommodate the movement of bulldozers and other heavy equipment.

The 1983 cache lay approximately 1.5m below this cut. The vibration and weight generated by the machinery were partially dispersed by the intervening occupation layers; however, the resultant crushing, cracking and breaking of the objects were severe. The statues had originally been constructed on a reed/rush core which had deteriorated completely. The voids thus created have either all but disappeared as a result of compression caused by the overburden of soil and compounded by the bulldozer traffic, or are filled with a free-flowing silt containing a high proportion of plaster crumbs which were originally intermeshed with the uneven perimeter of the organic core. Where the front and the back of the statues have compacted, the plaster is virtually pulverized or has achieved the new shape through the formation of a myriad of fine networks of cracks (FIG. 1).




1. 1983 cache (having been inverted in the field during lifting) undergoing excavation in the laboratory.

[1] For the discovery and nature of the 1983 cache of statues, see Rollefson 1985, Tubb 1985 and Tubb 1987. For the statues excavated in 1985, see Rollefson and Simmons 1986.

The presence of the second cache was suspected in 1984 when material similar to that of the first cache was observed to be eroding out of the vertical side of the terrace cut for the bulldozers. That part of the contents of the cache which had been subjected to this gradual exposure, in a zone which would have formed an evaporation front for moisture in the ground, has sustained severe water damage, perhaps also attributable to an ancient intrusive pit. Until the second cache could be lifted the following season, the exposed area was back–filled to try to arrest any further deterioration (FIG. 2).

Apart from the differences in condition attributable to the particularities in situation then, the plaster of both caches varies in the degree of its fragility from extremely fragile to relatively sound. In addition, where the plaster of adjacent figures has been in intimate contact, not separated by even a millimetre of pit fill, presumed cycling of the calcium carbonate between carbonate and bicarbonate in response to moisture in the burial environment has resulted in the formation of a natural cement in these areas.

Another factor contributing to differences in condition of the two caches may have been modifications in production method and/or compositional differences of the plaster. Evaluation of this evidence by Tubb and Grissom is still incomplete and, subsequently, it is not altogether clear whether or not perceived differences are the result largely of semantics and methodology. Should this prove to be the case, they may be deemed insignificant as research and collaboration progress.

Only a small number of plaster samples from the 1983 cache has been subjected to X–ray diffraction, scanning electron microscopy (SEM) and energy dispersive X–ray analysis by M. Fabrizi of the Institute of Archaeology and S. Tarling of Birkbeck College in London thus far. The results of these tests reveal a content of 89–90% calcite (calcium carbonate), 8–10% α-quartz (silicon dioxide) and a 0–3% mixture of three phases the best matches for which are fairchildite ($K_2Ca(CO_3)_2$), ferroan dolomite ($Ca(Mg[0.67]Fe[0.33])(CO_3)$ and buetschlite ($K_2Ca(CO_3)_2$). A comparison of a limestone sample from an outcrop on the site and of plaster samples using scanning electron microscopy reveals a marked morphological difference. The former is characterized by clearly defined particles and appears to be fairly crystalline. By contrast, the latter are characterized by a much smaller grain size with areas which tend to be amorphous or colloidal structurally. The lime plaster from the statues is rich in nannofossil content, however. Experiments conducted at the Institute of Archaeology in




2. Detail of 1985 cache undergoing excavation in the laboratory. N.B. The bituminous mastic used to decorate the eyes has been removed temporarily prior to consolidation of the statues.

London revealed that at temperatures of 700°C the structure of these nannofossils begins to soften and break down. Comparison of statue plaster with wall plaster reveals that the latter contains far fewer nannofossils.

Tubb has concluded, therefore, that a nannofossil rich mineral source, perhaps the chalk referred to by Mandel and Simmons (1988: 431) as being abundant in the area, was crushed and used as a filler to modify the working properties of the slaked lime putty. Certainly, too little quartz is present to have reduced shrinkage sufficiently for the plaster to perform satisfactorily. Indeed, it is possible that the quartz is present not intentionally but rather as a constituent of the stone used for calcination. The proportion of filler to slaked lime is normally on the order of 3:1 (Ashurst 1983: 19). Some of the nannofossils may be present as survivors of incomplete calcination, but the large quantities present in the statue plaster as opposed to the finer wall plaster lead inexorably to their identification as the mineral aggregate fraction of the plaster.

Stated simply, the 1983 statues are lime plaster consisting of recarbonated lime, a relatively small amount of sand and a high proportion of nannofossil rich calcite.

Plaster samples from the 1985 cache, on the other hand, reveal that the statues are made of a water resistant plaster, composed principally of calcium carbonate, with significant amounts of clay and small amounts of quartz. Acid digestion of samples from this cache showed an average of 13% by weight for the clay/soil fraction. X–ray diffraction analysis of the clay fraction showed a 14A clay mineral, probably montmorillonite; analysis of the soil–sized fraction showed quartz and augite. The sand fraction was less than 1% by weight. There is abundant marl at the site, and there is good evidence that this was the raw material for the statues. SEM comparison of samples from the 1985 cache and samples of local marl show many similarities, including the presence of fossils known as coccoliths (Boulton 1988: 44).

There is less certainty, however, on the extent to which the marl was heated. Crystallites, the small submicron particles which are characteristic of calcined lime, are not visible with a scanning electron microscope, although they were produced when the marl was heated to 850°C. After samples of the marl were heated in the laboratory to temperatures of 650°C, scanning electron microscopy showed the fossils beginning to decompose; at 700°C the fossils had disappeared (Boulton 1988: 45–48). The temperature of 650°C would have been about the minimum for calcination to have occurred: the disassociation temperature for pure limestone varies from 660°C to 898°C, depending inversely on the efficiency with which carbon dioxide is removed; however, the temperature can be lower in the presence of impurities.

Practical experiments made with ground marl show that a water resistant material can be made with either a small percentage of lime plaster (for example, 10%) or with some heating (for example, 600°C). In either instance, the SEM appearance of the marl is not visibly altered and matches that of the figure plaster.

An interesting side line is being examined by J. Burnett[2] of the Micropalaeontology Unit, University College London because of the abundance of nannofossil material in the plaster samples. She has separated out the nannofossils from samples taken from Figures 35 (Reema), 37 (Pescennia Nigra), 38 (Zeina) and Dumpies 5 (Scaramouche), 33 (Uriah), identified them and isolated the age–indicative species so that a geological date can be given to the mineral source. The results have been mid upper Cretaceous, more precisely, Turonian and Santonian, and support the obvious assumption that the raw material was local in origin (Bender 1974: 77–78, and FIG. 76) .

*Armatures*

The statues were formed by modelling the wet plaster on a reed/rush core, identified as either *Phragmites* which grows in Jordan along streams and rivers or *Arunda* by D. Cutler of the Jodrell Laboratories, Kew Gardens in London, which served as an armature for them. The bundles of reeds were secured, reinforced and spliced together using twine. Impressions of the reeds/rushes and of the twine have been beautifully preserved in the plaster.

The cores of the dumpies from the 1983 cache consisted of a simple bundle of reeds which extended from the heads down through the centres of the bodies from half to three–quarters of their total heights, leaving broad solid bases on which they would have been quite stable and rendering them ultimately portable. Only one bust has been found to date in the 1985 cache, and this has not yet been fully excavated so that its internal structure remains unknown.

The construction of the armatures of the full figures was much more complex. In the case of Reema, Figure 35, and Zeina, Figure 38, which have been thoroughly examined, two bundles of reeds extended through the legs to shoulder height separated by a third bundle between them running through the torso, neck and into the

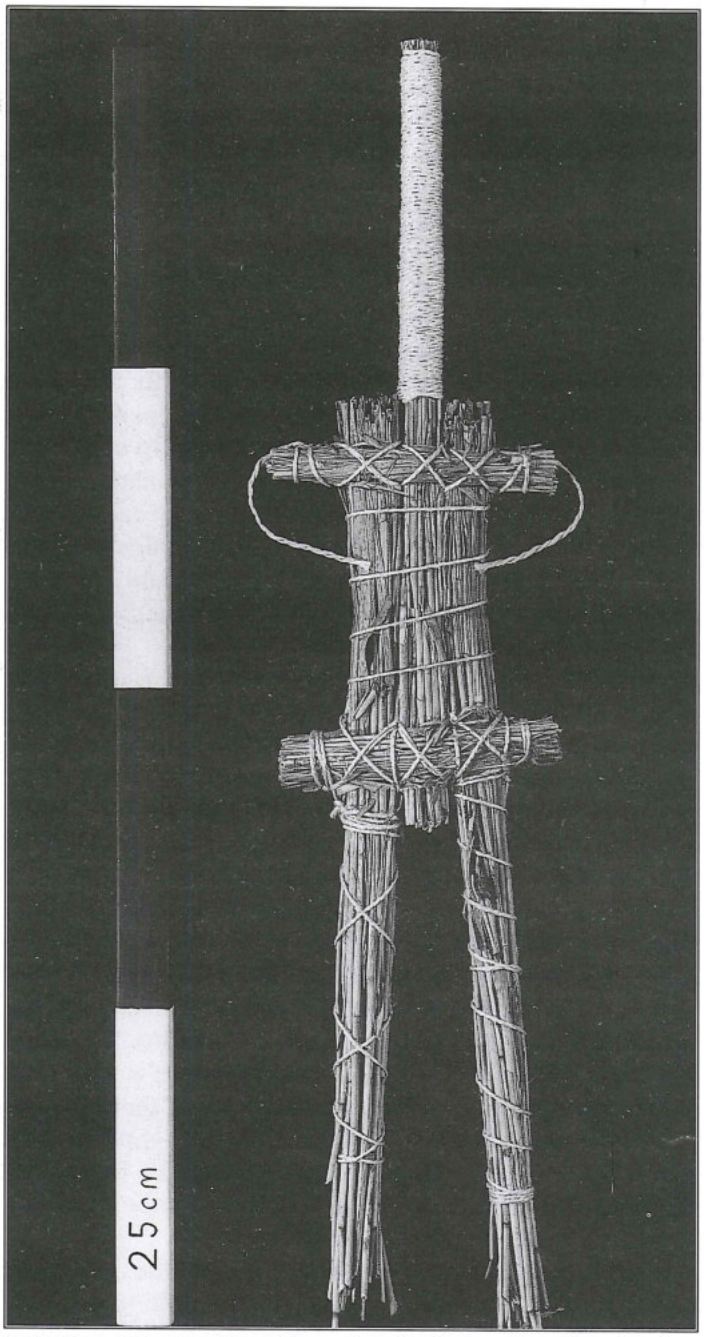
[2] Tubb is grateful to the following for their invaluable contributions: A. Roy and R. White of the National Gallery, London; M. Fabrizi and E. Titford of the Institute of Archaeology, London; J. Burnett of the Micropalaeontology Unit, University College London; S. Tarling of Birkbeck College, London; and D. Cutler of Jodrell Laboratory, Kew Gardens, London. She is also deeply indebted to P. Dorrell and S. Laidlaw for all their efforts in documenting the work photographically and to the Palestine Exploration Fund for kind permission to print two photographs from the Garstang archive. Tubb is also extremely grateful to the Department of Antiquities of Jordan and particularly Dr A. Hadidi, Dr G. Bisheh and Dr S. Tell for their unstinting support over the years.

head. At both hip and shoulder level the width of the armatures was extended by the addition of horizontal cross members of reed/rush bundles. Long pieces of twine were either looped around the bundles or crossed over around them to secure these elements in the leg and torso areas. Beginning at the bottom of the neck, a long piece of twine was lashed around the reed bundle thereby forming a continuous cover of it from the base of the neck to the top of the head, leaving the reeds to project slightly at the apex. The arms were modelled around a single piece of twine extending from the reed core in the shoulders of the figures. The figures have holes in their feet through which the reed bundles projected for at least 18cm based on evidence in the pit fill. These extensions, when embedded in a floor, would have provided an anchorage for the figures lending them stability when standing but also rendering them stationary (FIG. 3). While there are holes in the heels of the 1985 cache figures, damage to the area of the cache where they are located precludes the presence of such evidence.

The uneven contours of the armatures served as an ideal surface for the plaster to key into. Additionally, Tubb suggests that the reeds were probably used in a green state which would have reduced the tendency for water from the wet plaster mix to have been drawn into the armature ultimately decreasing the strength of the plaster and increasing the likelihood of it cracking. Evidence that the reeds used to form the cross–members were folded at their outer limits rather than cut as evinced in the plaster impressions supports the theory that the reeds were not dry during the formation of the armatures.

The use of an organic core in conjunction with plaster can then be seen to be a tradition spanning nine thousand years. It was observed by Strabo (XVI.1: 5–6) in Babylon, recorded in Hall 41 at Persepolis (Schmidt 1939: 54, FIG. 33) and documented by Wulff (1966: 135) in Iran as recently as 1966.

The amount of plaster around the bundles varies substantially throughout each statue. At some points the plaster wall is very thick and at others, as thin as a few millimetres. In some locations on the 1985 statues it appears that a thin, final layer was applied to the surface: this layer has a tendency to exfoliate.




3. Modern reconstruction of a reed and twine armature based on impressions noted in the interiors of Figures 35 and 38, Reema and Zeina (1983 cache). N.B. The reeds extending below the twine on the legs represent the projecting bundles which would originally have served to anchor the statues.

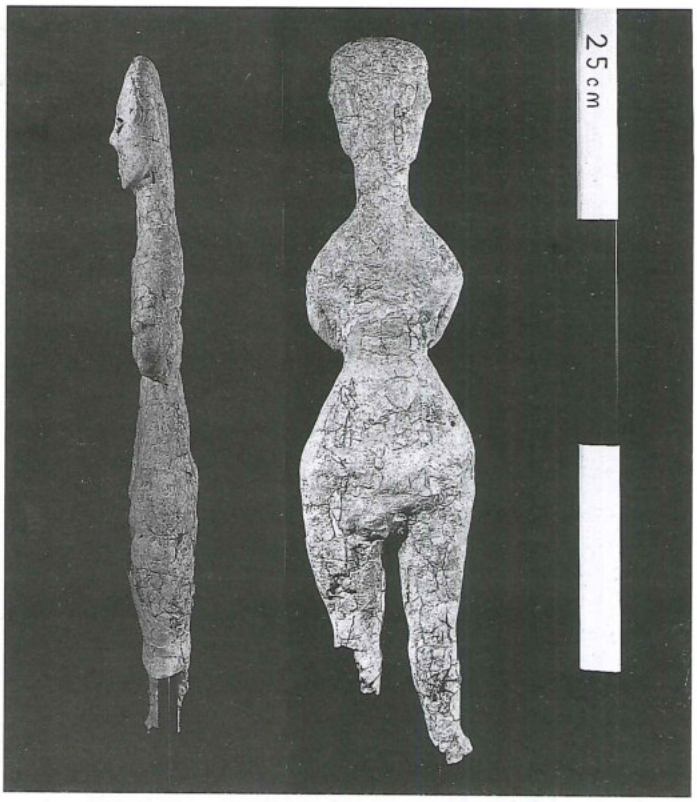
*Surface Decoration*

In both caches, a black mastic was used to delineate the eyes and create the irises/pupils (FIGS. 4, 6, 8-11). Optical microscopy of a sample from the 1983 cache revealed two components: 1) bitumen characterized by transparent brown, structureless, low relief, irregularly shaped particles, and 2) charcoal characterized by brown and black, small, opaque, elongated and splintery particles. Gas chromatography coupled with mass spectrometry was also used on a 1983 cache sample by R. White of the National Gallery, London, and suggested a bituminous component as part of a composite mastic.

The eyeliner was pressed into a groove cut around the eyeball (FIG. 2). It overlays the groove, whose edges are rounded, and stands somewhat in relief. The irises/pupils, on the other hand, were simply applied to the plaster surface of the eyeballs at their centres, the natural tack of the bitumen alone being relied upon for adhesion.




4. Front of Figure 35, Reema, after conservation (1983 cache).




5. Side and back of Figure 35, Reema, after conservation (1983 cache).

The bituminous mastic is now extremely brittle, frequently fractured to the point of being shattered, occasionally displaced and often missing at least in part.

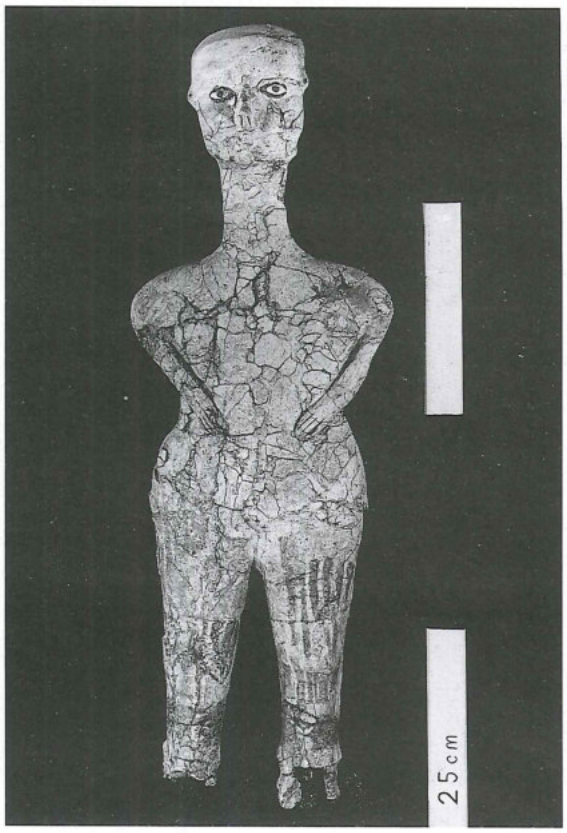
A dusting of large translucent emerald green crystals was applied to the eyeliner of some of the 1983 cache statues and has been identified using X–ray diffraction as dioptase, a hydrated copper silicate, by A. Roy of the National Gallery, London. This pigment has also been identified as a colourant on PPNB plaster beads from the Nahal Hemar Cave (Kingery 1988: 45). However, no traces of dioptase have been found to date on the 1985 cache statues.

The eyeballs of some of the 1983 statues are startling white in appearance which has led to speculation that they may have been built up to their full roundedness using a purer, whiter plaster (Tubb 1985: 118). This remains conjectural. This feature has not been observed by Grissom on the 1985 group, although the faces in general seem to be smoother and whiter than other portions of the statues. A fine white limewash/plaster was certainly applied to the heads and necks of the 1983 dumpies which have been examined.

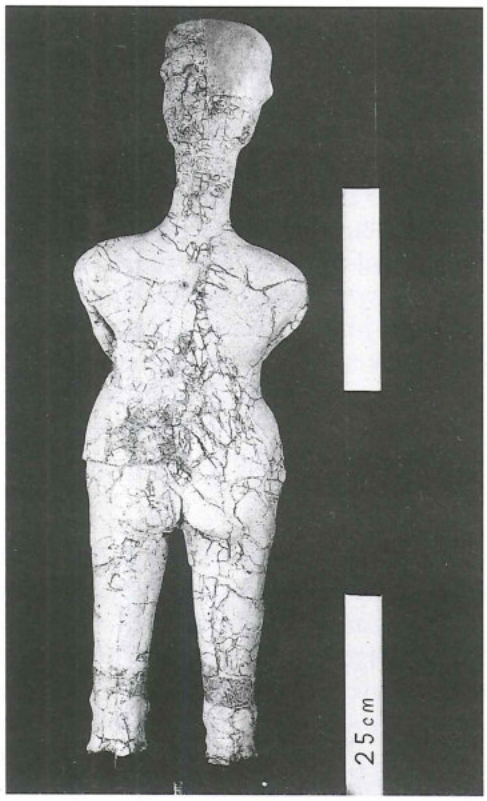
Carbon black and ochres including haematite (identified by X–ray diffraction and polarized light microscopy) were used to embellish the 1983 statues whereas no traces of colour have been found on the 1985 statues to date. The pigments on the 1983 statues are often poorly preserved from which it is evident that they were not applied to the wet plaster in a true fresco technique but were applied to the substrate when it was dry, probably mixed with an organic binding medium. The medium has deteriorated with time leaving the paint extremely friable and vulnerable (FIGS. 6-8, 12).

*Condition before Burial*

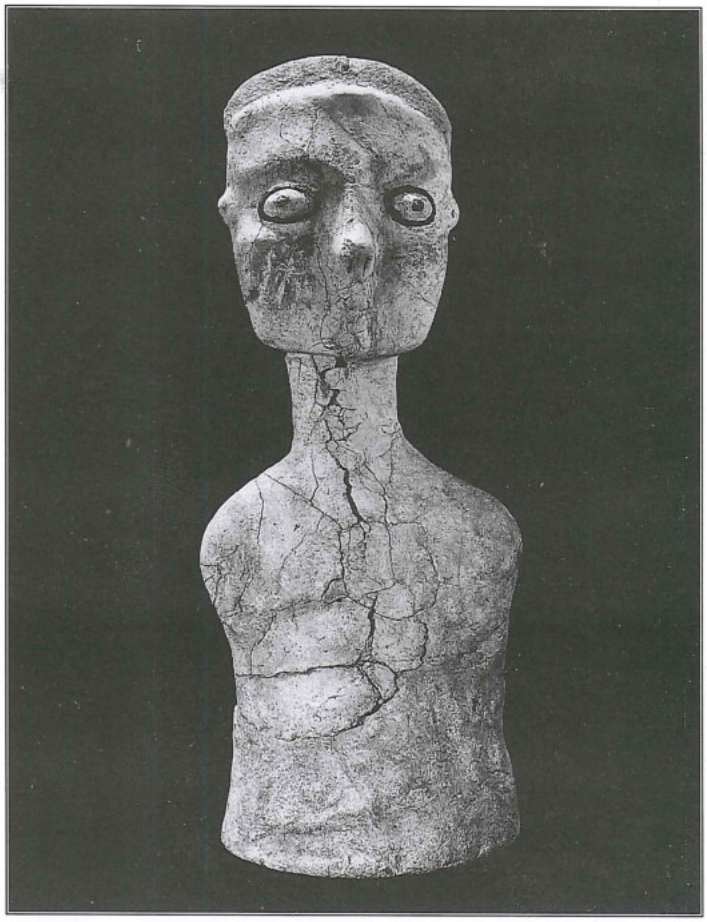
The 1983 statues had sustained pre–depositional damage. Irises/pupils are often missing and, in no case, are the fronts of feet still in alignment. It is unclear how much of this damage should be attributed to their disturbance when the reed extensions were presumably levered out of the ground prior to removal of the statues for disposal in the pit, and how much to the results of general wear and tear which could have occurred in their primary location. Also, although most of the statues



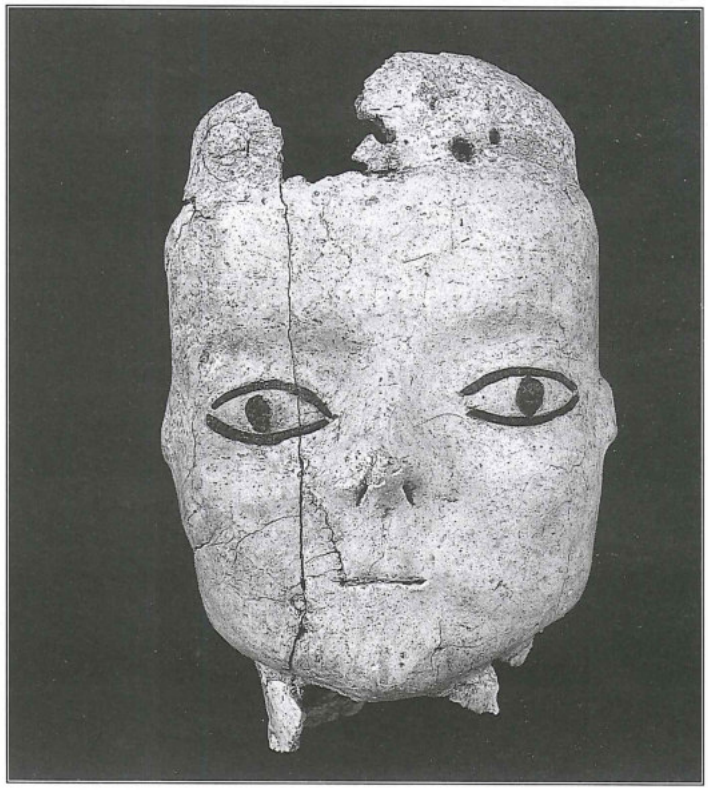

6. Front of Figure 38, Zeina, after conservation (1983 cache).




7. Back of Figure 38, Zeina, after conservation (1983 cache).



8. Front of Dumpy 33, Uriah, after conservation (1983 cache).



9. Head of Statue 1 during conservation (1985 cache).



10. Heads of Statue 3 during conservation (1985 cache).

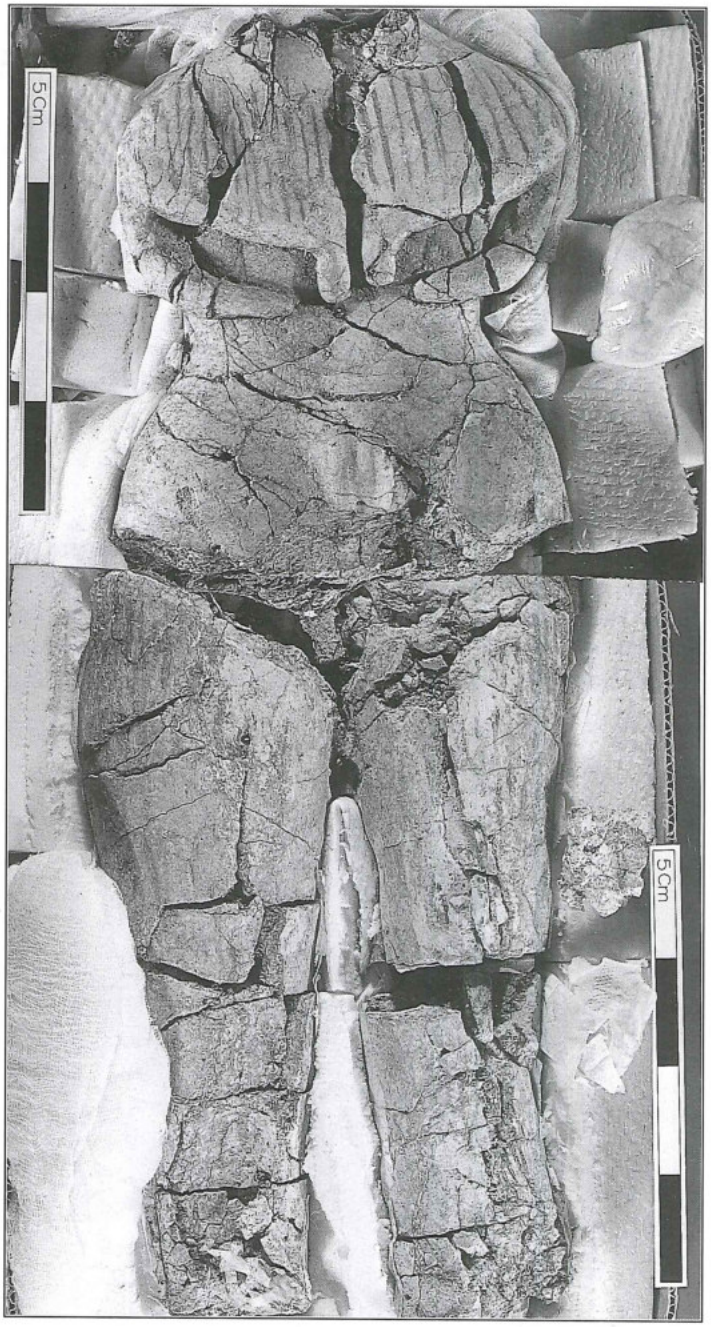


11. Head of Statue 4 during conservation (1985 cache).

were virtually intact when buried, one, at least, must have been a jumble of fragments, two heads were broken in half and located in different positions in the pit and a few bodies with missing heads and vice versa are present. It is possible that headless bodies and bodiless heads will marry up as conservation proceeds.

It is not clear to what extent the 1985 statues were damaged prior to deposition.

Certainly, both caches were interred in pits specially




12. Front of Figure 37, Pescennia Nigra, after separation from the other statues (1983 cache).

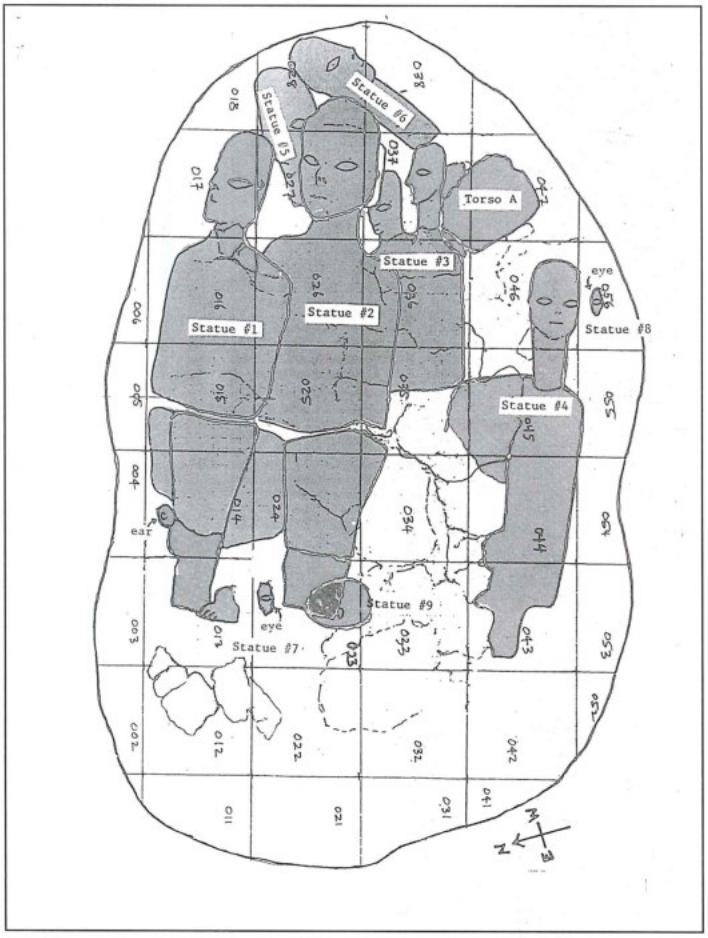
dug for them with the bottoms roughly levelled. The statues were placed in their respective pits with care, not unduly exaggerated. In the case of the 1983 cache, the chief concern seems to have been to stack the statues in stable piles, effectively layers, with an apparent disregard for the orientation of the heads in terms of directional bearing and whether they were face up or down. At the foot of the upper tiers, the dumpies (with the exception of Dumpy 33, Uriah) were arranged in an arc conforming to the edge of the pit and were stacked in interleaved piles, top to tail. This has resulted in severe damage to those

heads which were wedged between two solid dumpy bases. Despite this care, the stacks did still slip but only to a limited degree.

The 1985 statues were arranged in their pit so that about half of the pit contains a single layer and the other half multiple layers. One of the figures was originally placed directly facedown and the remainder were slightly sideways. All the intact heads are found at one end of the cache although fragments of heads have been found elsewhere. A more or less central figure with the largest head seems to dominate the cache. One might speculate that this could represent the head of a family, surrounded by family members (FIG. 13).

*Stylistic Comparison of Physical Attributes*

Both caches contain statues which can be ascribed to two broad categories based on size and on development of the bodies below the neck. The smaller group measures 35cm in height on average. Their bodies are largely featureless which has led to them being referred to as dumpies or busts (FIG. 8). The heads, however, have had the same degree of attention lavished on them as have those of the full figures. Tantalizingly, the bust from the 1985 cache appears to be two–headed (FIG. 10).[3] The larger group measures approximately 90cm in height. Their heads, in particular, and torsos are quite flat supported by well–rounded heavy thighs and legs. The weight of the bodies is evenly distributed on both legs (FIGS. 4-7, 12).




13. Drawing of 1985 cache during excavation in the laboratory as of November 1991.

Although the faces of the statues within each cache differ, it is still easy to distinguish the members of one from the other. Not surprisingly, the eyes are a dominant feature. Those of the 1983 cache tend to be larger and more elliptical. They have a staring, unfocussed, rather wide–eyed appearance which renders them remote from the viewer, lending them a sense of latent power. The eyes of the statues in the 1985 cache seem flatter, with more pointed corners (FIGS. 9-11). Although the irises/pupils of the 1983 cache are invariably round, they differ markedly in diameter from statue to statue. The irises/pupils of the 1985 cache seem to have a slightly rounded diamond shape which is rather cat–like. The ears of the 1983 cache are present as small protuberances often with small central depressions roughly impressed in them. The ears of the 1985 cache, on the other hand, are much more realistic in appearance having been modelled with greater care. The brow lines, cheeks and upper lips of the statues of both caches are rounded and exhibit skilled shaping of the plaster. The mouths of the 1983 statues are represented by a short simple horizontal slit. Those of the 1985 statues are represented by a wider linear incision, turning up slightly at the corners. The noses of the 1983 cache are very pronouncedly retroussé with the nostrils designated by two incised lines. The noses of the 1985 cache are only slightly upturned with the nostrils marked by either two linear incisions softened in outline or two rounded depressions. The chins of the 1985 cache are all cleft in contrast to the 1983 cache. The faces of the 1985 cache more closely resemble the plastered human skull recovered from 'Ayn Ghazāl in 1988 (Simmons *et al.* 1990: 109, FIG. 2).

The tops of the heads are invariably recessed from the faces and vertical. Grissom observes that this area is rougher in texture than the smoothed faces of the 1985 statues and suggests that a cloth or representation of hair might once have been attached at this point. A concentration of carbon particles has been noticed in this area on some of the 1983 statues (Dumpy 33, Uriah, for example) although the textural difference does not always seem to occur.

The necks of the statues of both groups vary considerably but some are unusually long. In the 1985 cache, the neck for one of the heads (Statue 6) is slightly longer than the head itself, while the necks of other statues

[3] At the time of writing this paper, Statue 3 of the 1985 cache had not been fully excavated and put together in order to confirm its having two heads.

(Statue 2, for example) have a more normal proportion of 40% of the length of the head.

The bodies of the 1985 figures are relatively featureless apart from sloping shoulders and delineation of the attachment of the thighs to the torso by a horizontal depression (FIG. 2).

In sharp contrast, the bodies of the 1983 figures are highly individual. Disproportionately small arms lie against the body curving onto the front of the torso to varying degrees. Occasionally, the arms terminate by tapering off (Figure 37, Pescennia Nigra). In others, the hands are endowed with fingers whose divisions were created by deeply incising the plaster (Figures 35 and 38, Reema and Zeina). The figures are characterized by narrow waists and broad hips. Three of the figures have been invested with sexual attributes. Pendulous breasts grace the upper torsos of Figures 8 and 35, Astarte and Reema. The pudenda of Figure 37, Pescennia Nigra, are depicted displaced upward on the lower abdomen. The buttocks of Figure 38, Zeina, are represented in some detail. Undulations in the plaster of the upper thighs may represent folds of fat (Figure 35, Reema). The knees and ankles are evident on the figures of both caches. Short strokes, occasionally longer lines and small blocks of colour have been used on the heads, bodies and legs of many of the figures. Whether these embellishments represent tattooing, cicatrix, cosmetics and/or clothing is unclear. The fronts of the feet are also not uniform and range from extraordinarily skilled naturalistic representations complete with toes and toenails to unimaginative featureless plaster shapes.

An indication that polydactyly was indigenous to the inhabitants of 'Ayn Ghazāl is suggested by the representation of a six–fingered hand (Figure 35, Reema) and a six–toed foot fragment from the 1983 cache.

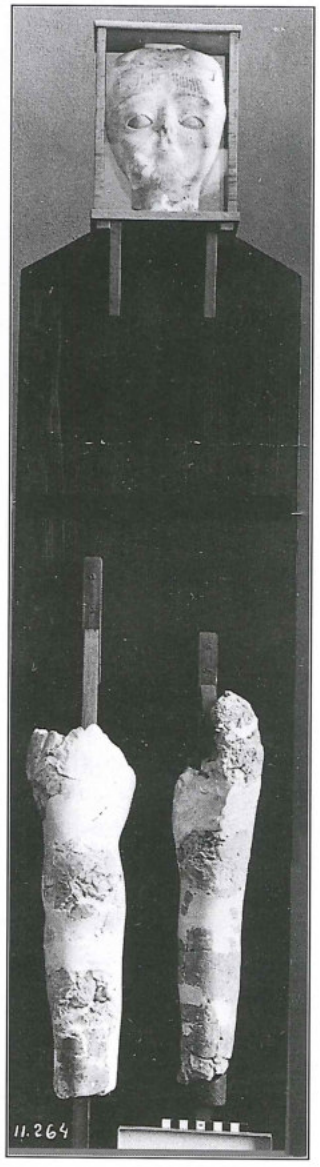
It is possible that the differences highlighted in this discussion are attributable to different dates for the two caches. Radiocarbon accelerator dates for the 1983 cache are 8700 +/- 80 and 8660 +/- 80 BP (Hedges *et al.* 1989: 228). Based on stratigraphical evidence, Rollefson (pers. comm. 1992) suggests that the 1985 cache may be later.

## Archaeological Parallels

The closest parallel for the 'Ayn Ghazāl plaster statues is the fragmentary remains of statues discovered from the Neolithic levels at Jericho by Garstang (1935: 166–167, and PLS. XXV, XXVI, LIIa-b, LIII; 1936: 70). Two separate deposits were recovered in 1935. In neither case had the individual statue fragments been in alignment at the time of deposition. Subsequent analysis of a sample from the head found in area 195 has been identified as lime plaster mixed with limestone fragments, quartz and clay (Kingery *et al.* 1988: 233; TABLE 2, 230; FIGS. 10.234, 11a&b.235). Restoration of the legs introduced a contrapposto stance which needs correcting in the light of archive photographs taken of the cache in 1935 and in the light of the 'Ayn Ghazāl statues (FIGS. 14, 15). This recreation led Garstang to attribute a sense of movement to the limbs of his figures (Garstang 1940: 57). He also maintained that the male figure was nearly life size but, again, this claim seems invalid based on inadequate evidence lending the reconstruction an attenuated appearance (FIG. 14).

Jericho was again the source of Neolithic human figure fragments during Kenyon's 1957–58 excavation season (Kenyon 1960: 91–92 and PL. XIIa). These consisted of a number of heads which seem to have been featureless, spade–shaped and completely stylized although decorated in bands of red, brown and cream paint. Kenyon believed these figures were chronologically later than those of Garstang (FIG. 16).

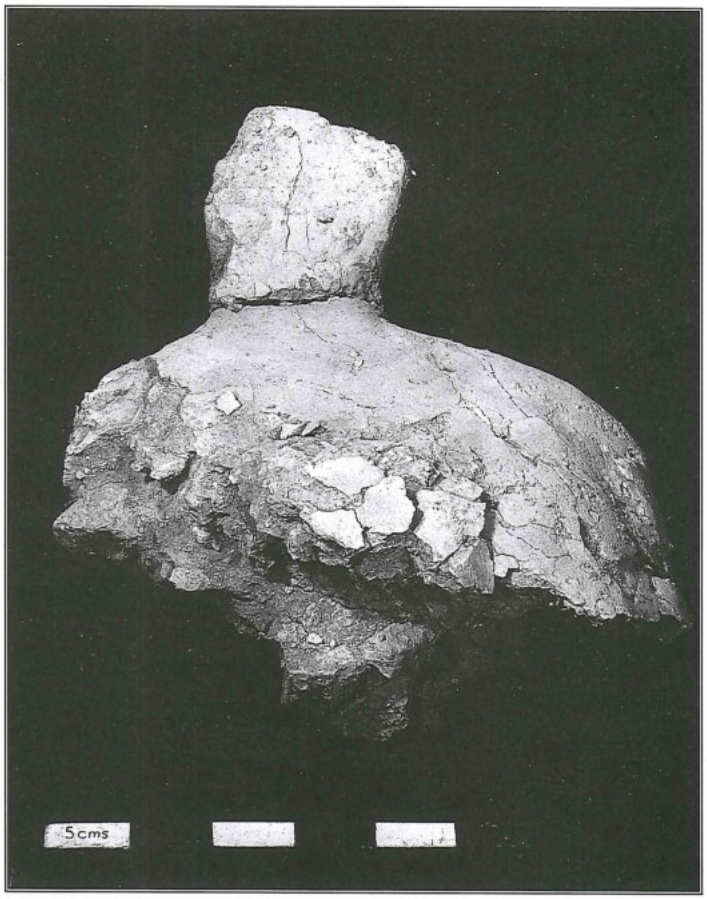
More recently, Bar–Yosef recovered many fragments




14. Statue from Garstang's 1935 excavation season at Jericho after conservation as originally exhibited. (Courtesy of the Palestine Exploration Fund).



15. Legs of one of the statues from Garstang's 1935 excavation season at Jericho after conservation. Note contrapposto stance. (Courtesy of the Palestine Exploration Fund).




16. Head and shoulders of a statue from Kenyon's 1957–58 excavation season at Jericho after lifting but before reconstruction. (Courtesy of the British School of Archaeology in Jerusalem).

of a human statue from the Nahal Hemar Cave which he considers to be very similar to the 'Ayn Ghazāl figures (Bar–Yosef 1985: 3, 14).

## Conclusion

Very briefly, functional analysis of the two caches indicates that they were cult figures. Their large numbers (approximately 26 in the 1983 cache and approximately 8 in the 1985 cache) and individual differences, coupled with the plastered skull tradition, may indicate a form of ancestor worship. Certainly, the statues are impressive technologically and imposing artistically. As the work proceeds, it is hoped to glean still more of their secrets albeit with the absolute knowledge that they will retain much of their mystery and all of their awesome presence.

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# Représentations humaines et animales sur le site d'Abū Ḥāmid (mi-7e-début 6e millénaire BP)

Au cours des quatre campagnes de fouilles conduites sur le site d'Abū Ḥāmid, dans la Vallée du Jourdain, à mi chemin entre le lac de Tibériade et la mer Morte a été dégagée sur près de 2000 m² une partie de l'établissement qui devait, au début du 4e millénaire s'étendre sur environ 1,400 km d'est en ouest et 0,300 km du nord au sud.

Le village que nous avions pensé, lors des trois premières saisons de fouille, avoir été occupé à l' extrême fin du 7e et au début du 6e millénaires BP seulement pendant une courte période — deux ou trois siècles — a révélé au cours de la 4e campagne qui a pris place à l'automne 1991, une durée d'occupation beaucoup plus longue. L'établissement pourrait avoir été fondé lors de la première moitié du Ve millénaire si ce n'est à la fin du VIe millénaire BC et fut abandonné, comme le montrent les datations par le C14, vers 3600 BC[1].

Sur la base du matériel, aucune coupure importante ne peut être observée et trois phases culturelles ont pu être distinguées[2]:

1- La plus ancienne fut reconnue dans de longues tranchées qui permirent de mettre au jour des maisons curvilignes aménagées dans des fosses paraissant à l'origine avoir été naturelles; comme le montrent et l'industrie lithique et la poterie (celle-ci, lorsqu'elle est décorée, n'est plus ornée de chevrons incisés comme dans le "Yarmoukien classique" mais est uniquement peinte — jarres et bols à décor interne et externe[3]) cette phase est postérieure au "Yarmoukien" que l'on trouve aussi bien à Sha'ar HaGolan et Munḥaṭa 2b, que sur le plateau jordanien à 'Ayn Rāḥūb, Abū Thawwāb, 'Ayn Ghazāl; elle serait l'équivalente de la phase Munḥaṭa signalée par J. Perrot[4], et correspondrait à celle récemment étiquetée sur la côte palestienne "Lodian" par Gopher[5].

2- Au cours de la seconde moitié du 7e millénaire BP et plus vraisemblablement vers sa fin, le caractère de l'établissement change; des maisons pluri-cellulaires sont construites en briques crues; elles comportent des pièces couvertes et des cours qui peuvent être closes; foyers, petites fosses à feu ovales, bassins aux parois soigneusement enduites y prennent place.
La poterie qui déjà annonce par ses formes et sa décoration[6] celle des niveaux supérieurs présente des liens avec celle — cf. la DFBW — retrouvée à Munḥaṭa 2a, Hazorea et W. Rabah. Les outils lourds en silex — haches, herminettes, ciseaux — deviennent nombreux. Dès ces niveaux, comme le montrent les restes anthracologiques d'oliviers (et non seulement les noyaux d'olives qui sont difficiles à distinguer de ceux des fruits des oliviers sauvages), la culture de l'olivier serait attestée. Nous sommes sur l'horizon chronologique de la phase "Rabah".

3 - Au tournant des Ve-IVe millénaires BC, le village est formé en certains secteurs par des maisons à une grande pièce rectangulaire à laquelle peuvent s'ajouter des pièces plus petites, en d'autres par des maisons constituées par des rangées de chambres très légèrement creusées dans les marnes comme elles le sont, au Jabal Sarṭaba, dans le rocher[7]. Culturellement ce village appartient à la phase "ghassoulienne", ce terme étant pris dans son sens le plus large — du Negeb à Tall al-Khazāmī près de Damas. Toutefois sur cet arrière fond, peu à peu les archéologues ont été à même de discerner plusieurs faciès; par ses composants, Abū Ḥāmid appartiendrait — ce qui pourrait s'expliquer par la transhumance d'une partie des membres des groupes et des relations qui en découlent — à un faciès reconnu dans la moyenne vallée du Jourdain, le Jawlān, la région d'Irbid. Sur ce territoire, l'on trouve certains caractères spécifiques qui restent, si tant est qu'ils soient présents, fort rares

[1] Cf. Dollfus et Kafafi (eds.) sous presse; GrN 16358: 5745 +/- 35 BP; GrN 14623: 5670 +/- 40 BP; GrN 17496: 5651 +/- 40 BP.

[2] Dollfus, Kafafi *et al.* 1993: 241-262.

[3] Dollfus, Kafafi *et al.* 1993: 247, FIG. 1.

[4] Perrot 1966.

[5] Gopher 1993.

[6] Dollfus, Kafafi *et al.* 1993: 249, FIG. 2.

[7] Smith and Hanbury-Tenison 1992.

ailleurs; ainsi, par exemple, les grandes jarres de stockage, les disques perforés et les "mortiers-piliers".

Ce cadre tracé, venons-en aux représentations animales et humaines trouvées dans les niveaux de la fin du 5e et au début du 4e millénaires.

Les **représentations animales**: elles apparaissent sous trois formes:

a - en relief, appliquées sur un récipient;
b - sous forme de figurines en terre durcie ou très légèrement cuites;
c - sous celle d'animal-récipient en terre cuite.

A ce jour aucune représentation animale en pierre n'a été mise au jour alors que les **représentations humaines** sont, à une exception près, en pierre.

## Représentations animales

*Représentations en relief appliquées sur un récipient*

Nous ne nous attarderons pas sur les représentations qui ornent les vases, mais indiquerons seulement que le motif de serpent, bien connu à Ghassūl IV, c'est-à-dire dans des niveaux contemporains de la dernière occupation d'Abū Ḥāmid apparaît sur ce gisement dès la phase antérieure comme en témoigne, parmi d'autres plus fragmentaires, le grand tesson retrouvé dans un des niveaux de l'horizon "Rabah"[8].

*Représentations animales en terre séchée et durcie au soleil ou plus rarement cuite*

Sont figurés des quadrupèdes et des oiseaux[9]. En ce qui concerne les figurines animales, nous avons eu le chance de pouvoir étudier leur mode de fabrication. En effet, dans une fosse du milieu du 7e millénaire furent retrouvés:

- Une cinquantaine de pâtons préparés pour la confection de figurines; ceux-ci affectaient la forme de plaquettes rondes (FIG. 1:1) ou rectangulaires de 5-6 cm de long ou de diamètre et épais de 1-2 cm que, dans une étape ultérieure du façonnage, on repliait.
- La première étape du modelage donne à ces pâtons la forme de boudins renflés qui devaient être ensuite déposés sur de la paille comme l'indiquent sur plusieurs d'entre eux les empreintes végétales (FIG. 1:5). Ces boudins ont presque toujours une face plane; plusieurs portent les marques des doigts qui les ont modelés (FIG. 1:4).
- Sur ces ébauches l'on peut voir les premiers pincements et étirements de la pâte qui permettent de former la queue qui est souvent repliée sur l'arrière-train (FIG. 1:3).
- Des figurines de quadrupèdes et d'oiseaux terminées (FIG. 2). Celles ci ont en moyenne 4 à 7 cm de long et ne portent en règle générale aucune trace d'outils. Nous avons pu constater que pour les pattes et les cornes coexistent deux techniques: ces éléments sont soit modelés directement à partir du bloc initial (FIG. 2:4, 6) soit modelés séparément puis appliqués (FIGS. 1:2; 2:1).

L'individu ou les individus qui réalisèrent ce lot de figurines animales ne se limitai(en)t pas au répertoire des quadrupèdes et des oiseaux (FIG. 2); il(s) préparai(en)t en même temps également des petits blocs de terre en forme de sphère aplatie dans lesquels ils avaient creusé par pression(s) du pouce une cupule. (FIG. 3:1, 2).

Ceci conduit à évoquer dans le lot des représentations de quadrupèdes l'une d'entre elles (FIG. 3:3 ) qui se distingue des autres:

- par sa taille; elle mesure environ 16 cm;
- par le fait qu'elle porte sur l'échine dorsale et près de la tête les marques d'un outil large de 0,6 cm (lame de silex?) qui servit à racler la terre;
- qu'elle porte sur son dos une dépression circulaire, une cupule. Celle-ci a un diamètre égal à 1,3 cm et est profonde de 1,7 cm. Quelle destination avait cette cupule?

Ceci reste encore une interrogation mais nous conduit au troisième type de représentation animale, *l'animal récipient* daté du début du 6e millénaire (FIG. 4:6).

En 1987, sur le sol d'une petite chambre construite contre une grande salle rectangulaire, furent retrouvés parmi des fusaioles, des outils en silex, des fragments de poterie très ordinaires qui jonchaient le sol, ce qui apparut, au cours du remontage, être un bovidé porteur d'un ou de deux récipients[10].

L'animal a une longueur approximative de 43 cm, une largeur maximale de 22 cm, si l'on ne compte pas le vase qui, à l' origine, le surmontait mais qu'il fut impossible de lui raccorder. A mi-dos, la paroi du flanc droit s'évase; on y note l'arrachement correspondant au départ d'un récipient; celui-ci semble avoir été dépourvu de fond et devait ainsi communiquer avec le corps de l'animal[11] qui est creux[12]. Un deuxième arrachement sur le dos de l'animal paraît correspondre à l'emplacement d'un autre récipient.

De ce(s) récipient(s), de nombreux tessons informes ont été recueillis mais seul un fragment cylindrique à base très légèrement évasée a pu être remonté. Une échancrure dans la paroi indiquerait qu'il s'agit d'une base fenestrée. On note également les traces d'un arrachement; toutefois cette partie ne put être replacée sur le corps de l'animal.

Cette grande figure de bovidé trouvée à Abū Ḥāmid

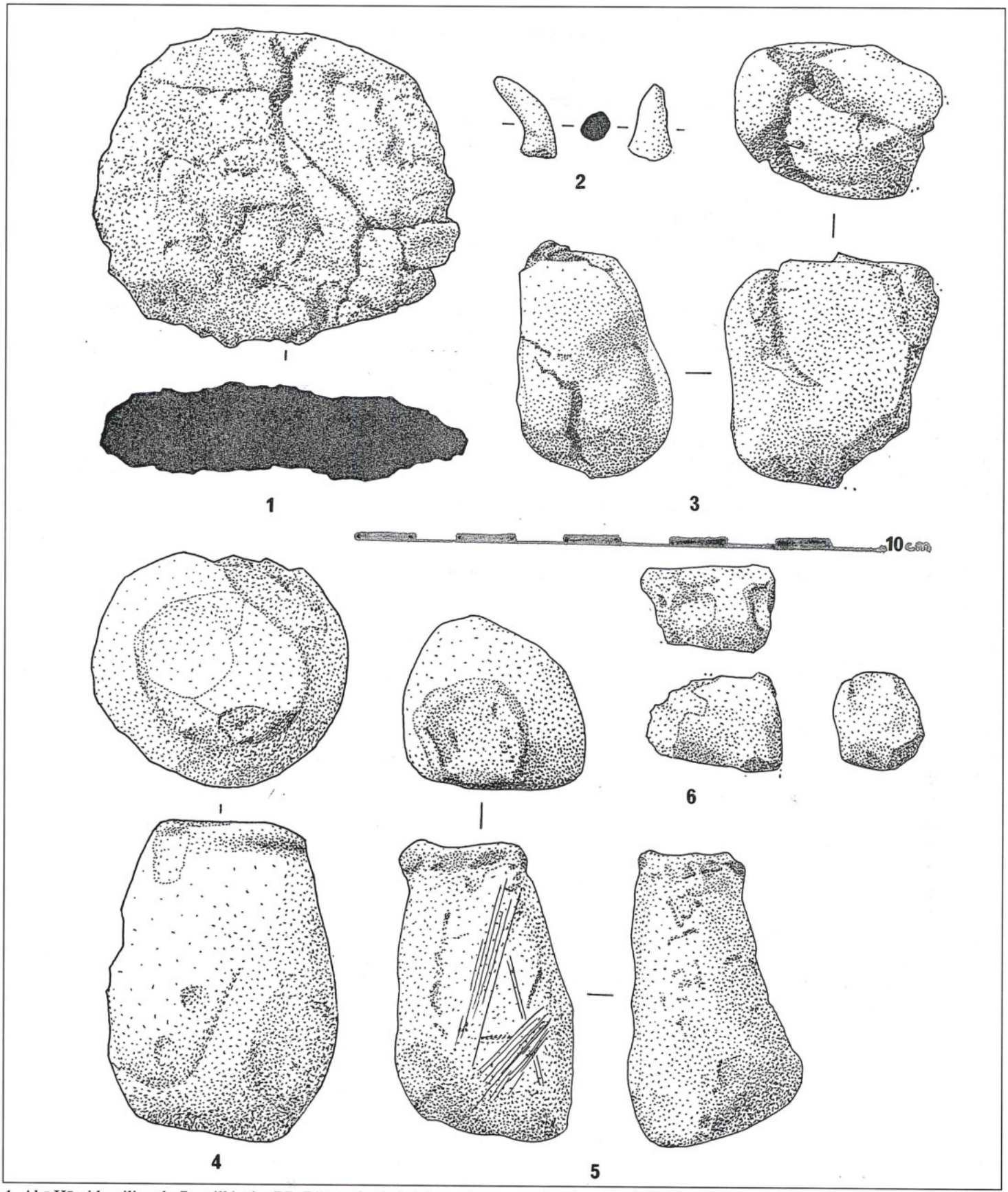
[8] Dollfus, Kafafi *et al.* 1993: FIG. 2:10.

[9] *Ibid.*: FIG. 4.

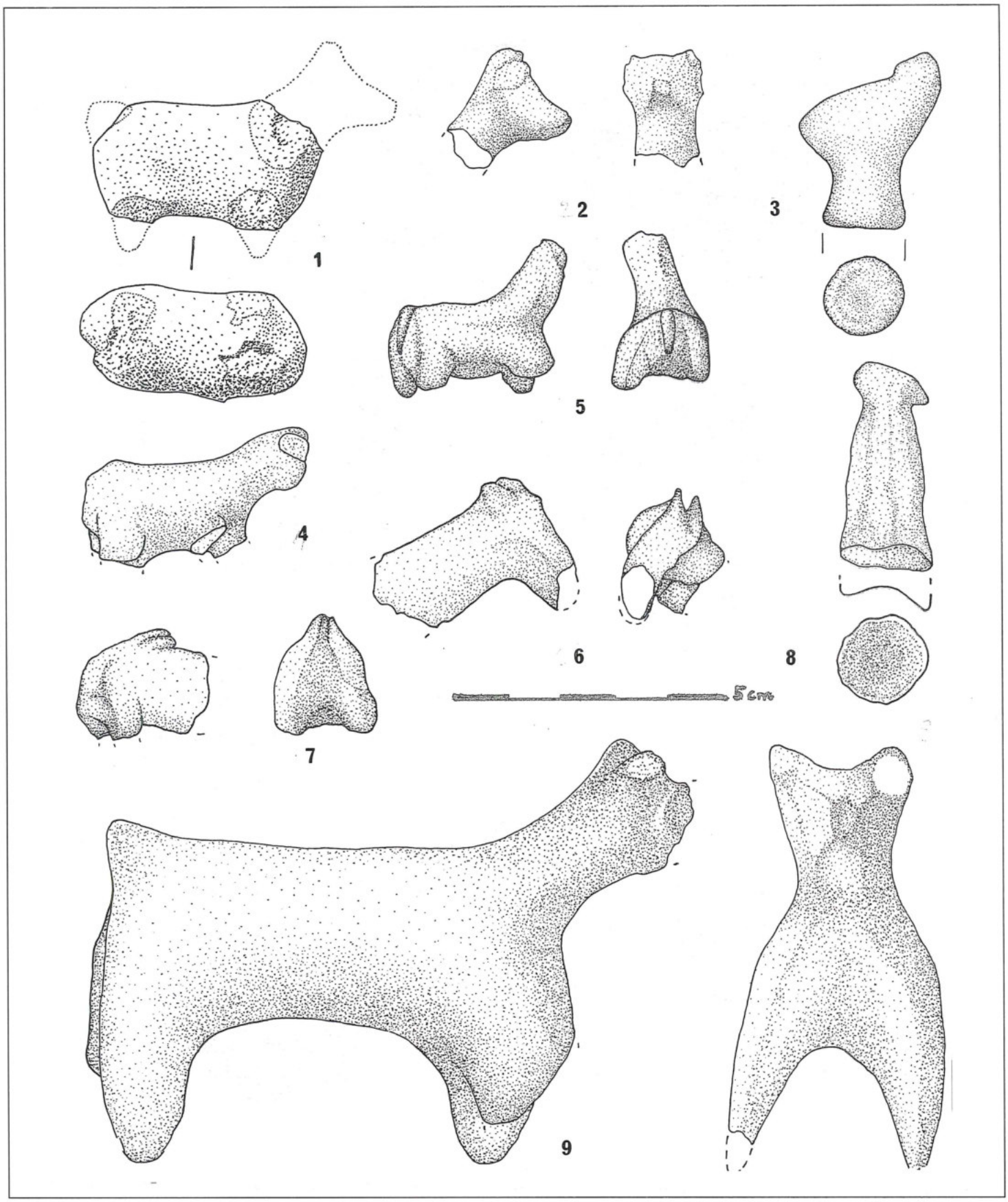
[10] Cf. Kafafi, in press.

[11] Cf. la série de petits récipients sans fond et portant des traces d'arrachement publiée par M. Tadmor et qui devaient provenir d'objets similaires.

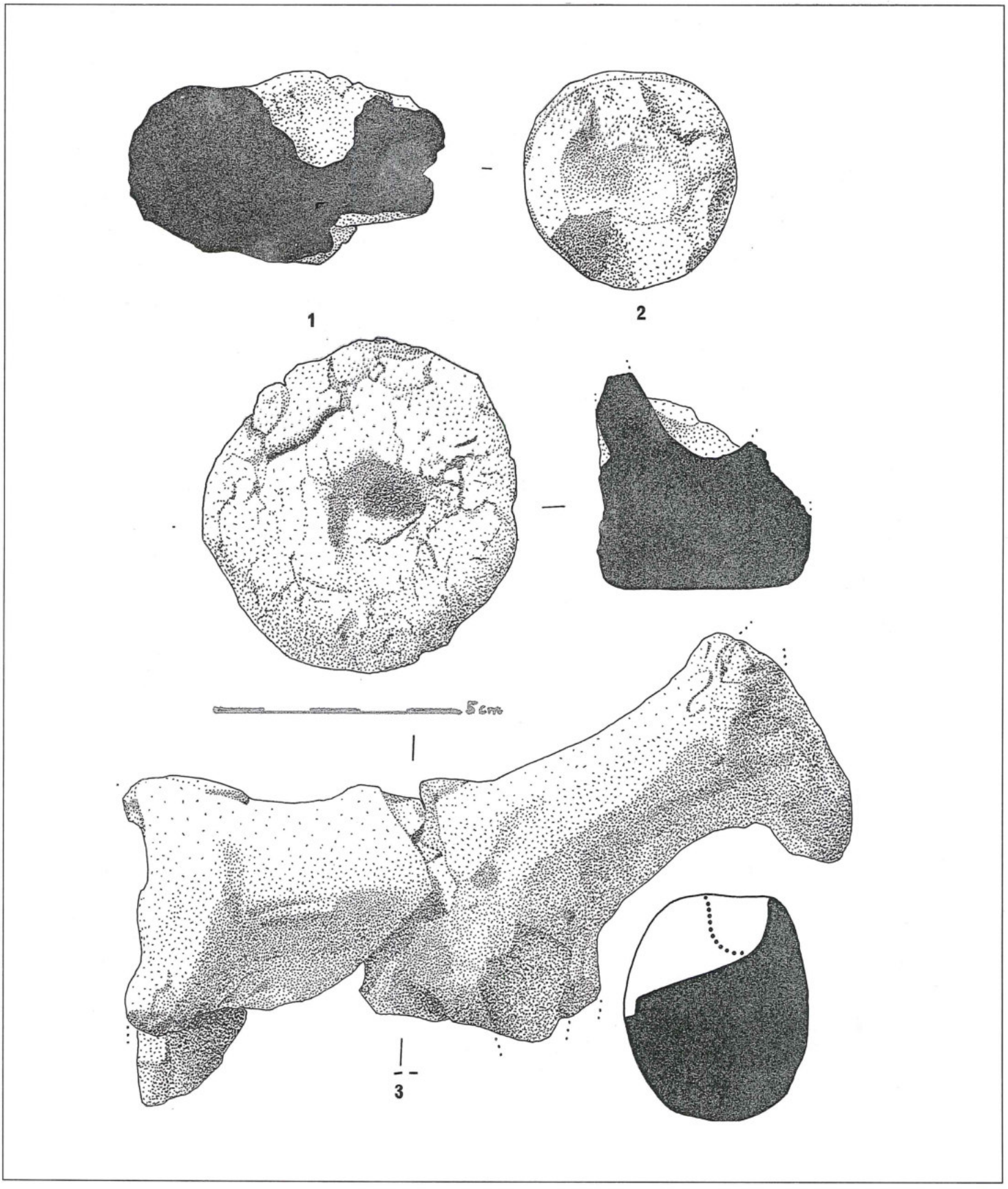
[12] Cf. figurine creuse ou vase en forme d'animal à Tall al-Khazāmī. Contenson 1969: PL. IVA.



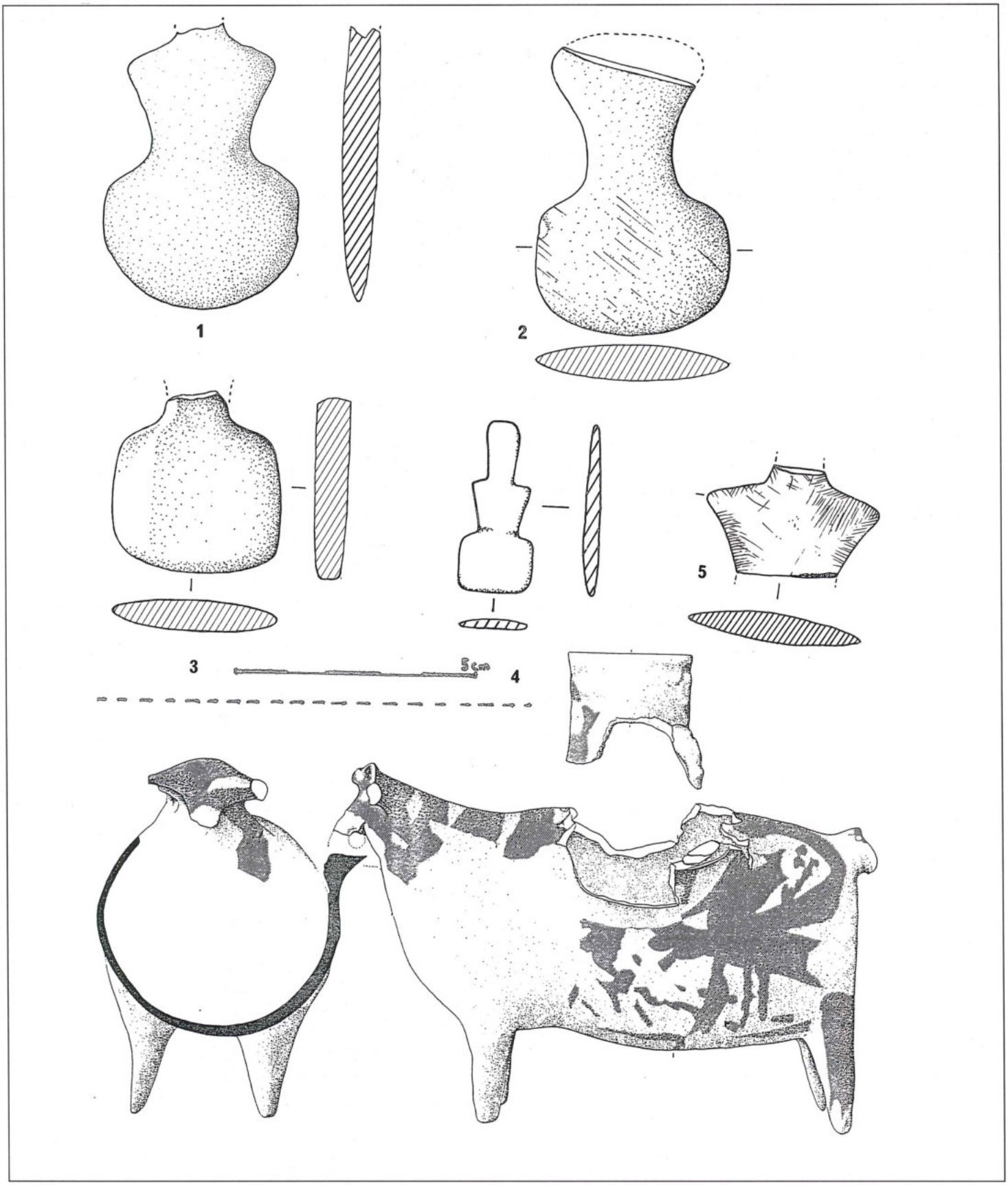

1. Abū Ḥāmid, milieu du 7e millénaire BP. Pâtons destinés à la confection de figurines (1, 4, 5); ébauches de figurines (3, 6); corne appliquée (2). Terre crue.




2. Abū Ḥāmid, milieu du 7e millénaire BP. Lot de figurines provenant de la même fosse que les pâtons. Terre crue.




3. Abū Ḥāmid, milieu du 7e millénaire BP; sphères aplaties à cupules (1, 2); grande figurine animale portant sur le dos une cupule (3) provenant de la même fosse que les pâtons et les figurines représentés FIGS. 1 et 2. Terre crue.




4. Abū Ḥāmid, fin du 7e millénaire BP figurines-violons, pierre (1, 2); début du 6e millénaire BP figurines violons, pierre (3-5); début 6e millénaire, grand vase zoomorphe en forme de taureau, terre cuite (6).

entre dans une classe d'objets peu nombreux mais bien connue au sud du Levant, animaux ou exceptionnellement humains chargés de vases ou de corbeilles. Ils ont été recensés et décrits par C. Epstein et proviennent du Negeb (Gilat et Zumeili[13]), de la région de la mer Morte (En Geddi et Ghassūl), des grottes à sépultures de la région côtière (Azor et Givata'yim); peut-être est-il possible de leur rapprocher une statuette en basalte de Tall Turmus qui représente un bélier sur le dos duquel était posé un récipient et un objet encore non publié acquis récemment par le *Museum of Jordanian Heritage* (Yarmouk University).

Sur un plan stylistique l'objet d'Abū Ḥāmid s'apparente aux statuettes de Gilat. Comme elles, l'animal d'Abū Ḥāmid est de grandes dimensions alors que les représentations d'En Geddi, de Ghassūl, de la plaine côtière sont comprises entre 6 et 15 cm. Comme elles, il est peint mais il l' est moins soigneusement. A Gilat les traits sont fermes et tracés sans la moindre bavure; les yeux sont traités de façon identique pour l'homme et pour l'animal. Le bovidé d'Abū Ḥāmid porte un décor tracé à l'aide d'une large brosse trempée dans une peinture très liquide qui occasionne le même type de coulures que celles observées sur un grand nombre de jarres. Les yeux ne sont pas marqués.

La conclusion que nous pouvons en tirer est que si les deux représentations de Gilat paraissent bien être l'oeuvre d'un même individu, les autres semblent avoir été façonnées par des mains différentes. Il ne semble donc pas — l' hypothèse était cependant tentante — que nous soyons en présence d'un seul producteur qui aurait répandu ses oeuvres à travers la région à partir d'une place centrale, qui aurait pu être un centre religieux. Par une analyse comparative des composants de la pâte et des pigments du taureau et de certains pots retrouvés dans l'établissement d'Abū Ḥāmid, il sera tenté de déceler si la "figure" de taureau est ou non de fabrication locale.

Quittons les représentations animales pour terminer avec celles anthropomorphes.

## Les représentations anthropomorphes

La plus ancienne, que nous ayons retrouvée date d'un niveau de la phase "Rabah" et est en terre durcie. Elle présente les mêmes caractères que ceux de la partie supérieure des figurines-violons en pierre. Provenant de ces mêmes niveaux sont deux figurines façonnées en forme de "violon" à partir de petits galets plats d'origine locale (FIG. 4:1, 2). L'une est formée par deux parties arrondies séparées au niveau de la taille par un étranglement aux côtés légèrement convexes; la seconde est également formée d'une partie base arrondie, d'un rétrécissement, puis d'un élargissement au niveau des épaules d'où s'amorce le départ du cou ou de la tête.

Toutes les autres, stylistiquement plus anguleuses, proviennent de niveaux du début du 4e millénaire BC et sont façonnées en calcaire dur et en pierre verte (FIG. 4:3, 4, 5).

Elles appartiennent à un type connu de Byblos au nord[14] au Sinaï au sud[15] et se caractérisent par un grand schématisme qui contraste d'une part avec le naturalisme des figurines animales en terre que nous avons mentionnées, d'autre part avec les statuettes masculine et féminine en ivoire de la région de Beer Sheba[16]. Aucun trait du visage n'est indiqué, les bras sont réduits à des moignons, les hanches sont larges, les membres inférieurs ne sont pas indiqués. Il y a là une pratique stylistisque peut-être en partie due au matériau employé, la pierre.

La présentation qui vient d'être faite des représentations animales et humaines retrouvées à Abū Ḥāmid montre que si, dans son ensemble, et certainement au début du 6e millénnaire, la culture matérielle d'Abū Ḥāmid partage des traits avec des sites de la Moyenne Vallée du Jourdain, du Jawlān et de la région d'Irbid, en revanche aussi bien la grande figure-récipient animal que les figurines-violon en pierre attestent de liens plus forts avec certains sites du sud de la Palestine. Ceci pourrait venir à l'appui de la thèse qui voudrait que Gilat — de même que l'est En Geddi — soit un lieu de sanctuaire; toutefois, selon Alon et Levy[17] les objets en rapport avec le culte n'auraient pas été fabriqués dans ce lieu. Se trouve alors posé pour les objets d'Abū Ḥāmid que ce soient les figurines violon en pierre ou le vase-récipient en forme de taureau le lieu de fabrication et/ou d'échange. Nous espérons que la poursuite des études et analyses nous permettra dans un prochain avenir de formuler des hypothèses.

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[13] Pour Zumeili, Perrot, comm. person.

[14] Dunand 1973: PL. CLXII.

[15] Oren et Gilead 1981: 35.

[16] Perrot 1959

[17] "In the excavations at Gilat, no evidence for any primary or secondary manufacture of standing stones, basalt fenestrated stands, violin shaped figurines or stone palettes was found... Given these observations, the cult objects described here seem to have been brought to the site in a complete state, which suggests that they were traded for some material commodity, socio-religious services or both". Alon and Levy 1989: 209.

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# The Terra Cotta Anthropomorphic Figurines

## Introduction: Origins of Anthropomorphic Representation

Anthropomorphic representation is known from very early in antiquity, either from archaeological evidence or from written sources represented by epigraphical documents mentioning potter-gods or ordinary potters. According to Mesopotamian tradition, the practice of fashioning terra cotta figurines goes back to the creation of the world. In one episode Enki asks his mother, the goddess Nammu, to form a creature of clay:

> Mix the heart of clay that is over the abyss
> You, do you bring the limbs into existence
> Nimah (the earth-mother goddess) will work above thee,
> (goddess of birth) will stand by thee at thy fashioning. (Kramer 1961: 70).

The biblical account of man's creation, represents the creator as a potter (*yosser*) modeling Adam out of clay (Badre 1980: 13). In the Ugaritic legend of Keret, the god El is described as making a clay shape: *Sha'taqat:* meaning the one who heals. It is *she* who will take care of and heal King Keret (Caquot *et al.* 1974: 566, CTA 16, V, 1. 26-30 notes h-i).

## Workshops for Figurines

This study will be based on the anthropomorphic representation in Syria, mainly of the Bronze Age, but including some examples of the Iron Age. There is very little evidence for potter's workshops in Syria. Antoon Moortgat thinks he has identified one in Tall Khuwayra (Chuera) in the area of the Northern Temple, where he found a large pile of fine levigated clay that would only be used for delicate objects such as tablets and figurines. This, he suggests, was in connection with the nearby kiln and the *Wasserpülanlage* (a system for washing with abundant water). This complex has yielded a large number of terra cotta figurines and clay chariots which may justify his hypothesis that it actually was a workshop (Moortgat 1962: 17). In a second stage, figurines were baked in kilns. These have been found in many sites associated with figurines such as Tall 'Abd and Tall Ḥabūba Kabīra (Hensch 1973: 56-57, FIGS. 20-21). Potter's tools of clay, pebbles or flints have also often been found but rarely in their proper context. These were mainly used for scraping or smoothing the clay surface of the terra cotta figurines.

## Clay and its Provenance

In the mythological texts, the gods are said to have taken the clay from a humid context, mainly from riversides (Barrelet 1968: 29). This is confirmed by the concentration of terra cotta figurines at sites located along rivers in Syria: the Orontes and the Euphrates, where it is interesting to note the uniform texture and colour of the clay in each area. The advantage of obtaining clay from river banks is that it saves the potter the levigation process which uses water in successive stages, a job that would automatically be done by the river. In a second stage, the clay is mixed with a temper which can vary from fine limestone to hematite or mica grits. These give elasticity to the clay during the firing stage and consequently reduce the risks of malformation or cracking.

## TECHNIQUES OF FASHIONING FIGURINES

There are two major procedures for fashioning clay figurines: free-hand modeling and pressing in a mould.

### A. Free-hand Modeling

This is the most primitive method used in manufacturing clay figurines: the technique depends on the preconceived concept of the potter before he fashions the figurine, whether he wants it standing, seated or riding an animal (Badre 1980: 18). There are various shapes executed using a free-hand modeling technique.

*I. Figurines Represented in a Standing Position*

This category forms the largest majority of anthropomorphic terra cotta figurines.

*1. The Snow-Man Technique.* The snow-man technique

is the most primitive and schematised rendering of the human form. The main features: the head, the arms and the legs are pinched from the original clay lump. Other details, such as the eyes, the ears, etc., may be indicated by incision, by application and sometimes emphasised by painting. This technique was originally used in the representation of female figurines and was found in the very early sites of Syria, at Muraybit (FIG. 1a) of the eighth millennium (Cauvin 1974: 48, FIGS. 3-4; 1978: 118; FIG. 25) and at Chagar Bazar (FIG. 1b) of the Chalcolithic period (Mallowan 1936: 19, PL. I; 3).

The female figurine was represented as a seated steatopygous "mother goddess", a form which was widely distributed in the ancient Near East and of which similar specimens were found in the Pre-Pottery Neolithic B level of 'Ayn Ghazāl in Jordan (ca. 7500-5000 BC) (FIG. 1c - Zayadine 1986: 40, no. 17). Male figurines were also commonly represented in the snow-man technique. They did not form a unified type as was the case with female figurines, but the technique used for their fashioning was the common denominator. The Tall Brāk figurine (FIG. 1d - Badre 1980, PL. XXX.1; XXXI.12-13) and that from Byblos (FIG. 1g - Dunand 1954: 1039, FIG. 1146) have their parallel in the male figurines of 'Ayn Ghazāl (FIG. 1e, f - Zayadine 1986: 40, nos. 15, 16).

*2. Flat Figurine Technique.* The potter in this case sets the clay lump on a flat surface, shapes the contour of the figurine using the pinching technique and stretches out the limbs. It is obvious that these figurines, because of their flat shape, were meant to be placed lying on, or standing against a flat surface.

The arms are represented in full, either brought forward or more commonly folded over the chest holding the breasts (FIG. 2a - Badre 1980: 394, PL. LXIII). They are also rendered in the shape of stretched horizontal stumps (FIG. 2b - Badre 1980: 393, PL. LXIII). The face has a bird-like aspect, where some details such as the nose, the ears and the beard are produced by the pinching technique. Other details of the face are completed either with incisions, with applications, or with a combination of both. Round pellets, either plain or with a central perforation, represent the eyes, the ears, the breasts, and the navel. The headdress is stretched out in a comb-like shape, perforated at the corners. These holes may have been used to suspend the figurine. In an almost symmetrical way, the pinched-out ears are also pierced through, possibly for earrings. Decorative elements are added in a secondary stage; these are applied narrow bands to represent necklaces, belt or diagonal crossed bands over the chest. They are usually plain bands incised mechanically in the rouletted technique using an indented wheel-like tool (FIG. 2c - Matthiae 1966: PL. 60.5), a simple stylus or a fork-like instrument. The lower part of the figurine has wide hips and the legs are brought together in a single piece, separated by a medial incision. The contour of the pubic triangle is indicated by an incised outline and filled in with several rows of hatchings produced in the rouletted or free-hand technique. In some cases (FIG. 2d-e - Fugmann 1958: FIGS. 74, 85) the body appears disproportionate as there is no distinction between the two parts of the body; the torso and the lower trunk are fused in a circular shape ending in a concave base. The arms are very rarely indicated on this type of figurine. When they are indicated, they appear as small bands applied over the chest.

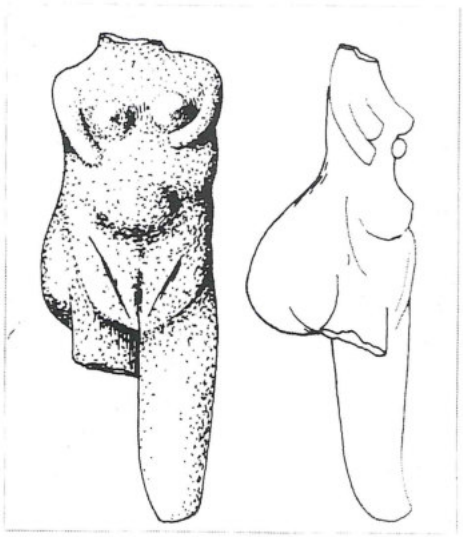
Most of the above described features: the pubic triangle, the navel, the breasts, the folded arms holding the breasts, the bands across the chest and the typical comb-like headdress, are characteristics of female figurines. The male figurines are much less frequently represented than the female. They are produced in the same basic technique for the body and the facial features. The headdress is tilted backwards. Distinct details are the applied beard and the male organs. In some rare exceptions the navel, the breasts and the folded arms appear on male figurines. The arms are either brought toward the side to carry a jar over the shoulder (FIG. 2f - Badre 1980: 195, PL. X) or sometimes brought forward to hold an animal applied to the chest (FIG. 2g - Badre 1980: 195, PL. X). These different objects held by the figurines probably symbolize offerings, an attitude which seems to be particular to the male figurine.

In general, the above described figurines are particular to the Orontes valley (Badre 1980: 45-53) and belong to the second millennium BC, with a concentration towards the middle of this millennium.

*3. Composite Technique of Flat Torso and Column-like Body.* The fashioning of these figurines is executed in two stages: 1) the upper part where the flat torso is fashioned according to the above-described technique; and 2) the lower part, where the lower trunk is rendered in a schematized column-like shape with a circular, oval or rectangular section. In the last two cases the column-like body does not affect the general flat appearance of the figurine. A concave base is shaped at its extremity, to make the figurine stand up.

The great variety of the figurines produced in this technique depends mainly on the various styles of the headdress. These appear in the following types:

*a) The headdress with long braids to the front and rectangular bun to the rear* (FIG. 3a). The braids are made as applied bands decorated with incised herring-bone design. Two similar bands represent the necklaces. A row of pellets with vertical incisions is placed over the forehead, and the eyes are represented by pierced pellets. A similar type of figurine (FIG. 3b) shows a simpler decora-



a



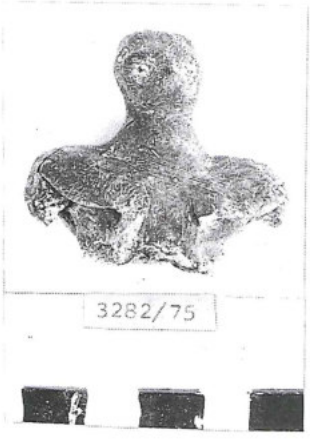
b




c



d




e

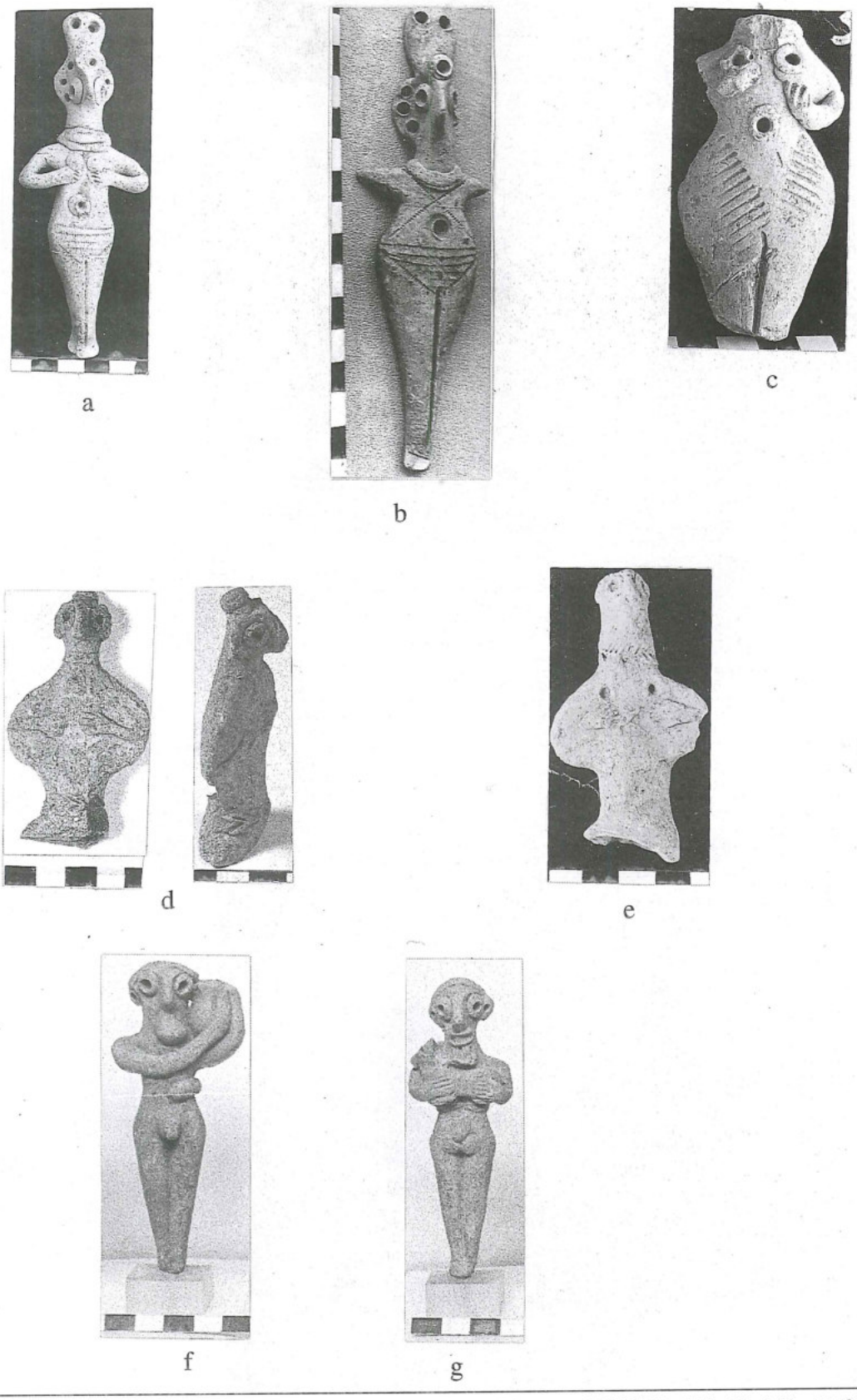



f

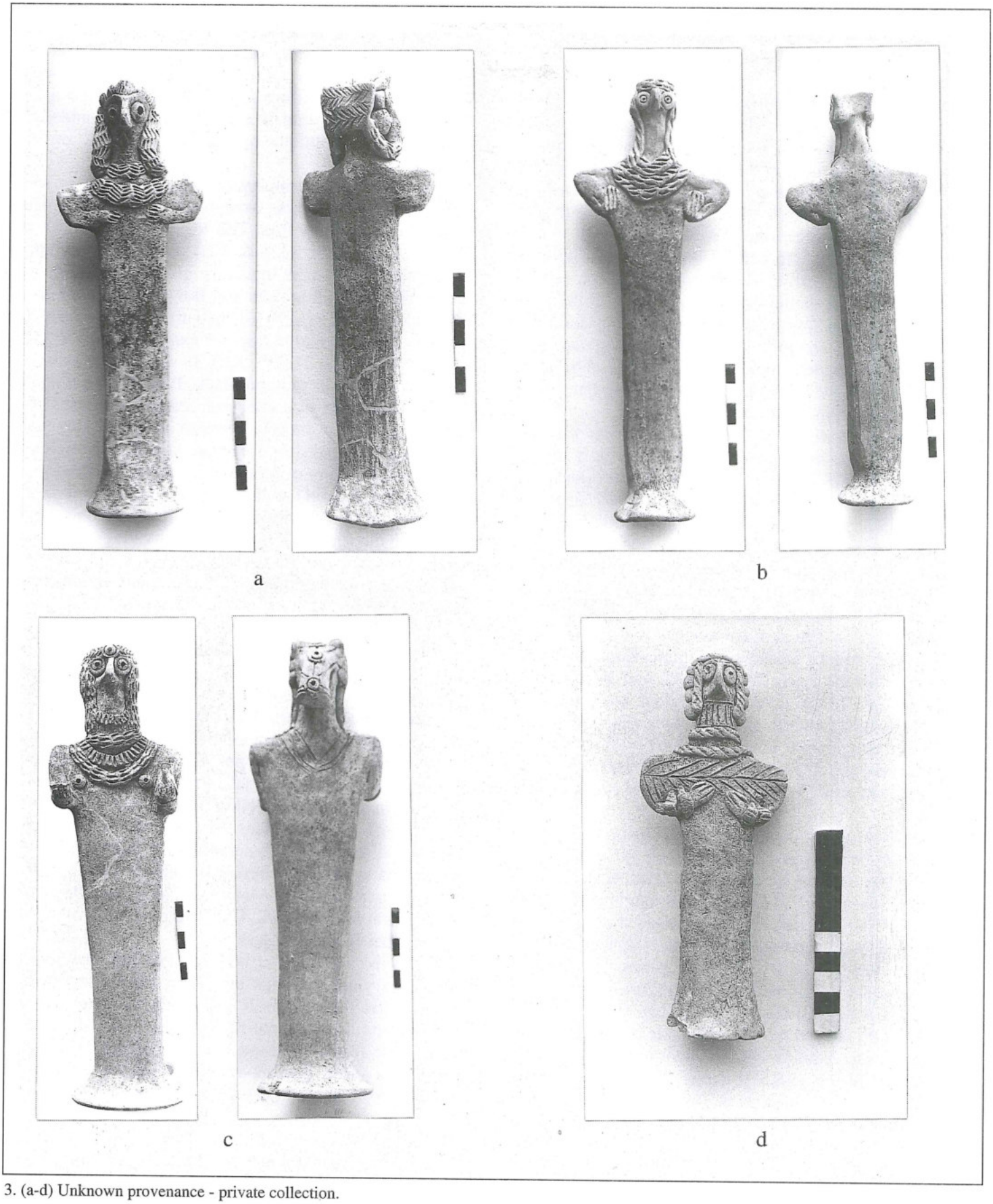


g

1. (a) Muraybit; (b) Chagar Bazar; (c, e, f) 'Ayn Ghazāl; (d) Tall Brāk; (g) Byblos.




2. (a) Unknown provenance - AUB Museum; (b) unknown provenance - Aleppo Museum; (c) Tall Mardīkh; (d, e) Ḥamā; (f, g) Salamiyyah.




3. (a-d) Unknown provenance - private collection.

tion for the necklaces and the hairstyle, which consists of one or two rows of deep nail incisions. The eyes are applied pellets with a reed incision around a central perforation.

*b) A headdress with long braids to the front and a pony-tail to the rear* (FIG. 3c). The braids are applied bands decorated with incisions. Four applied bands decorated alternately with vertical and horizontal hatchings represent the necklaces. These are continued in the back by a counter-weight indicated by three parallel incised lines in a V-shape. The forehead band is decorated with a horizontal band incised with herring-bone design. The eyes are applied pellets with a reed incision around a central perforation. Similar pellets are applied, one on the central forehead and a row of three over the pony-tail. Oblong folded pellets are applied over the pinched ears. Applied perforated pellets represent the breasts. The arms are brought forward holding unusual offerings: a saucer in the right and a pigeon in the left.

*c) A headdress with short braids to the front and enlarged pony-tail to the rear* (FIG. 3d). This type is similar to (b) above except for shorter braids. The necklaces are partly applied in two bands, and partly incised: one consists of vertical strokes between two horizontal lines, the other is a large herring bone design across the front shoulders. Bracelets are indicated on each wrist: two applied small bands, with fingernail incisions.

*d) A flat elongated headdress* (FIG. 4d-e - Badre 1980: 297, PL. XXXIV). The ears are pinched out with three or more oblong pellets folded over them. Simple pierced holes represent the eyes. The necklace and the bracelets are also indicated by a row of vertical incisions. The arms are brought forward. In some cases, this type of figurine is carrying a child in a highly stylized form. It consists of an elongated lump of clay for the body which has been squeezed in to indicate the neck and bring out the head.

*e) A highly elongated headdress ending in a turreted crown, with an enlarged applied pony-tail to the rear* (FIG. 4a). The ears are treated in the same way as in the preceding example (d). Three applied bands with a double row of incised hatchings represent the necklaces. Two similar bands are applied on the forehead and the base of the turreted crown. The stump arms are brought forward and pierced through as if to hold something.

*f) A conical pointed headdress* (FIG. 4b). This is usually decorated with incised motifs: lines, strokes or small dots and is rarely represented without decoration. The ears are pinched downward, either covered by an oblong pellet, or sometimes simply pierced through. The eyes are often represented as perforated pellets and sometimes have the shape of coffee bean pellets.

On the illustrated example (FIG. 4f) the eyebrows appear as an applied band decorated with incised herring bone design. On this same figurine the necklaces appear as a combination of applied and incised bands. The latter continue in the back. A long pony-tail is decorated with incisions applied to the back. The arms are stumps brought forward holding a lamb in the left and against the shoulder. This ram is a unique example rendered in one pinching technique applied transversely, on each shoulder.

The very large majority of these figurines is represented nude, but some exceptions are partly or fully dressed. An example from Tall Khuwayra (Chuera) (FIG. 4c - Moortgat 1960: 44, FIG. 42a) shows the body entirely covered with reed incisions giving the effect of a dress. The pelleted breasts are, however, applied on top of the dress. The priority of their role is more important realistic representation. Another example from Tall Tayināt (Badre 1980: 21, PL. XXI.3) shows elements of a garment painted in red and black. Paint and bitumen are occasionally used to emphasize certain features. Only a few figurines are entirely covered with red slip. Other specimens of dressed figurines are known; they belong to the second category of moulded plaques (cf. *infra*).

From the regional study of human figurines it appears that the above described composite technique applies mainly to the region of the Euphrates valley and is dated to the period between the beginning of the third millennium and the beginning of the second millennium BC (Badre 1980: 71-85).

*II. Figurines Represented in a Kneeling Position*

Very few figurines are represented in a kneeling position. In order to make this posture possible, the legs are brought forward together in one piece (FIG. 5a-b - Ingholt 1940: 60, FIG. 1; Badre 1980, PL. LXVI.71), and as a counterbalance, a clay peg is devised and stretched backwards from the original form of the figurine. In the few known cases, the kneeling position seems to be characteristic of male figurines, as their beards make clear. They are often carrying a container, an animal or a weapon applied against the chest, probably as offerings or ex-votos. In some cases the hands are brought to the knees, as in a praying position. The whole attitude of the figurine is that of a worshipper.

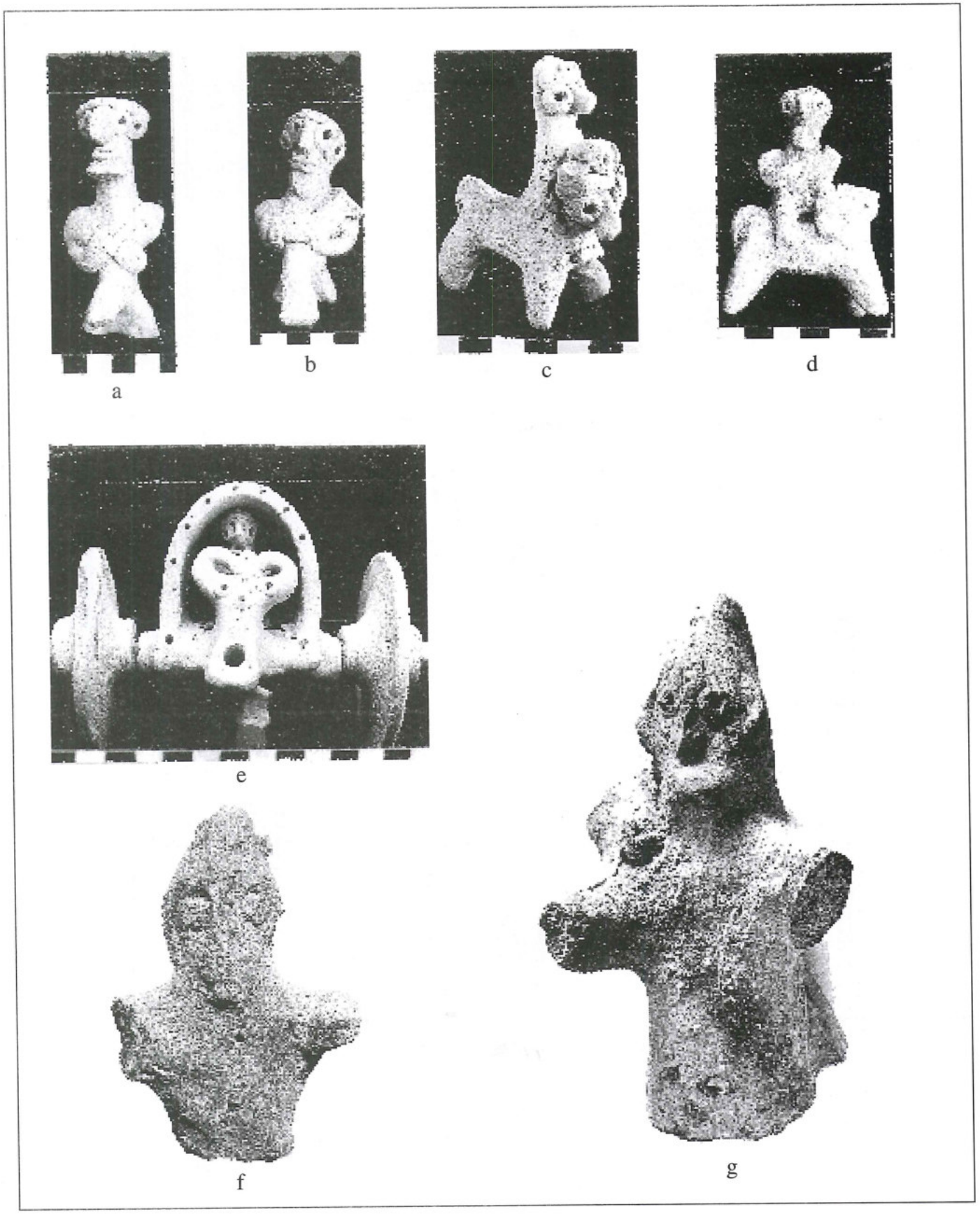
From the above described standing and kneeling figurines carrying offerings and from further research on this specific type (Ingholt 1940: 62), we conclude that worshipping and presenting ex-votos were male functions while female figurines are represented occasionally carrying a child and have their sexual attributes emphasized, symbolizing fertility and reproduction.

*III. Figurines Represented as Riders*

Zoomorphic figurines are almost as numerous as human figurines, but very few human figurines riding animals




4. (a, b, d, f) Unknown provenance - private collection; (c, e) Tall Khuwayra (Chuera).




5. (a, e) Ḥamā; (b, d) unknown provenance - AUB Museum; (c) Tall Mardīkh; (f) Tall Judayda; (g) Dayr ʻAllā.

have been discovered to date. These animals are quadrupeds of an indefinite species: a bull or a donkey. The human figurine is represented either astride (FIG. 5c - Matthiae 1974: 29) or sitting with both legs on one side of the animal (FIG. 5d - Badre 1980: 406, PL. LXVII.80). The riders are usually male with pointed or tilted headdresses. The animal and the riding figurines are fashioned separately then fused together in a secondary stage, sometimes skipping the lower part of the rider's legs.

The arms are either bent forward to hold onto the head or the horns of the animal, or represented as stretched-out horizontal stumps. The concept of these riders is common to all periods. The only distinctive chronological feature may be in the specific type of the human figurine itself. There are, however, some cases where there is no distinctive difference between the periods — for example, if we compare the Bronze Age rider from Tall Judayda (FIG. 5f - Badre 1980: 254, PL. XX.2) with the rider of the Persian period from Dayr 'Allā (FIG. 5g - Zayadine 1986: 124, no. 158). They have the same posture, similar pointed headdress and pelleted eyes. Figurines similar to the riders are shown driving a chariot (FIG. 5e - Badre 1980: 406, PL. LXVII.81) and are represented standing or seated in the chariot.

**B. Moulding or Relief Technique**

Small terra cotta plaques with a frontal relief figure, usually of a woman and very rarely of a man, have been found in most parts of the Near East, where they are known to archaeologists by the conventional names of their technique: the "Astarte plaque" or the "tongue reliefs". This technique implies an economic development because through such a procedure it is possible to achieve mass production of the same type of figurine. It also implies progress in technology, since moulded reliefs require a more complex procedure.

The earliest examples are from Mesopotamia and date from the third millennium BC. The Palestinian and Syro-Phoenician specimens were introduced at a later date; no plaques have been found so far in any Chalcolithic or Early Bronze Age deposits. Even in the Middle Bronze period they begin to appear in very small number, and it is not until about the 15th century that they really become abundant.

A relief or a plaque implies the creation of a mould and therefore a model or a prototype. The prototype is shaped by hand in a first stage and then baked. In a second stage the mould is produced by pressing the prototype into a lump of clay. The result is a negative of the original model. This mould is then baked. In a third stage a lump of clay is impressed in the mould and the relief comes out in the image of the original prototype. A more direct and faster way is to carve the mould itself in negative, but this implies greater and more proficient skills. The final result is usually adjusted by retouching the edges before the final baking: the "margins" were either finely cut (*détouré*) or simply left as they were. From the technique of treating the back side of the figurine with a final hand smoothing, it can be concluded that the majority of the plaques were impressed in univalve moulds. Such moulds have been discovered in excavations at Mari, Mumbaqāt and Maskanat Aymār (Meskeneh-Emar) (Badre 1980: 101).

Taking into consideration the economic reasons for such a moulded production, one can expect to find series of identical reliefs and a large number of moulds, but neither is the case. There are indeed a large number of the same identical type of relief, but the difference in the size of these reliefs within and throughout the sites may indicate the production of one mould per relief!

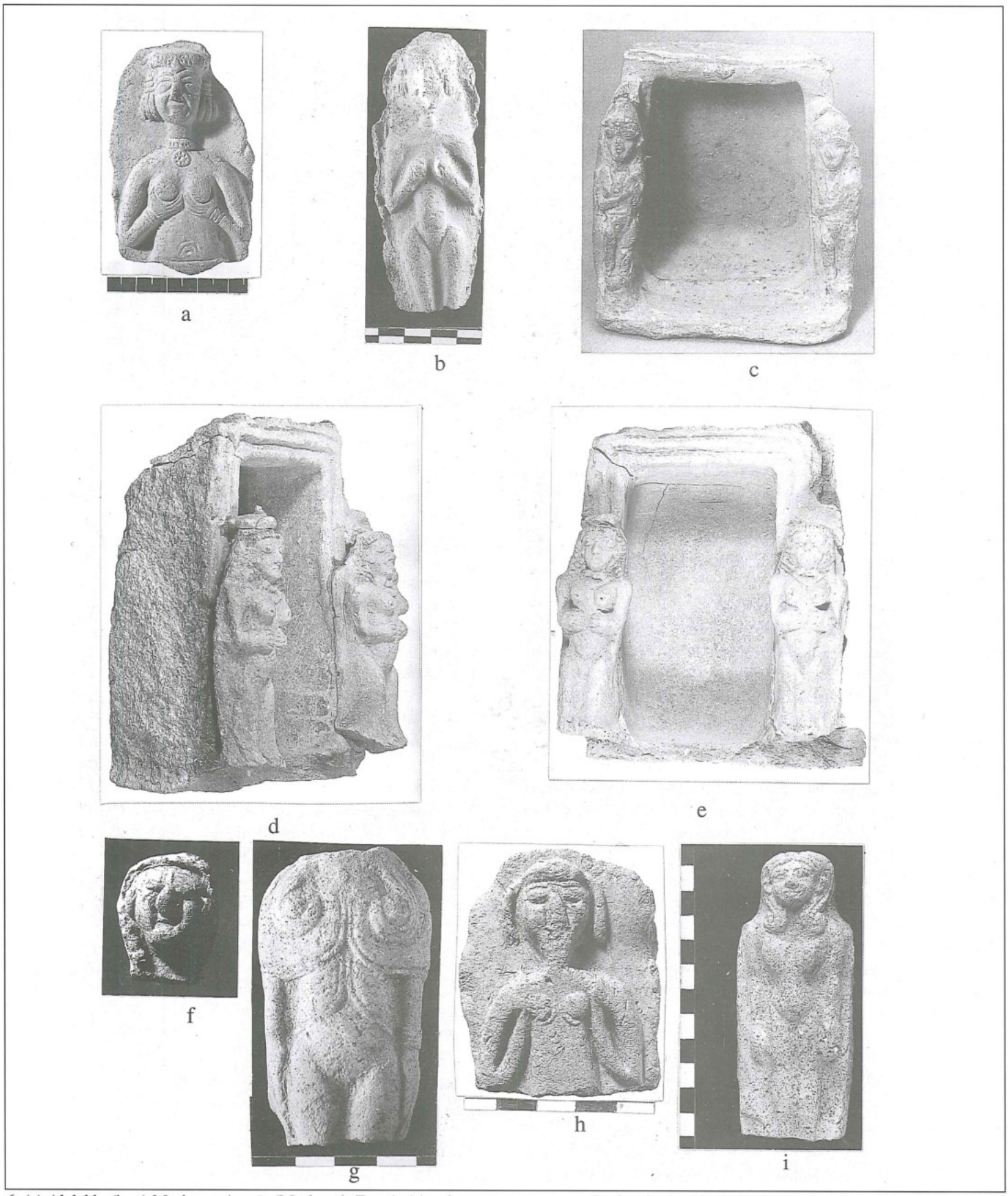
Among the basic types are:

*1. The Relief of a Nude Standing Figure with Bent Arms Holding Breasts with Both Hands*

a. The basic example of this common type comes from Alalakh (Woolley 1938: 247, PL. LVI.7) and Aymār (FIG. 6a-b - Badre 1980: 302, PL. XXXVI.9), showing a naturalistic body with pubic triangle indicated. The jewelry represented in relief includes three bracelets for each wrist and a necklace with a central pendant. The features of the face are distinct with almond-shape eyes and triple earrings showing in profile. There is a horizontal band on the forehead. This type is found throughout many Syrian sites: Tall 'Aṭshāna, Çatal Hüyük, Maskanat Aymār and Kamīd al-Lawz (Badre 1980: 65).

b. The standing figure with thick hair moulded in a roll of even vertical locks slanting down to the shoulders. This type of figurine is usually applied to the facade of a miniature shrine, which, in turn, is normally part of a larger clay structure. Such miniature shrines found *in situ* at Maskanat Aymār (Margueron 1976: 206, FIGS. 6-7) and Kamīd al-Lawz around an altar belonging to the Late Bronze sanctuary, as well as one of unknown provenance in the American University of Beirut Museum (Seeden 1979: 7-19), leave no doubt as to their function in connection with a temple building. These figurines come in twin pairs identical in shape, size and details. They are certainly made in the same mould. Some features, such as the eyes and eyebrows are outlined with black paint. These terra cotta models of a shrine are similar to one which has an entrance guarded by two naked women playing tambourines found in the Jordan Archaeological Museum (FIG. 6c - Zayadine 1991: 39).

c. The standing figure with short vertical locks. It is similar to the above mentioned types (a and b) but with more simplified, schematized facial features. We should note for this type the similarity between the Late Bronze fig-




6. (a) Alalakh; (b, g) Maskanat Aymār (Meskeneh-Emar); (c) unknown provenance - Jordan Archaeological Museum; (d, e) unknown provenance - AUB Museum; (f) Dayr ʻAllā; (h) Kamīd al-Lawz; (i) Ugarit.

urine of Kamīd al-Lawz (FIG. 6h - Badre 1980: 236, PL. VII.4) with the much earlier (c. 3000 BC) terra cotta head from Dayr 'Allā (FIG. 6f - Zayadine 1986: 61-62, no. 71).

*2. The Relief of a Nude Standing Figure with Arms Extended to the Sides*

The basic example of this type is represented by the standing figure with "Hathoric" hairstyle found mainly on the coastal sites, i.e. Ugarit (FIG. 6i).

Like modelled figurines, most moulded figurines are represented in the nude. Some exceptions appear, mainly on the figurines of Maskanat Aymār (FIG. 6g - Badre 1980: 306, PL. XXXVIII.28) where they are shown dressed in a double cape, the lower one to the waist surmounted by a shorter one to the level of the elbows. In spite of the double thickness of the clothing, the breasts are showing again as if to stress the importance of the fertility symbol for which they stand.

**Conclusions**

The study of the technique of manufacturing terra cotta figurines leads to some major conclusions which may be summarized as follows:

*1. Identification of the Nature of the Figurines*

a. Male figurines are distinguished by their apparent organs or beard. In the absence of these, the shape of the head — pointed, flat or slanting backwards — can be indicative. The head with the turreted crown is also characteristic of male figurines. The riders and kneeling figurines, as well as those carrying ex-votos (vessel, arm or animal), have been recognized as males.

b. Female figurines are distinguished by their breasts (with some exceptions), their navel and their pubic triangle. The position of their arms bent forward, usually holding the breasts is another characteristic of female figurines. While the headdress is a basic element, which types the female figure, the headdress also serves to identify the geographical distribution of the figurines. Thus, the comb-like headdress is typical of the Orontes valley, while elaborate combined hairstyles (cf. *supra*) are characteristics of the Euphrates region and Hathoric hairstyles are basically found on the moulded figurine of the coastal region.

*2. Geographical/Typological Distribution of the Figurines*

In addition to the above mentioned distribution of headdress styles in the three main regions of Syria, there are other elements that are characteristic of each one of them. Thus, the flat circular body (cf. *supra*) and the crossed bands over the chest are typical of the Orontes valley. However the pillar-shaped body, the coffee-bean pellets for the eyes, as well as the reed-incised and perforated pellets, which represent other various features, are found exclusively in the Euphrates region.

It is important to note that there are some rare exceptions to these conclusions, i.e. the pillar body does appear in rare cases in the Orontes region, but in earlier chronological contexts than the ones usually known in that region. Indeed the known Euphrates figurines belong mainly to the third and second millennia, while the Orontes figurines are more abundant in the middle of the second millennium. Recognition of these exceptions leaves the door open for revision of the above conclusions should future excavations in the Orontes, Euphrates and the coastal regions bring to light equal quantities of figurines, with an equal distribution for each period.

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# Stamp and Cylinder Seal Techniques in Jordan

Stamp and cylinder seals are most valuable documents to date archaeological levels. They often give chronological and geographical information and are generally studied for their historical and iconographic evolution. But by observing and interpreting the tool traces left by the seal cutters or by looking at their manufacturing processes, we can also find precious information on the different techniques used for their creation. This aspect is rarely examined in the ancient Near East, even in Mesopotamia, where the glyptic art is best known. When studying the way in which the ancient craftsmen worked in Jordan,[1] we will have to refer mainly to those Mesopotamian prototypes.

The beautiful agate seal of Darius I (521-486 BC), discovered in Egypt and contemporary with the Ṭawīlān tablet, shows the Persian king in his chariot, hunting an impressive and threatening lion, under the protection of his national god Ahura Mazda.[2] Iranian and Mesopotamian influences are easy to recognize; the theme of the seal is well known and allows us to reconstruct the daily and religious life of the king as well as the languages in use in his time. Historical and social information can thus be discovered in the seal, but the manner of manufacturing seals has never been analyzed. The tools used to render the volume in the body of the king, the lion and the horse, and the ones used to cut the palms, the feathers of Ahura Mazda, the crown of the king, or the cuneiform inscriptions were surely as specific in antiquity as in modern times. Seals are normally carved in deep relief or in intaglio; they have the same role as a mould: the impression left in the wet clay of a tablet in Mesopotamia or a vessel in Jordan always shows a reverse design. The Old Persian, Elamite, and Neo-Babylonian inscription in our example had to be read in the right direction on the support. This peculiarity must have presented a problem to text engravers, who seem have been different from the craftsmen of the design. The function of stamp and cylinder seals is identical in the ancient Near East: they authenticate a document. They have the legal status of a signature and testify to someone's property; they can be indicators of contents or have medical or magic purposes and can also be worn as amulets. The location of their design on a clay support can differ from period to period and from region to region.

Stamp seals were invented in Mesopotamia in the protohistoric period (fifth millennium BC; Homès-Fredericq 1970), and were in use until the beginning of the third millennium, when they were progressively replaced by cylinder seals, but they reappeared in the first millennium BC. In Jordan stamp and cylinder seals came into use in the Early Bronze Age, probably under Mesopotamian influence. They were also attested at the same period in Palestine (Ben-Tor 1978: 2), and were used continuously until the Iron Age, showing Mesopotamian, Syrian, Egyptian, or Hittite influences, depending on changes in international trade or domination. The shapes of the stamp seals vary, depending on the periods in which they were in use.[3] They are mostly small, with one flat surface, decorated with a design, and sometimes completed by an inscription, as in the Late Bronze or Iron Ages in Jordan.[4] Their impressions are well defined and show the original shape of the seals.

The cylinder seals are quite different: they are shaped like small cylindrical tubes carved with an intaglio design. They appear in the Uruk period in Mesopotamia (second half of the fourth millennium BC), and in the Early Bronze period in Jordan, where they are in use at the same time as the stamp seals.

[1] The most striking difficulty in studying the glyptic art in Jordan is the fact that only few seals have been excavated, compared to the thousands discovered in Mesopotamia.

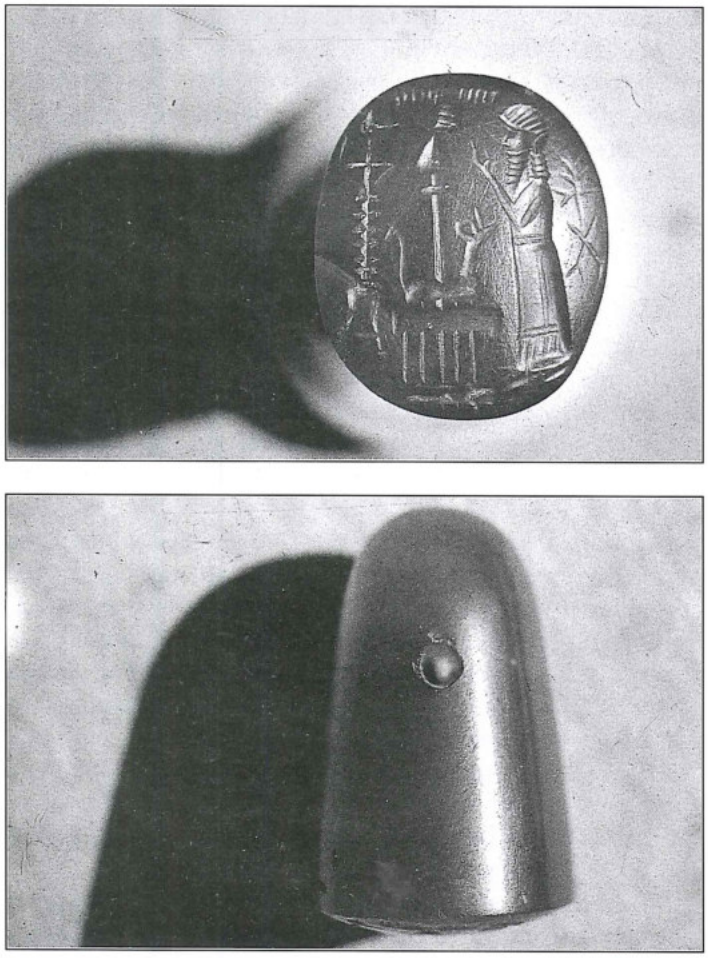
[2] Inscribed agate cylinder seal, found in Thebes (Egypt), 37 mm length, 16 mm height, British Museum no. BM 89132. Wiseman 1959: no. 100; Collon 1987: 130, no. 558.

[3] Stamp seals can have various shapes: dome, hemispheroid, lentoid, conical, conoid, pyramidal, or gabled. In Mesopotamia they sometimes have the shape of a kidney, a foot, a spool, a bead, a lying animal, or its head (lion, bull, hare). In Jordan, scarab or scaraboid seals are numerous. Others are barrel-shaped, lenticular, conoid, or conical.

[4] See the inscribed Moabite, Edomite, and Ammonite seals. Compare with the seals of the Assyrian and Neo-Babylonian periods in Mesopotamia.

Both stamp and cylinder seals have a longitudinal perforation, bored vertically in the cylinder seals and horizontally in the stamp seals. The perforations are especially interesting for our study, because this part of the seal remained unpolished, showing the marks of the tools and abrasives used to drill the holes. These perforations are for suspending the seal on a string or within a bead necklace. The seals can also be part of a bracelet or worn on a pin or fibula to close garments such as those used by the ladies of Mari. In Jordan too, women can have their personal seals, as we know through the texts (Millard 1991: 142).

A chalcedony stamp seal (FIG. 1)[5] is said to come from the Iron Age II Tomb of Adoni Nur in 'Ammān.[6] It represents a worshipper, with long hair and beard, a skirt descending to his ankles, a spade of the god Marduk on the altar, and the Mushrushu dragon, the special lamp of Nusku above the tripod standard, and cuneiform-shaped signs. The whole composition is in the tradition of the Neo-Babylonian seals in the "drilled" and the "cut" style of Mesopotamian (Porada 1948: 71-99), Palestinian (Tushingham 1992), and Jordanian glyptic art (Yassine 1984: FIG. 57, seal no. 184). Nevertheless when analyzing the regular octagonal faceting of the stamp, the tool marks in the cylindrical suspension hole and the iconographic details, as well as the inscription, one can determine that the seal has been made with modern tools.



1. Chalcedony stamp seal, purchased, Iron Age II, Jordan Archaeological Museum, no. J.6021. (Courtesy Department of Antiquities of Jordan).

In contrast with Mesopotamia, where the seals were pressed on clay tablets, in Jordan, from the Early Bronze Age on, seal impressions on pottery (essentially jars and containers), are known from examples from al-Lāhūn, Numayra, Bāb adh-Dhrā', and other sites.[7] These types of impressions also appeared in Palestine (Ben Tor 1978: 40-42), and Syria (Mazzoni 1984: 18-45). An Early Bronze I juglet, found in a family tomb in al-Lāhūn on Wādī al-Mūjib, preserves a deep linear, geometric incision, pressed in the soft clay before firing, near the neck of the vessel (FIG. 2).[8] The design of the stamp seal shows concentric circles, a motif also used on cylinder seals with geometric patterns (Ben Tor 1978: PLS. 2-5). It brings to mind an EB III jug shoulder from Bāb adh-Dhrā', made either by a cylinder or stamp seal (Lapp 1989: 7, FIG. 6). Seals from Palestine are engraved with the same pattern of concentric circles or spirals, made by V-shaped tools (Ben Tor 1978: 39). The stone with which the stamp seal at al-Lāhūn was made must have been quite soft, as the grooves are deep, showing that the engraver had no difficulty embellishing it with a pointed instrument. Its original shape probably presented a dome or a button, like the first examples in Mesopotamia (Homès-Fredericq 1970: 11, 18, 24, 84). In a cylinder impression from Numayra (FIG. 3) on the neck of jar 1301,[9] a lion attacking an ibex or a gazelle with long horns shows Mesopotamian inspiration, although the seal was engraved by a local artist.

The information we have on the original seals and their manufacturing process is often hypothetical for Jordan, because we have no texts about corporations of seal cutters. We have no representation of craftsmen, who remained anonymous and, as far as I know, no hoards have been discovered in this region. Once more, in order to get information, we have to look at the documentation of

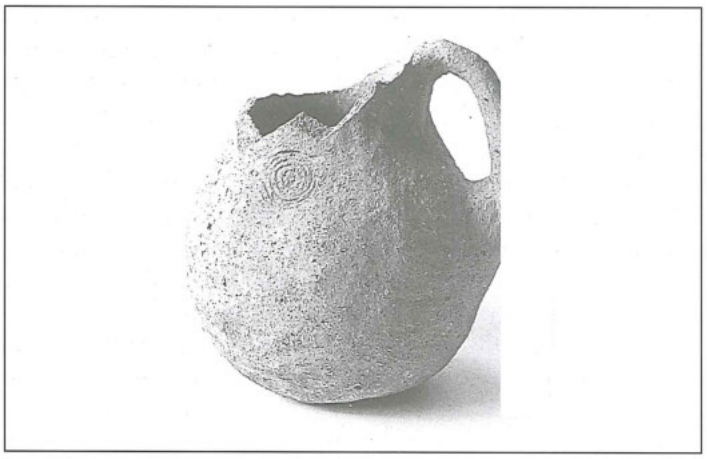
[5] Chalcedony stamp seal, Jordan Archaeological Museum, no. J.6021, Iron Age II, not published.

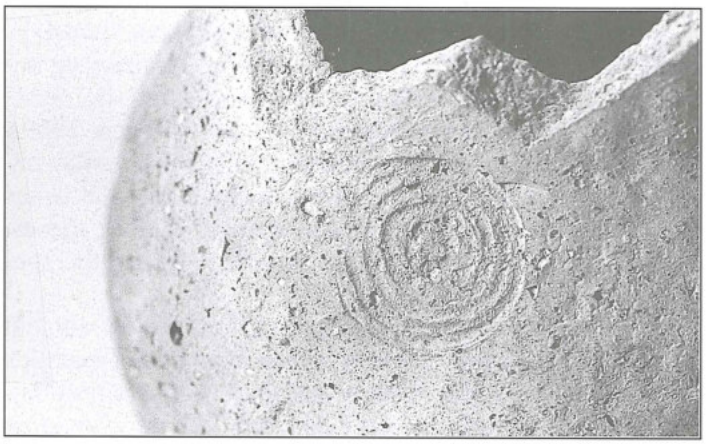
[6] I would like to thank Mr. Moussa Zayyat and Miss Seeham Balqar, of the Jordan Archaeological Museum, who allowed me to present this unpublished stamp here, as well as Dr. Joseph Greene who made the excellent photographs.

[7] Abū al-Kharaz, 'Ammān, 'Arqūb aẓ-Ẓahr, Bāb adh-Dhrā', al-Bālū', al-Baq'ah valley, Buṣayra, Dhībān, al-Ghassūl, al-Ḥandaqūq, Jāwa, Katarat as-Samra, al-Lāhūn, al-Maflūq, Numayra, Petra, Rabbat 'Ammon, Ṣāfūṭ, as-Sa'īdiyya, Sbayla, Ṭiwāl ash-Sharqī, Umm Ḥammad ash-Ṣharqī, 'Umayrī, az-Zayraqūn, etc.

[8] Stamp impression on juglet no. L.82/64, al-Lāhūn, sector 3, EB I. Homès-Fredericq 1986: 91.

[9] I would like to thank N. Lapp who kindly allowed me to reproduce this seal impression on jar no. 1303 of Numayra, EB III. Lapp 1989: 8, FIG. 7



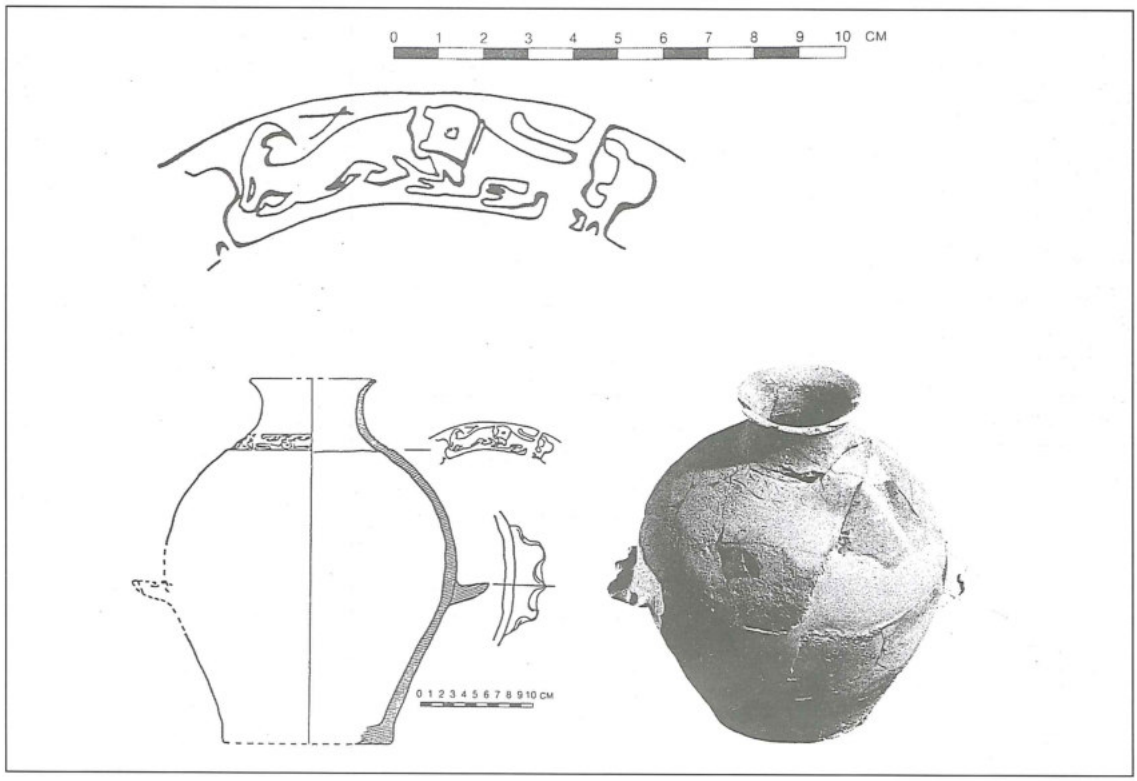


2. Juglet with stamp impression, al-Lāhūn, no. L.82/64. EB I. (Photo W. Delauwer, Belgian Committee of Excavations in Jordan).

the neighbouring countries. We know the Sumerian and Akkadian terms for seal cutter (*za-gindin, zadim, burgul, purkulullu*) as well as the term for his helper, called in Sumerian "*kab-sar*" (jeweller or stone mason) (Loding 1981: 6-14). Following an Achaemenid text, the apprentice had to be trained for four years before becoming an accomplished craftsman (Collon 1987: 102-103). Some Greek and Latin authors, such as Theophrastes and Pliny the Elder, mention the methods used in their time, probably inspired by more ancient techniques (Merrillees 1990: 23).

We will now try to follow the different steps for manufacturing cylinder and stamp seals. The logical process is first to find the raw material, examining the quality of the stones; then to give the general outline of the seal; and finally to engrave its lateral surface and its inner suspension hole. These last two operations can be interchangeable.

To understand how seals were made in antiquity, the modern lapidary techniques used for cutting agate beads in northern India warrant discussion. A thorough study of the Cambay beadmaking industry has been published by G. L. Possehl (1981), who observed that there was a striking similarity between this industry and ancient seal manufacturing at Lothal. In this region, southeast of Mohenjo Daro and Chanhudaro, the lapidary industry flourished between 2400 and 1700 BC. The seals were shipped from there to Mesopotamia; the intensity of this international trade during the Akkadian period is attested by the discoveries of H. Frankfort at Tall Asmar (1933: 47-53).




3. Seal impression on jar no. 1301, Numayra, Early Bronze Age. (Courtesy N. Lapp).

In the mines of northwest India, teams of three to five people nowadays extract lumps of precious or semi-precious stones. A man digs holes (around 3 feet in diameter) with picks or shovels to get the nodules out of the agate strata. Two or three women gather the lumps, clean the appropriate stones from the earth or from the waste materials, and sort them by size. Sometimes a small chip is made to see the quality of the selected stones. This first sorting and grading of the material is thus done in the mine, while a second, more careful selection, is done in the village. The stones are then transported to Cambay and brought to a specialized workshop in bags of 50 to 100 kg, where they are heated in small pots with smouldering sawdust (Possehl 1981: 41-42). A chemical reaction results that allows them to be transformed more easily. The first, rough outlines of the beads are cut and then smoothed by finer chipping with water buffalo horns, hammers, or spikes, while another worker does further chipping with a small iron hammer. The different stones are re-examined and sorted, then transported to a more specialized workshop, where the final touch is given.

In the Indian mines, the workers select agate, the material used for the Darius seal. Other stones can also be found in the region: jasper, rock-crystal, and similar minerals. In antiquity, seals were also made of different materials, mainly mineral (stone, faience, clay), vegetal (wood), or animal (ivory or bone). A great variety of minerals was used, ranging from river pebbles to chlorite and limestone. The stones could be opaque, translucent, or transparent. They sometimes have beautiful colours, such as cornelian, obsidian, turquoise, amethyst, agate, jadeite, hematite, and serpentine. Some are very hard to cut, such as rock-crystal, diorite, and amethyst. From the eighth century BC onward "quartz", chalcedony, and cornelians were mostly in favour. Lapis lazuli was probably chosen for its beautiful dark blue colour. In Jordan in the Iron Age, we find seals in limestone, agate, amethyst, chalcedony, jasper, quartzite, sardonyx, etc. Many stones were imported, attesting to international relations between far away regions and Jordan. It is often difficult to define the country of origin, but steatite could come from Egypt or Iran and serpentine, lapis lazuli, and alabaster from Mesopotamia, Iran, or Afghanistan (Homès-Fredericq 1970: 100-101).

When a wealthy person bought a seal in antiquity, he paid special attention to the magic value of the stone. Cuneiform texts reveal that a seal in lapis lazuli gives "power to its owner", while a seal in rock-crystal brings him more and more wealth and his name will be honoured. A seal in *ZA.TU.US.ASH* (an as yet unidentified material) presumably allows its owner to live with joy in his heart, while a seal in green marble will give favour upon favour before death (Williams Forte 1976: 1).

Next to the religious or magic power of the stone, its choice also depends on its technical characteristics. The material must be soft enough for shaping and carving the motives on the seal with the available tools (in the beginning flint scrapers, progressively replaced by copper, bronze, or iron chisels and engravers) and it must resist cracking while the general form, the design, and the suspension hole are being shaped. It must be hard enough to avoid breaking if it is dropped or bumped and must be solid enough not to wear down quickly. The hardness of the stones and the tools can also influence the design.

Stones vary in hardness, measured between 1 and 10 on the Mohs scale of hardness. The soft stones vary between 1 and 6, the hard ones between 7 and 10. Seals generally have a hardness between 3 and 7 (Berry 1969), the most adequate for preservation and conservation being between 4 and 6. The modern archaeologist also has a few simple chemical tests available to identify stones, such as the carbonate test, the dolomite test, and the specific gravity test.[10]

As we have no literary sources to know how ancient craftsmen decided if a material had the proper qualities of resistance, we may believe that they followed tradition and worked in an empirical fashion. We may imagine that they examined the texture and the structure as well as the colours of the minerals. They probably valued the homogeneity of the very fine-grained rocks and generally chose single mineral crystals. They surely had observed that a fingernail scratches soft materials (hardness 2.5 or lower), a copper tool harder ones (hardness 4), and an iron instrument even harder ones (hardness over 6). In the first periods soft stones (Mohs hardness 1 to 3) were used, such as calcite and limestone (Gwinnett and Gorelick 1991: 189). Later, when stronger instruments were in use, harder stones were selected, such as basalt, translucent, semi-opaque to opaque chalcedony, cornelian (Mohs 7), diorite, goethite, haematite, jasper, lapis lazuli, quartz and quartzite, and rock-crystal. Soft stones, such as chalk, chlorite, serpentine, and soapstone were still in use,[11] next to other materials, such as sintered quartz compositions (Egyptian faience, frit, or paste).[12]

Once the stones had been selected, the general outlines of the seal were shaped by a first faceting: unfinished or broken seals found in a workshop of Mallia give information about this technique in the Greek Late Bronze Age, but the observations can also be made for

[10] See Berry 1969: 67 for more details of the different tests which can be used in modern times.

[11] For a list of soft and hard stones, with their characteristics and hardness scale, see Merrillees 1990: 33-42.

[12] The faience factories in Palestine and Jordan are studied in McGovern 1985.

the Western Asiatic seals. Stamps could easily be shaped in soft stone: in the beginning, flint burins or engravers were probably used, as the chipping technique was known in the prehistoric period. When stronger implements (copper and iron) were invented, harder stones could be used. J. G. Younger (1981: 33-34) assumes that the "cylinders were shaped from cores made by the tubular drill", because their diameters were relatively standard. Saw and file traces are recognizable on some seals (Younger 1981: 34, FIGS. 12-13). These marks were later abraded with sand, mixed with olive oil or water.

The tools used for the design and the stringhole can be studied through modern experimentation. A few years ago two American orthodontists, L. Gorelick and A. J. Gwinnett, experimented with the techniques of seal manufacture.[13] As dentists, they were interested in the morphological aspects of dental bio-material and they used the Scanning Electron Microscope (SEM) for their examination of the surface of enamel after bonded braces are removed. As Dr. Gorelick had a large collection of cylinder seals, the two colleagues became interested in examining the irregular surfaces of ancient seals. They were confident that they could read the marks of the tools as easily as they could on teeth, if they examined them with their specialized microscope. They had to study tool traces on rough surfaces, where polishing had not removed them. They thought that if they experimented with filling the drill holes of seals and beads with silicone, the impressions left in this "highly accurate, flexible and inert material" which "literally turns the drill holes inside out, thereby disclosing their surface topography", could give valuable information, once examined with the SEM (Gwinnett and Gorelick 1991: 189).

Gwinnett and Gorelick (1979: 26, FIG. 21) looked carefully at the design of a Proto-Elamite stamp seal. Some marks were very regular, and must have been made by a bow-drill; other lines were made by a pointed instrument (engraver or chisel). Others were not intentional; the tools of the craftsmen skid sometimes. They also observed marks of abrasive (sand, mixed with olive oil or water) used to make the work of the seal cutter easier. All those marks were very faded and could not have been distinguished without the microscope.

The instruments used by the lapidaries in antiquity are known from tools found at Tall Asmar in Mesopotamia: different hoards packed and hidden in small pots were found under the floors of Akkadian houses (2450-2250 BC) (Frankfort 1933: 47-48 and FIG. 37). They belonged to jewellers or perhaps to craftsman, travelling from one town to another (Frankfort 1939: 5). Their equipment consisted of several engravers, small edged copper chisels, and a borer probably belonging to a bow-drill with a spatula-shaped cutting edge and square section. The pots also contained a small lapis lazuli seal with a silver cap (ready to be sold), finished and unfinished seals, beads, earrings and other ornaments, two pointed instruments in copper, a whetstone probably used for polishing the seals, a set of weights and a copper plate. Alalakh, Ugarit, and Karkemish in Syria and Uruk, Tepe Gawra, Chagar Bazar and other sites in Mesopotamia, have revealed comparable tools (Collon 1987: 102-104). Those of a Babylonian jeweller from c. 1750 BC were found in a jar from Larsa (Arnaud *et al.* 1979: 20-23, 54-64), containing beads, seals and sealing, weights, a whetstone, and a small anvil. For Iran, G. Contenau mentioned at Susa a small metal point moved by a bow-drill.[14] Perhaps other objects, described in excavation reports as needles, awls, or points could be interpreted as engravers, borers, and chisels for seals and jewelry in Jordan.

In prehistoric times, the tools to make scratches, lines, and grooves, were probably hafted flint micro-burins (Gorelick and Gwinnett 1981: 21), but they quickly became pointed bronze or copper stems, found in the Syrian and Mesopotamian lapidary treasures. The pink alabaster seal of Bāb adh-Dhrā' was carved with one of these pointed stems in the Early Bronze Age.[15] The seal cutter first made a human figure, but later on, he or another craftsman changed his mind and engraved a more traditional, geometric design with a similar pointed tool. These were in use for a long time.

On a sintered quartz (faience) scarab seal found at al-Lāhūn (FIG. 4),[16] the flat side was carved with various pointed tools of different dimensions, used in the Late Bronze/Iron transitional period. It shows the body of a ram and a well modelled, upraised *ureus* that could have been made by the tubular drill technique, while an *atef*-crown was deeply carved by a V-shaped instrument. The coat and the scales on the bodies of the animals were later criss-crossed with a pointed engraver, showing that the combination of different techniques allowed special details to be rendered. The design is a well known iconographic motif of Egyptian influence and shows once more that Moab had international relations far away to the south. The seal, however, was locally made by the artist who probably had a model in favour at this period. He seems to have not understood the hieroglyphic signs, which he reproduced in a wrong order, giving a defective spelling of the god's name, Amon-Re.[17]

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[13] For a list of their publications, see Gwinnett and Gorelick 1991: 196; see also Gorelick and Gwinnett 1991: 37-48.

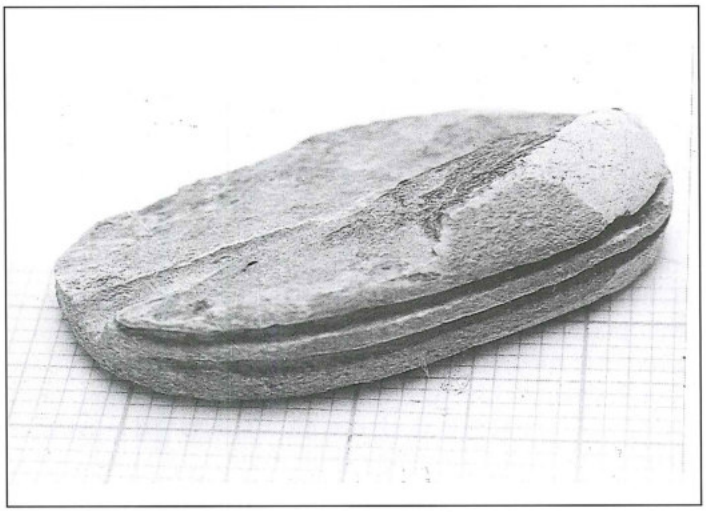
[14] Contenau 1931: 606: "une petite tige en métal, qu'il (l'artiste) anime d'un mouvement de rotation en avant et en arrière, grâce à la corde d'un archet".

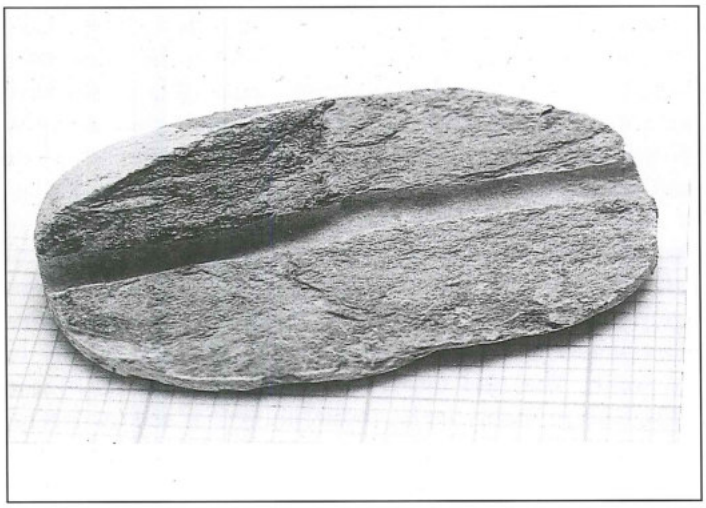
[15] Cylinder seal, 40 mm H., 25.5 mm diam., Early Bronze. Lapp 1989: 5, FIG. 4.

[16] Stamp seal, 30 mm length, 19 mm width, upper part broken: 10.5 mm to 3 mm H. transitional period Late Bronze-Iron Age. Homès-Fredericq 1988: figure on p. 42.

[17] I thank our colleagues L. Limme and K. Kitchen who gave me this precious information.







4. Scarab seal, no. L.87/10, al-Lāhūn, transitional period Late Bronze-Iron Age. (Photo W. Delauwer, Belgian Committee of Excavations in Jordan).

If we observe the design on a cylinder seal from Dayr 'Allā, now in the Jordan Archaeological Museum in 'Ammān (FIG. 5),[18] we notice that the snake and the stem of the life tree were made with pointed instruments (chisels and engravers) whereas the flowers on the tree and the head and body of the two human figures were made of drilled rather than engraved holes.

The first drills were probably made of stone or wood and moved by hand (Bessac 1986: 124, FIG. 29), as the work of Gorelick and Gwinnett has shown. The stem is regularly turned and leaves circular marks in the stone, especially if some abrasive (sand, beach sand, or crushed stones, mixed with water or olive oil), is added (Gorelick and Gwinnett 1981: 44-45). An Egyptian fresco represents a carpenter and a lapidary with bow-drills of the Late Bronze Age.[19]

Artisans soon realized that it was possible to obtain regular holes in the stone by using a constant rotation speed and relatively constant pressure (Bessac 1986: 233, FIG. 54). The bow drill, such as the one described by Contenau, was originally made as a vertical drill, but later on as a horizontal lathe, with a string turned around the drill. The tip of the drill is placed on the object to be perforated. Some abrasive is added at the beginning of the work (Possehl 1981: 44-46).

In Egypt, as in Cambay, the drill rests on the workman's leg, to allow him to apply carefully controlled force on the bow with the alternating movements of the rope. The force of the pressure depends on the hardness of the stone. Different tests with drill bores were made by Gwinnett and Gorelick. They examined with their



5. Cylinder seal of Dayr 'Allā, Jordan Archaeological Museum, no. J.12677a. (Photo S. Da'ja, courtesy Department of Antiquities of Jordan and Joint Expedition at Deir 'Alla).

[18] Cylinder seal, Dayr 'Alla excavation 1961, Jordan Archaeological Museum, no. J.12677a; Late Bronze Age. Homès-Fredericq and Franken 1986: 145, no. 415.

[19] Fresco from a tomb at Thebes, Late Bronze Age. Gorelick and Gwinnett 1978: 40, FIG. 4.

scanning electron microscope the holes left in a slate pebble, drilled with bow drills of wood, hollow cane, and flint. The different tools left different holes. They experimented with changes in a wooden drill stick and the hole at different stages, using sand as an abrasive. The wear of the instrument is clearly visible (Gwinnett and Gorelick 1979: 19, FIGS. 4-7). Similar traces can be found in the sealing of stamp and cylinder seals (especially in the Sibitti representations).

One of the last operations when preparing a seal is to make a vertical or horizontal suspension or string hole. This perforation is always made in the same way, and can be seen on various cylinder seals of the Royal Museum of Art (FIG. 6).[20] First a small cup was chipped on the upper side of the seal: it was used as a starting hole to fix the tool (chisel or drill) and could also serve as reservoir for the abrasive (sand or hard stone grit, mixed or suspended in a liquid such as water or oil). On the back of the scarab seal of al-Lāhūn (FIG. 4 ) a 0.2 cm wide hole is clearly visible, as this part of the object was broken in antiquity. The initial hole is generally drilled somewhat more than halfway, for reasons of resistance. The same operation is done on the other side of the object. A poorly trained lapidary will end up with a bad junction and misaligned drill holes. At al-Lāhūn, the first hole was done with a fairly new drill while the second one was continued with another tool. It is of course safer to drill small holes from both sides rather than a straight hole through the seal, because breakage, chipping, and shattering around the suspension hole during the oscillation of the tool are frequent.

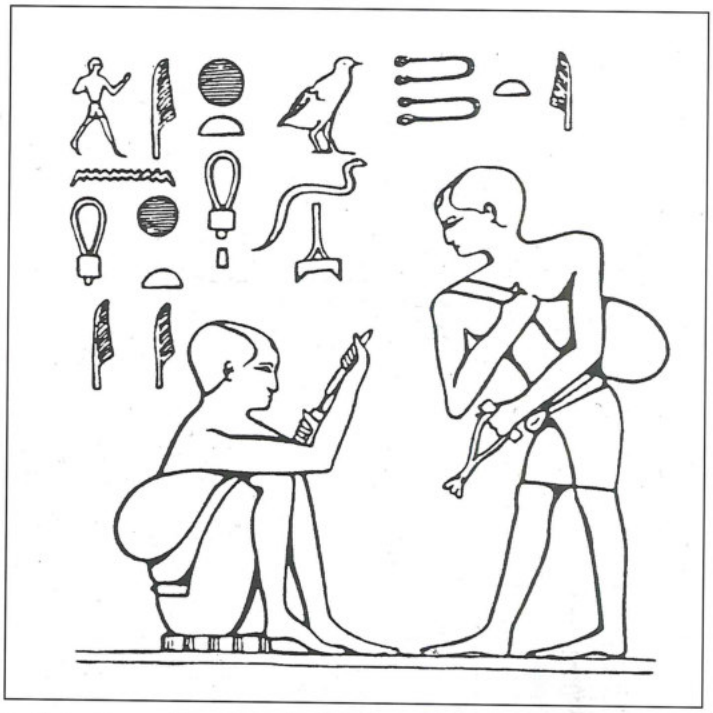
Once again, Egyptian representations can help (FIG. 7) (Gorelick and Gwinnett 1981: 24; Homès-Fredericq *et al.* 1981: 11, FIG. 5). In a relief from the fifth dynasty (2500 BC) the seal maker holds a seal in one hand and in the other a vertical hand drill in a wooden shaft, to drill the hole. With a circular movement in the hole and the help of an abrasive (see the bag of the second seal cutter), the craftsman drilled the suspension hole.

This way of drilling the holes requires precision. The second hole must be placed to meet the first one exactly: this is often a matter of chance. In a marble cylinder (FIG. 8) from the Royal Museum of Art and History of Brussels,[21] the hole was bored from both sides, but the tool was broken when the drilling was nearly finished. This seems to happen often in the Jamdat Nasr period. The tools probably broke because the instruments were misused or were not strong enough (FIG. 9).[22]

Before a seal could be sold, it had to be polished, so that all unnecessary marks were wiped off. Today in Cambay, a modern commercial abrasive wheel is powered by an electric motor (Possehl 1981: 43, FIG. 7): the beads are turned continuously until the surface is smoothed and polished to the desired degree. Coarse abrasives are used at first, finer ones are used later. Thus tool marks are erased and the seals are beautifully brilliant. The carefully polished seals and beads from 'Ammān, Jericho, or Jarash(?) (Bienkowski 1991: 134, FIG. 150) were probably made in the same way, although in antiquity, seals were polished by hand. This was al-




6. Cylinder seal, Royal Museums of Art and History, Brussels, no. 0.1437.

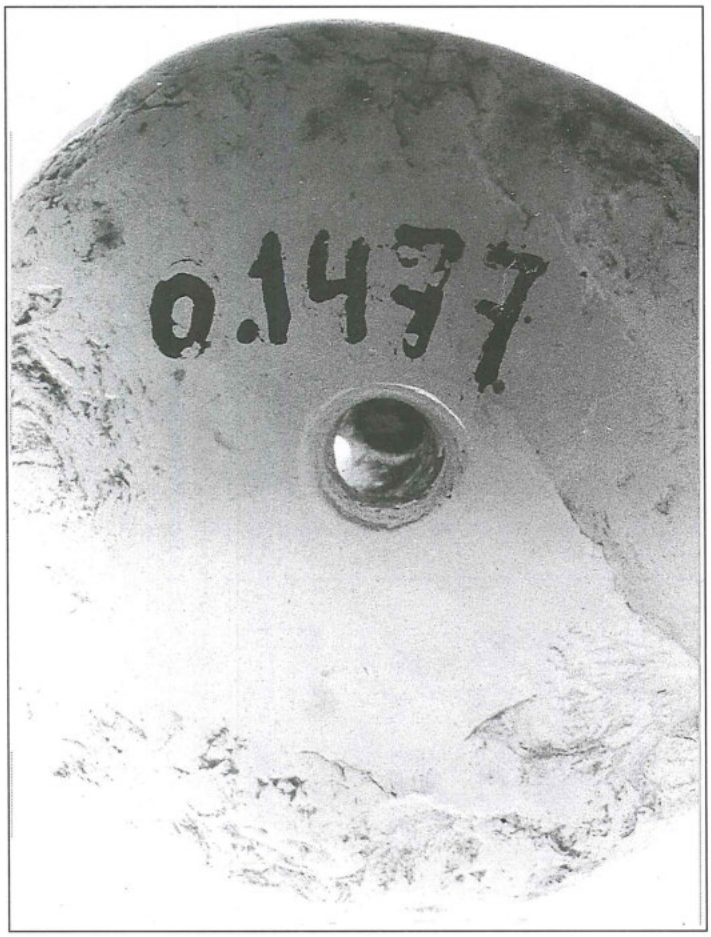


7. Seal cutter on Egyptian relief, Sakkara, fifth dynasty (Gorelick and Gwinnett 1981).

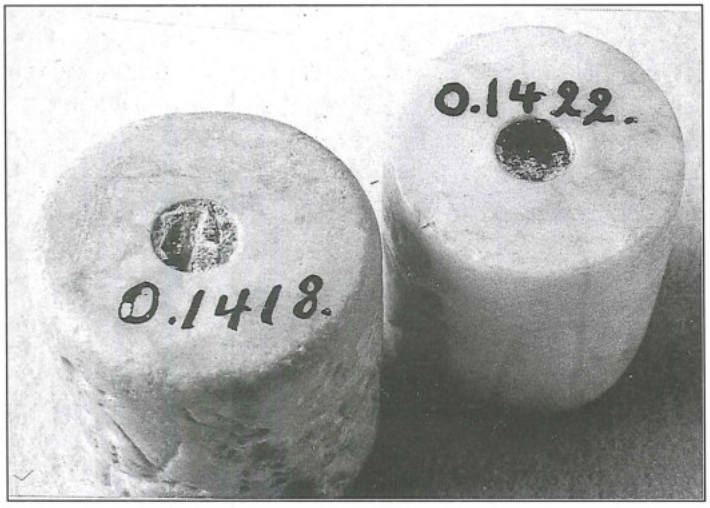
[20] Marble cylinder seal, Jamdat Nasr period, Royal Museums of Art and History, Brussels, no. 0.1437. Speleers 1943: 33.

[21] Marble cylinder seal, Jamdat Nasr period, Royal Museums of Art and History, Brussels, no. 0.1477. Speleers 1943: 21.

[22] Marble cylinder seal, Jamdat Nasr period; Royal Museums of Art and History, Brussels, nos. 0.1418, 0.1422. Speleers 1943: 43, 52.




8. Cylinder seal of the Royal Museums of Art and History, Brussels, no. 0.1477.




9. Cylinder seals of the Royal Museums of Art and History, Brussels, nos. 0.1418, 0.1422.

ways the case: in Cambay, some years ago, before the bead industry became mechanized, Possehl (1981: 46) observed that the "beads and slurry were swan into a skin bag and was 'rolled' across a floor between two men". The result was nearly the same as using a machine. Progressively finer abrasives must have been used to give the seal a smooth finishing touch, producing finer and finer grooves (Gwinnett and Gorelick 1991: 189).

Seals could be personalized by inscriptions, such as the beautiful agate with metal ring belonging to "Palti, son of Maish, the herald",[23] or the one attested by the clay bullae of "Qaus-Gabr, king of Edom" (Millard 1991: 143).

After these different steps, it was still possible to embellish the seal with bronze, silver, or gold metal caps. The decoration depends on the period, the wealth of the purchaser, and the craftsmen. The octagonal, white, chalcedony stamp seal, found in the tomb of al-Muqābilayn by Harding (1950: 46, no. 33 PLS. 13.2, 15.9), is mounted on a bronze swivel, which is part of a fibula. It matches a fashion of this period in western Asia and should be of Mediterranean origin (Yassine 1984: 99). In any case, this jewelry must have been precious enough to be buried in the tomb.

**Conclusions**

The numerous Near Eastern stamp and cylinder seals are usually studied from the iconographic, historical, or geographical points of view. Not much is known about ancient craftsmen: the Sumerian and Akkadian names for their function are mentioned in the Mesopotamian texts but little else. For Jordan their workshops or methods are not yet known. The study of the techniques used for seal manufacturing in different countries of the Near East gives important information about their work processes. Stamp and cylinder seals appear in the Early Bronze Age in Jordan; they were first impressed or rolled on pottery, in contrast with Mesopotamian tradition. Soft materials (stone, clay, bone, wood) were used in the beginning, replaced by harder stones when copper and iron implements were in use. The shapes and the designs depend on the tools used by the lapidary; the marks on the unpolished surfaces are also good indicators for the study of manufacturing.

The first tools seem to have been made of microburin or flint engravers and wooden drills; later, copper (end of the fourth millennium BC) and iron (first millennium BC) chisels and engravers were used. The hand drill developed into a bow drill (which was first held vertically and afterwards transformed into a horizontal bow lathe). The abrasives used at the time could have been beach sand, crushed stones, and other crushed hard materials, mixed with water and oil. To choose their design, the seal cutters looked at models or sketches.

The normal manufacturing of a seal followed the

[23] Agate seal with metal ring from Umm Udhayna tomb, Jordan Archaeological Museum. Millard 1991: 141, FIG. 162.

above mentioned process: hardness, colour, magic, and sometimes medical properties were taken in consideration when choosing the raw material to make a seal. The different steps in faceting and cutting a seal, in engraving the design, and polishing or embellishing it, can be reconstructed thanks to comparisons with the lapidary industry in modern India.

The technical development also depends upon the material used (hard or soft stones, bone, ivory, clay, etc.), their origin (local or foreign) and the tools (engraver, chisel, drill, etc.). The historical events (political expansion of each region) and international trade also left their influence. Looking at the modern analysis of the tool marks by Scanning Electron Microscope and making comparisons with the contemporary beadmakers of Cambay, it is possible to evoke the everyday life of the sealcutters in ancient Jordan.

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# Recherches sur les ateliers sigillaires jordaniens au Fer II

Aucun atelier sigillaire jordanien du Fer II (c. IX-VIe s. av. n. è.) n'ayant été identifié au cours de fouilles archéologiques, la recherche dans ce domaine doit utiliser une approche indirecte: la mise en série de la production sigillaire locale de cette époque. Une telle recherche se heurte à trois difficultés principales:

1 - Beaucoup de sceaux sont apparus sur le marché des antiquités, le plus souvent sans indication d'origine.

2 - Même si l'origine des sceaux est connue et vérifiée, leur lieu de découverte et leur contexte archéologique ne correspondent pas nécessairement à leur lieu ni même à leur région de production. Comme leurs propriétaires, les sceaux antiques pouvaient "voyager".

3 - Le sceau antique lui-même pouvait avoir été réalisé dans plusieurs ateliers. En effet, on peut schématiquement distinguer:

   a - le choix du matériau, précieux ou semi-précieux (or, argent, lapis- lazuli, ivoire, quartz, hématite, calcédoine...), ou encore bon marché (calcaire local, os...);

   b - la mise en forme de ce matériau sous forme d'un cylindre (surtout en Mésopotamie), d'un scarabée (surtout en Egypte et Phénicie), d'un scaraboïde (surtout en Syrie-Palestine) ou d'un conoïde... ayant telle ou telle dimension;

   c - la gravure de l'iconographie avec le choix de certains motifs représentés suivant un certain style et une certaine disposition;

   d - éventuellement la gravure d'une légende indiquant le plus souvent le nom du propriétaire, précisé ou non par son patronyme et/ou sa fonction.

Lorsqu'il s'agissait de sceaux en matériaux communs (pierre locale, os), toutes ces étapes étaient souvent réalisées dans le même atelier; c'était moins fréquent pour les sceaux en matières nobles parfois d'origine lointaine: il y avait un commerce des matériaux à l'état brut (en particulier, pierres précieuses ou semi-précieuses) ou déjà mis en forme (cylindres, scarabées, scaraboïdes, conoïdes "nus"), ainsi que de sceaux gravés avec une certaine iconographie, la légende, dont la place pouvait être réservée ou non, ne pouvant être gravée que sur place, au moment de l'achat du sceau par son propriétaire. Ainsi, à côté d'ateliers locaux, à l'iconographie parfois assez fruste et s'occupant surtout de graver le nom du propriétaire, il pouvait y avoir des ateliers régionaux diffusant dans tout un pays, et parfois au-delà, et des ateliers ayant une production si abondante qu'elle donnait lieu à un véritable commerce international: conoïdes dits "néo-babyloniens", scarabées de jaspe vert de Tharros[1].

A ces trois difficultés, s'ajoute le fait que la publication des sceaux trouvés dans les fouilles régulières laisse parfois à désirer[2].

Cependant, depuis une quarantaine d'années, des progrès considérables ont été accomplis dans l'identification paléographique des sceaux inscrits ammonites, moabites et édomites pour lesquels nous disposons maintenant d'instruments de travail sérieux, même s'ils sont à corriger et à compléter. Grâce à eux, il est possible de mettre en série ces sceaux suivant leur forme, leur matière, leur disposition du champ, leurs motifs iconographiques, leur paléographie et le contenu de leurs légendes afin d'essayer d'en préciser l'atelier de production. C'est dans cet esprit que nous voudrions étudier plusieurs séries ammonites et moabites et évoquer les problèmes de la sigillographie édomite.

## I - SCEAUX AMMONITES À ICONOGRAPHIE MÉDIANE ENTRE DEUX REGISTRES HORIZONTAUX INSCRITS

Pour le domaine ammonite, on dispose maintenant du *Corpus of Ammonite Inscriptions* de W. E. Aufrecht[3] qui

[1] Cf. surtout S. Moscati, *Le officine di Tharros*, Rome, 1987.

[2] La matière et les dimensions des sceaux ne sont pas toujours indiquées et les illustrations sont parfois difficiles à utiliser.

[3] Lewiston, 1989 (*infra*: Aufrecht). Pour une évocation rapide de l'iconographie des sceaux ammonites inscrits, cf. aussi P. Bordreuil - A. Lemaire, 'Nouveaux sceaux hébreux, araméens et ammonites', *Semitica* 29 (1979), pp. 71-84, spéc. 79-84; Aufrecht, pp. 351-352; F. Israel, 'Note Ammonite III', dans Cl. Baurain *et alii* éd., *Phoinikeia grammata*, Namur, 1991, pp. 215-241, spéc. 222-223

comporte déjà près d'une trentaine de sceaux dont le champ est divisé en trois registres horizontaux, le registre central étant essentiellement[4] occupé par un ou plusieurs motifs iconographiques et les registres inférieur et supérieur réservés pour l'inscription. Cette disposition mérite d'autant plus d'être soulignée qu'elle semble pratiquement absente du reste de la sigillographie ouest-sémitique[5]. Suivant le motif principal du registre médian, on proposera de distinguer:

**- Série 1: sceaux avec scarabée volant aux quatre ailes éployées**

Cette série[6] comporte au moins cinq sceaux inscrits: *lmnḥm b//n ynḥm* (Aufrecht 42; FIG. 1), *lš wḥr//hnss.* (Aufrecht 68; FIG. 4), *lmlkm'wr//'b//d b'lyš'* (Aufrecht 129), (.....)*//bn//'l ḥnn* (Aufrecht 141; FIG. 2)[7], *ltmk'//bn//'l'zr* (FIG. 3)[8]. Les trois premiers sceaux comportent aussi, de part d'autre du scarabée, un sceptre ou enseigne à tête "papyriforme"[9] ou "astrale"[10](boule surmontée d'un croissant aux pointes tournées vers le bas). Les premier, quatrième et cinquième sceaux présentent les lettres *b* et *n* de part d'autre du scarabée, position occupée par ' et *b* dans le troisième. Les dimensions assez similaires des quatre sceaux de cette série[11] et surtout leur matériau commun, un calcaire rouge brun avec éventuellement des taches noires, vraisemblablement un calcaire local de Transjordanie[12], confirment que cette série est l'oeuvre d'ateliers locaux. Comme deux de ces sceaux (n° 68 et 129) indiquent de hautes fonctions dans l'administration royale et qu'un autre provient probablement de la tombe d'"Adoninur serviteur/ministre d'Amminadab" (n° 42) près de la citadelle de 'Ammān, on pensera à un atelier de la capitale ammonite vers la fin de l'époque royale (fin VIIe et surtout début du VIe s.)[13].

Les scarabées ailés des sceaux n° 42,129,141 et du sceau *ltmk'* ont tout à fait le même style et sont probablement l'oeuvre d'un même graveur, tandis que celui du n°68 comporte quelques maladresses (asymétrie et absence du croissant renversé sur le sceptre de droite) trahissant probablement une autre main (apprenti ou atelier différent reprenant à sa manière ce motif).

On rapprochera de cette série un scaraboïde en hématite[14], d'environ 15 mm de longueur, trouvé à Byblos. Sa face gravée plate comporte dans le registre médian "un scarabée aux ailes éployées" flanqué, de part et d'autre, d'un oiseau dressé (faucon?) tourné vers l'extérieur. Les registres supérieur et inférieur, séparés du registre médian par un double trait horizontal, portent une légende que M. Dunand qualifait de "phénicienne fruste" et lisait *l'ldš' bt šlmt*[15]. Cependant,

- d'après le fac-similé de la légende, la tête de la quatrième lettre (*d* ou *r* ?) paraît ouverte, caractéristique absente de la paléographie phénicienne mais bien attestée dans la paléographie ammonite de la fin du VIIe ou du début du VIe s. av. n. è.;
- le champ est disposé en trois registres horizontaux, le registre médian étant illustré et les registres supérieur et inférieur inscrits, disposition inconnue en sigillographie phénicienne mais fréquente en sigillographie ammonite;
- la représentation des deux oiseaux dressés de part d'autre d'un motif central semble peu phénicienne mais bien attestée en ammonite (*infra*: série 2);
- les noms *'ld/rš' et šlmt* sont aussi rares en phénicien qu'en ammonite; cependant le théonyme *'l* du premier est fréquent en ammonite.

Sous réserve de vérification de l'original, on rattachera donc ce sceau à la sigillographie ammonite, plus précisément à la série 1. On pourrait même proposer de le situer vers le début de la série (deuxième moitié du VIIe s.) car les deux oiseaux dressés paraissent faire le lien avec la série 2.

**- Série 2: sceau avec tête cornue de face**

Cette série[16] comporte au moins sept scaraboïdes: *l'ḥnn* Aufrecht 19; FIG. 6), *l'š'* (Aufrecht, p. 345, n° 78 a; FIG. 7), *l'lyš' bn prpr*[17] (Aufrecht 79; FIG. 8), *lplṭ* (Aufrecht 87; FIG. 9), *l(mt?)n'l bn 'wr'* (Aufrecht 106; FIG. 10),

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4 L'inscription déborde parfois le cadre des registres inférieur et supérieur, le registre médian comportant assez souvent une ou deux lettres, éventuellement *b* et *n*, disposées à droite et à gauche du motif principal: cf. Aufrecht 3, 5, 23, 85, 129, 131, 132, 133, 141, ainsi que le sceau *ltmk'* (infra).

5 Hormis le problème posé par la sigillographie édomite (infra).

6 Pour une présentation préliminaire de cette série, connue alors à 3 exemplaires, cf. R. W. Younker, 'Israel, Judah and the Motifs on the Baalis Seal from Tell el-'Umeiri', *BA* 48 (1985), pp. 173-175. Le scarabée volant aux quatre ailes éployées apparaît aussi, dans une disposition générale différente, sur Aufrecht 32, 122.

7 Cf. aussi N. Avigad, 'Another Group of West-Semitic Seals from the Hecht Collection', *Michmanim* 4 (1989), pp. 7-21, spéc. 14, n° 13·

8 Cf. provisoirement B. Zuckerman, *Puzzling Out the Past, Making Sense of Ancient Traditions from Biblical Times,* 1987, pp. 28-30.

9 Cf. P. Bordreuil, Syria 62 (1985), p. 24; N. Avigad, *Michmanim* 4 (1989), p. 14.

10 Cf. R. W. Younker, BA 48 (1985), pp. 177-178; E. Gubel, 'Notes sur l'iconographie royale sigillaire', dans *Atti del II Congresso Internazionale di Studi Fenici e Punici III*, Rome, 1991, pp. 913-922, spéc. 917.

11 N° 42: 18x15,6x9 mm; 68: 16x14x8 mm; 141: 16x14x7 mm; *ltmk'*: c. 14x12x6 mm, tandis que la bulle nÚÚ 129 suppose un sceau de c. 19 mm de diamètre.

12 Cf., pour le n°141, N. Avigad, *Michmanim* 4 (1989), p. 14.

13 Cf. A. Lemaire, *Syria* 63 (1986), p. 321.

14 Aufrecht 23 est aussi en hématite.

15 M. Dunand, *Fouilles de Byblos I (1926-1932)*, Paris, 1939, p. 48, n° 1291 PL. CXXVII; cf. aussi E. Gubel, dans *Atti del II Congresso...*, 1991, p. 920: ce sceau (FIG. 5) est réputé disparu (*ibidem*, n. 30).

16 Pour sa mise en évidence, cf. P. Bordreuil - A. Lemaire, *Semitica* 24 (1974), pp. 27-34, le sceau *l'š'* devant maintenant être rattaché au domaine ammonite (cf. F. Israel, 'Les sceaux ammonites', *Syria* 64 (1987) pp. 141-146, spéc. 142).

17 Pour cette lecture, cf. N. Avigad, *Hebrew Bullae from the Time of Jeremiah*, Jérusalem, 1986, p. 92.




1.

*'bgdhwzḥṭy* (Aufrecht 114; FIG. 11) et un sceau anépigraphe de l'ex-collection Clark[18]. Sauf le n°79 où les cornes vers le haut révèlent un bucéphale, les autres têtes de face avec les cornes descendant et s'enroulant peuvent évoquer des béliers. Sauf le n°19, la tête est généralement flanquée, de part et d'autre, d'un oiseau dressé[19] généralement (sauf le n°14) tourné vers l'extérieur. Les registres supérieur et inférieur sont généralement inscrits, cependant la courte légende sans patronyme des n°78 a et 87 n'occupe que le registre supérieur: le registre inférieur a alors été rempli par un gros point (astre?) à l'intérieur d'un croissant couché, éventuellement flanqué de part et d'autre d'un gros point (n° 87). Ce motif occupe aussi le registre supérieur du sceau anépigraphe dont le registre inférieur a été rempli par un zigzag (ou ligne de vagues). Ainsi, si l'acheteur ne désirait pas graver son nom ou son patronyme, la place réservée pour la légende pouvait-elle être occupée par des motifs de remplissage; c'est sans doute la fonction du début d'abécédaire du n° 144, permettant peut-être aussi à un apprenti graveur de s'entraîner à graver les lettres à l'envers.

Hormis le n°19 (*infra*), cette série présente une iconographie homogène vraisemblablement gravée dans le même atelier. Le sceau n° 87, le cachet anépigraphe (tous deux apparemment en quartz fumé) et le sceau n° 78 a comportent les mêmes motifs de remplissage et pourraient avoir été l'oeuvre d'un même graveur situé approximativement, d'après la paléographie, vers le milieu du VIIe s., avant la série 1. Le n° 106 provient de Dayr 'Allā tandis que le n° 144 et le sceau anépigraphe sont réputés provenir de Turquie et de Samarie[20]; la localisation de cet atelier reste donc incertaine; cependant, si notre interprétation du sceau de Byblos est justifiée, il pourrait former le lien, dans le même atelier de la capitale ammonite, entre la série 1 et la série 2 comportant aussi bien des scaraboïdes de calcaire (n° 78 a, 106, 114) que de quartz laiteux ou fumé (n° 7 9,87, anépigraphe).

Le sceau n°19 se différencie des sceaux précédents par sa matière (cornaline), ses traits de séparation non doublés et une sorte de sceptre se divisant en trois à son sommet flanquant de part et d'autre la tête cornue; on retrouve un motif similaire sur les sceaux n°2, 24, 28, 30, 99 et 140. Sur les n° 30 et 140, il s'agit d'un sceptre terminé par une sorte de grenade ou de fleur de lotus schématique; sur les n° 30 (série 3: infra) et 99, ce motif est situé de part et d'autre d'un quadrupède. Comme pour le n° 68 de la série 1, le n° 19 pourrait être l'oeuvre d'un apprenti ou d'un atelier différent.

On notera que la tête cornue avec les cornes descendant en "S" apparaît aussi, dans une disposition différente, au dos du sceau *l'l'mṣ bn tmk'l* de Tall al-'Umayrī[21]. Par ailleurs, le bucrane entre deux oiseaux tournés vers l'extérieur apparaît sur deux cachets anépigraphes d'une collection privée (au registre supérieur principal, pour l'un: n°13, et sur les registres supérieur et inférieur, pour l'autre: n° 14).

**- Série 3: sceaux avec antilopidé[22] galopant**

Cette série comporte cinq sceaux: *ltmk'(?)*[23]*//bn// mqnmlk* (Aufrecht 3; FIG. 15), *lṣnr. //bn//'l'mṣ* (Aufrecht 5; FIG. 16), *lš'l b//n 'lyš'* (Aufrecht 30; FIG. 17), *l'y'/bn/tmk'l* (Aufrecht 132; FIG. 18), *lyn/ḥm.* [24]. Les quatre premiers sceaux sont des scaraboïdes en pierre semi-précieuse: agate (3, 30), quartzite (5) et serpentine (132). Dans trois d'entre eux, les lettres *b* et *n* encadrent l'animal (3, 5, 132), fonction prise par une sorte de sceptre dans le n° 30. Même si, sur le n°132, la séparation des registres n'est marquée que par un simple trait horizontal et si l'allure générale de l'animal est un peu plus fine, ces quatre sceaux sont probablement à rattacher à un même atelier à situer, d'après la paléographie, dans la première moitié ou vers le milieu du VIIe s. L'origine précise de ces sceaux reste incertaine, cependant l'emploi de pierres semi-précieuses fait d'abord penser à un atelier de la capitale ammonite[25].

On retrouve l'antilopidé galopant dans le registre supérieur principal des sceaux n°11, 91 et 92.

**- Série 4: sceaux avec antilopidé marchant**

Cette série ne comporte actuellement que deux exemplaires: *ltmk'l br mlkm*[26] (Aufrecht 1; FIG. 19), *lzk' br mlkm'z* (Aufrecht 136; FIG. 20). Le style schématique de l'animal marchant distingue cette série de la précédente. L'emploi de br ("fils" en araméen) et la pa-

18 Autrefois Y.M.C.A. de Jérusalem, n° 103 (FIG. 12).

19 Cet oiseau dressé (faucon?) apparaît aussi, souvent seul, sur les sceaux n° 7 (?), 8b(?), 14, 46, 60, 72, 112, 134, 143, ainsi que sur deux sceaux publiés récemment (N. Avigad, *Michmanim* 4 (1989), p. 13, n° 11.12). Cf. aussi L. Y. Rahmani, 'Two Syrian Seals', *IEJ* 14 (1964), pp. 180-184.

20 *Semitica* 24 (1974), pp. 27-28.

21 Cf. R. W. Younker *et alii*, 'The Joint Madaba Project...', *AUSS* 28 (1990), pp. 5-22, spéc. 25,52, PL. 25; L. G. Herr *et alii*, 'Madaba Plains Project...', *ADAJ* 35 (1991), pp. 155-179, spéc. 158.

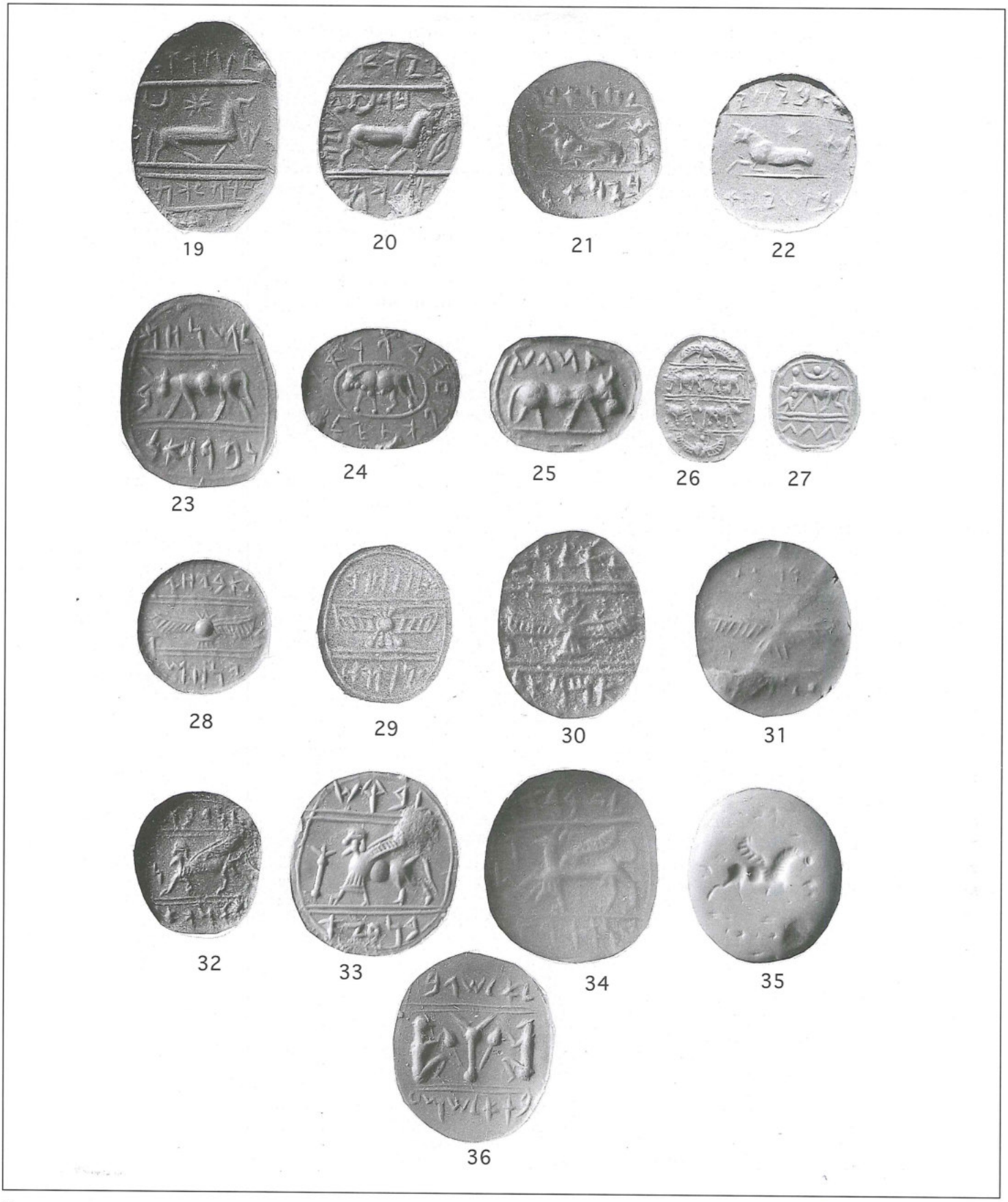
22 P. Bordreuil (*Catalogue des sceaux ouest-sémitiques inscrits de la Bibliothèque Nationale, du Musée du Louvre et du Musée biblique de Bible et Terre Sainte*, Paris, 1986 [*infra*: Bordreuil], pp. 65-66) a vu dans cet animal une gazelle, Aufrecht un cheval (p. 131; cf. aussi F. Israel dans *Phoinikeia grammata*, 1991, p. 222) ou un taureau (p. 350) et E. Puech un bovin [*RB* 96 (1989), p. 590]. L'allure générale et la forme des cornes rendent invraisemblable l'identification avec un cheval; il s'agit plutôt d'un antilopidé.

23 Malgré Bordreuil 73 et Aufrecht 3, il n'y a probablement pas la place de restituer un *l* dans la lacune de la fin de la ligne qui se terminait vraisemblablement par le ' , peut-être suivi d'un petit trait vertical de séparation (cf. Aufrecht 74).

24 *Cf. Antike Münzen..., Auktion* XXIV, *Sternberg, 19-20 nov. 1990*, Zürich, p. 71, n° 443 ·La mauvaise qualité de la reproduction fait hésiter entre un bovidé et un antilopidé et le rattachement à cette série de ce conoïde aplati (?) à simples traits de séparation reste incertain.

25 La présence de lapis-lazuli, quartz et, peut-être, améthyste semble attestée "autour de 700 av. J.-C." par les fouilles de la Citadelle: cf. J.-B. Humbert - F. Zayadine, 'Trois campagnes de fouilles à Ammân (1988-1991). Troisième terrasse de la Citadelle', *RB* 99 (1992), pp. 214-260, spéc.pp. 256, 258.

26 Pour cette lecture, cf. A. Lemaire, 'Les transformations politiques et culturelles de la Transjordanie au VIe s. av. J.-C.', *Transeuphratène* 7 (1994).




2.

léographie incitent à rattacher ces deux conoïdes à un même atelier et probablement à un même graveur ammonite vers le milieu du VIe s. (époque néo-babylonienne).

**- Série 5: sceaux avec un bovidé marchant**

Cette série ne comporte actuellement qu'un seul sceau[27]: *lmnḥm//b//n brk'l* (Aufrecht 133; FIG. 23). Cependant, dans une autre disposition, le bovidé (buffle?) marchant apparaît aussi sur le sceau "A Beyadél serviteur/ministre de Padiél" (Aufrecht 13; FIG. 24) à situer sous le roi ammonite *Pudu-il* des textes assyriens (c. 701-677). On proposera donc de rattacher le sceau n° 133, lui aussi en agate blanche/grise, à un atelier de la capitale ammonite c. 700 ou dans le premier tiers du VIIe s.

Le bovidé marchant se retrouve aussi, répété dans les registres inférieur et supérieur, sur un scaraboïde anépigraphe de Tall al-Mazār[28] et, dans des dispositions différentes, sur deux sceaux anépigraphes d'une collection privée (FIG. 26, 27). Bien que d'origine incertaine, l'iconographie de ces deux derniers sceaux semble les rattacher à la sigillographie ammonite.

**- Série 6: sceaux avec un quadrupède couché**

Deux sceaux se rattachent à cette série: *lḥn' bn/byd'l* (Aufrecht 99: bélier couché; FIG. 21), *l'byḥy/bt 'zy'* (Aufrecht 126: taureau ou antilopidé couché; FIG. 22). Sur le premier sceau, le bélier est flanqué, de part d'autre, par un sceptre se terminant en fleur de lotus ou grenade et situé sous un croissant couché. Sur le second, le taureau ou l'antilopidé est situé sous un astre et devant une fleur de lotus[29]. D'après la paléographie, ces deux sceaux semblent dater de la fin de l'époque royale ammonite (c. 600 ou début du VIe s.), cependant les animaux et leur style sont différents et leur rattachement à un même atelier reste assez incertain.

**- Série 7: sceaux avec un disque solaire ailé**

Ce motif apparaît sur quatre sceaux: *l'byḥy//bt//ynḥm* (Aufrecht 23; FIG. 28), *lmnḥm b//n mgr'l* (Aufrecht 89; FIG. 29)[30], *l'ln b//n//'mr'l* (Aufrecht 118; FIG. 30)[31], *lrm'l//bn//'l..*(FIG. 31)[32]. Chacun de ces soleils ailés a un style différent, cependant ils comportent certaines particularités communes[33], en particulier l'empennage strié. Le rattachement à un même atelier de cette série au style assez varié reste incertain même si la paléographie semble les situer au VIIe s. ou vers 600 (n° 188 ?).

**- Série 8: sceau avec un quadrupède ailé passant**

Ce motif apparaît sur quatre sceaux: *lndb'l//bn//tmk'* (Aufrecht 85; FIG. 32), *l'bd'd/r bn 'wr'l*[34] (Aufrecht 131; FIG. 34), *lbqš//bn 'z'* (Aufrecht 140; FIG. 33), *lmnḥm (b)/n 'l'* (FIG. 35)[35]. D'après leur paléographie, les trois premiers sceaux sont à dater du VIIe s., peut-être plus précisément de sa première moitié; cependant leur style est assez différent[36]. Leur rattachement à un même atelier paraît assez vraisemblable pour les n° 85 et 140 (kérub) mais incertain pour les deux autres. Le quadrupède ailé à crinière (cheval ou lion ?) du dernier sceau peut être rapproché d'un animal similaire sur un conoïde de la "tombe d'Adoninur"[37].

**- Série 9: sceaux avec deux singes accroupis de part et d'autre d'une plante stylisée**

Jusqu'à maintenant, ce motif n'est apparu que sur un sceau: *l'lšgb/bt 'lsm'* (Aufrecht 9; FIG. 36). Malgré le caractère assez schématique de la représentation, l'identification des deux figures accroupies comme des singes paraît assez claire à cause de leur museau[38]. D'après la paléographie, ce scaraboïde de jaspe rouge avec des veines noires peut être rattaché à un atelier ammonite du VIIe s.

**- Série 10: sceaux avec deux sphinx assis de part et d'autre d'une plante stylisée**

Ce motif n'est attesté, jusqu'à maintenant, que sur le scaraboïde *lmlkmgd* (Aufrecht 127) daté approximativement vers le milieu du VIe s. (époque néo-babylonienne). Bien que le registre inférieur prévu pour le patronyme n'ait pas été inscrit, ce sceau appartient bien à la même catégorie que les sceaux ci-dessus: registre médian avec iconographie entre deux registres pré-

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27 Le bovidé marchant apparaît aussi comme le motif principal du sceau Bordreuil 107 (FIG. 25) classé comme araméen avec la lecture *tngy*. Cette lecture et cette classification paraissent très incertaines (cf. J. Naveh, JSS 33 (1988), p. 115). Il semble plutôt s'agir d'une pseudo-inscription servant de motif de remplissage tandis que le style du bovidé, proche de celui d'Aufrecht13, 133 et le matériau utilisé (calcaire brun) font penser à un sceau provenant d'un atelier ammonite.

28 Cf. Kh. Yassine, *Archaeology of Jordan: Essays and Reports*, Amman, 1988, p. 154.

29 La fleur de lotus, connue aussi en sigillographie hébraïque (cf. N. Avigad, 'Two Seals of Women and Other Seals', dans *Y. Yadin Memorial Volume*, EI 20, 1989, pp. 90-96, spéc. n°13.14), apparaît comme motif complémentaire sur le sceau n° 38 et comme motif principal sur un sceau ammonite à trois registres horizontaux encore inédit (future série 11).

30 Les doutes de U. Hübner (*UF* 21, 1989, pp. 223-224) sur l'authenticité de ce sceau ne nous semblent pas fondés.

31 Ce sceau est réputé provenir de 'Amman, cf. *The Barakat Gallery, A Catalogue of the Collection* I, Beverly Hills, 1985, p. 187.

32 Cf. A. Lemaire, *Semitica* 40 (1991), pp. 44-46, n° 26·

33 Cf. D. Parayre, 'Les cachets ouest-sémitiques à travers l'image du disque solaire ailé (perspective iconographique)', *Syria* 67 (1990), pp. 269-301, spéc. 283.

34 Pour cette lecture, cf. A. Lemaire, 'Sept nouveaux sceaux nord-ouest sémitiques', *Semitica* 41-42 (1993), pp. 63-80, spéc. 66.

35 Cf. P. Bordreuil, dans *Ancient Art of the Mediterranean World and Ancient Coins, NAAG Public Auction, 11. April 1991*, Zurich, p. 17, n°26·

36 Cf. surtout le n° 131 où il s'agit plutôt d'un griffon (cf. le bec) que d'un sphinx (cf. n°85,140) avec une aile éployée en avant.

37 Cf. L. G. Harding, 'The Tomb of Adoninur in Amman', *PEFA* VI (1953), pp. 48-75, spéc. 53, n° 5, PL. VI,5.

38 Cf. aussi la présence probable d'une queue sur les sceaux n° 13 et 84.

vus pour la légende.

Ainsi, cette disposition qui, hormis l'édomite (*infra*), ne semble pas attestée ailleurs en sigillographie nord-ouest sémitique, joue un rôle de premier plan en sigillographie ammonite où elle est attestée depuis c. 700 jusque vers 550 av. n. è. L'étude des différentes séries semble montrer que la plupart de ces sceaux sont à rattacher à un (ou des) atelier(s) de la capitale. Ils révèlent une certaine succession chronologique dans le choix et le style des motifs principaux et on remarque que la séparation des registres, généralement marquée par un double trait horizontal, l'est parfois (n°19, 132), surtout au VIe s. (n°1,99,126, 127,136), par un simple trait.

## II - SCEAUX MOABITES INSCRITS AVEC SCENE CULTUELLE

Les sceaux inscrits moabites[39] sont moins nombreux que les ammonites. Leur iconographie se distingue par la fréquence de l'astre étoilé et du croissant placés côte à côte dans le même registre (registre supérieur: Israel VII, IX, XI, XIII, XIV, XXV, XXVIII, XXXIV; registre inférieur: XVIII, XXX), ainsi que par la représentation d'un griffon marchant sans couronne (Israel XVIII, XXIV) mais éventuellement avec aigrettes (Israel XXXII, Bordreuil 3). On y reconnaît aussi plusieurs représentations de scène cultuelle dans le registre supérieur principal, l'inscription occupant le, les ou l'un des registre(s) inférieur(s) plus petit(s). On peut distinguer:

### - Série 1: sceaux avec scène cultuelle comportant deux personnages debouts face à face, levant le(s) bras l'un vers l'autre

Cette série comporte une dizaine de scaraboïdes: *'mṣ hspr* (Israel V; FIG. 37), *l'zr'* (Israel XII; FIG. 38), *lḥkm** [40] (Israel XV; FIG. 39), *'ḥyḥy* (Israel XX; FIG. 40), *km(š. ?)* (Israel XXII; FIG. 41), *lyl'* (Israel XXXI; FIG. 42), *l'ḥ'*[41], *'mṣ*[42], *škr* (FIG. 43) [43], *l'yr* (Bordreuil 102; FIG. 44)[44]. On remarque un certain nombre de différences ou de variantes, soit dans les motifs accompagnant les deux personnages debouts face à face, soit dans le style de gravure, détaillée ou schématique, avec des traits fins ou plus épais et arrondis. On peut distinguer:

- *groupe a*: les sceaux *'mṣ hspr* et *lḥkm** avec soleil ou soleil ailé au sommet, sorte de pyrée surmonté d'un croissant couché (lié ou non au pyrée?) au milieu du champ et coiffures des personnages en forme de bonnets arrondis;
- *groupe b:* les sceaux *lyl'* et *km(š. ?)* avec un croissant couché au sommet et un pyrée central se terminant en forme de trait vertical (représentant la flamme?);
- *groupe c:* les sceaux *l'zr'* et *škr* avec gravure schématique et coiffure aplatie pour les personnages; le schématisme est encore plus poussé dans le deuxième que dans le premier: l'astre est ainsi devenu une simple croix (cf. Israel XIII, XXVIII);
- *groupe d:* les sceaux *'ḥyḥy, l'ḥ', 'mṣ* et *l'yr* avec style linéaire (gravure à la pointe?) et représentation d'un bras en arrière des personnages. Cependant chaque sceau de ce dernier groupe présente des traits originaux:
- les restes probables d'un buisson sacré, au milieu, et, au sommet, un soleil ailé schématique flanqué d'un astre étoilé et d'un croissant couché, pour le sceau *'ḥyḥy;*
- un astre étoilé, au milieu, et, près du sommet, un croissant couché, pour les sceaux *'mṣ* et *l'ḥ'* (figure asymétrique);
- un croissant couché souligné[45] entre les personnages, pour le sceau *l'yr.*

Les groupes **a, b** et **c** pourraient se rattacher à un même atelier, avec un style de plus en plus schématique, tandis que le groupe **d**, avec une technique de gravure différente, pourrait être à rattacher à un atelier différent. Le sceau *km(š.?)* a été trouvé à Sabasṭya/Samarie, le sceau *škr* est dit provenir d'as-Salṭ, le sceau *l'ḥ'* d'Ascalon (?) et le sceau *'ḥyḥy* de Karak. De manière conjecturale, on pourrait se demander si les groupes **a**, **b** et **c** ne se rattacheraient pas à un atelier du nord de Moab (Dhībān/Dibôn ?) et le groupe **d** à un atelier de Karak.

Cette iconographie d'une scène cultuelle, probablement d'inspiration mésopotamienne[46], peut être rapprochée de celle de trois autres sceaux où elle occupe tout le champ:

- le sceau inscrit *lmnḥmt//'š tpdmlk** (Israel XXVI, BM 136202)[47], avec sur l'autre face une scène d'adoration à deux personnages sous un soleil ailé (cf. Israel V) et personnifié (cf. Israel XXVII);
- un scaraboïde anépigraphe d'une tombe d'Abū Nṣayr

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39 Cf. F. Israel, 'Studi Moabiti I', dans G. Bernini - V. Brugnatelli éd., *Atti della 4a giornata di Studi Camito-Semitici e Indeuropei,* Milan, 1987, pp. 101-138 (*infra* : Israel); S. Timm, *Moab zwischen den Mächten*, ÄAT 17, Wiesbaden, 1989, spéc. pp. 159-264 (infra: Timm).

40 Ce sceau présente une iconographie moabite mais une légende édomite (d'où l'astérisque): cf. A. Lemaire, dans B. Sass - Ch. Uehlinger éd., *Studies in the Iconography of Northwest Semitic Seals*, OBO 125, Fribourg, 1993, p. 17, n. 16,17.

41 Cf. P. Bordreuil, *SHAJ III*, 1987, pp. 283-286, spéc. 284-285; Timm 27.

42 Cf. N. Avigad, *Michmanim* 4, 1989, p. 15, n° 17.

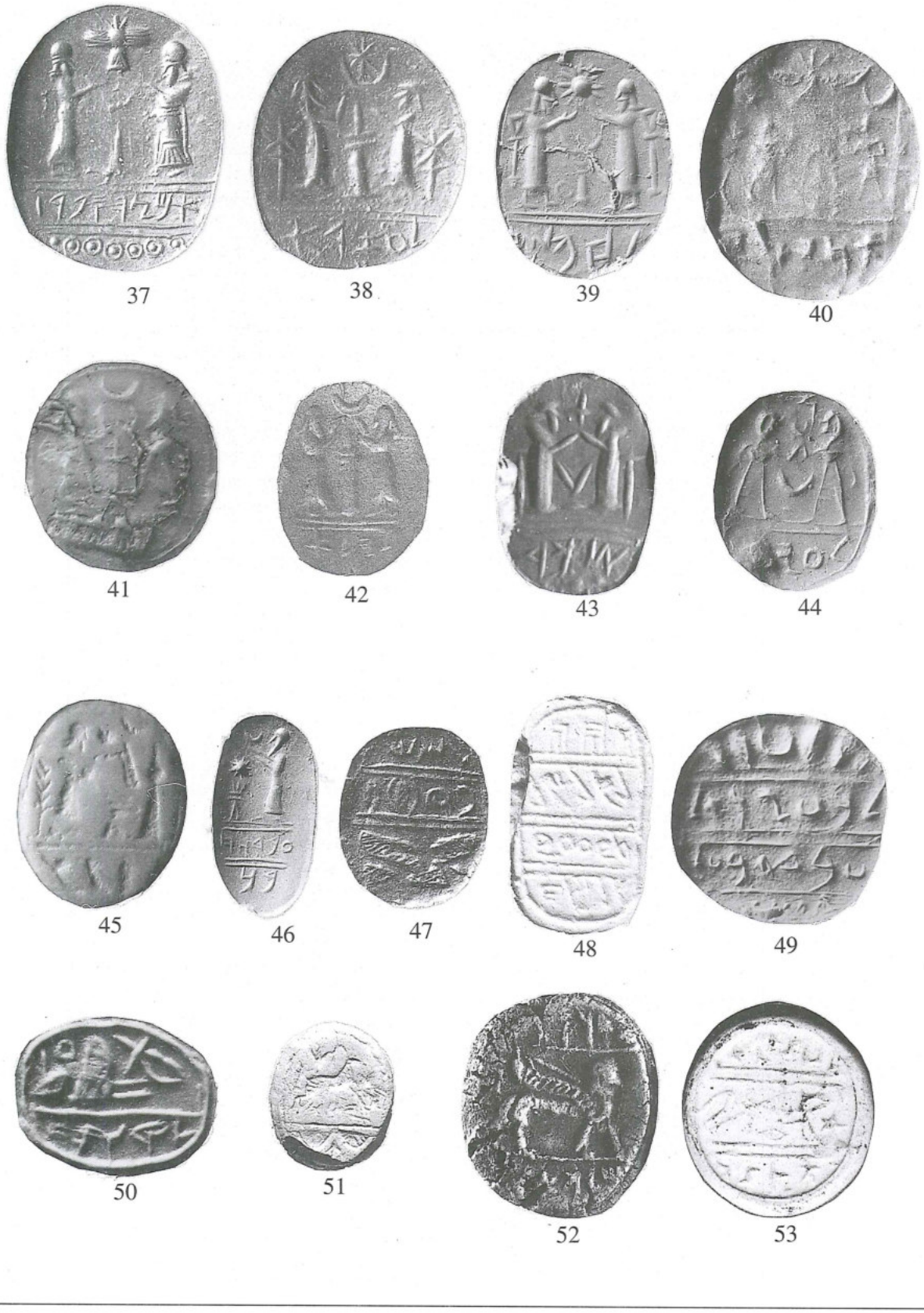
43 Cf. A. Lemaire, 'Cinq nouveaux sceaux inscrits ouest-sémitiques', *SEL* 7, 1990, pp. 97-109, spéc. 103-104, n° 3.

44 *Ibidem*, n. 34.

45 Le croissant couché souligné est aussi attesté dans Israel VII, IX.

46 Cf. T. Ornan - B. Sass, 'A Product of Cultural Interaction: The Seal of Nergal-Sallim', *Israel Museum Journal (IMJ)* 10 (1992), pp. 62-66.

47 La plupart des commentateurs lisent *gdmlk* (cf. Israel XXVI; Timm 39), mais la hampe descend vers la gauche et il s'agit plutôt d'un *p* que d'un *g*, d'où la lecture *pdmlk*, patronyme déjà attesté en Israel XIII. De plus, le *d* inversé de bas en haut est caractéristique de la paléographie édomite (cf. A. Lemaire, dans B. Sass - Ch. Uehlinger éd., *Studies in the Iconography...*, 1993, p. 16; O. Keel - Ch. Uehlinger, *Göttinnen, Götter und Gottessymbole*, Quest. disp. 134, Freiburg, Basel, Wien, 1992, p. 338) d'où l'astérisque marquant un sceau "mixte" (iconographie moabite et légende édomite: cf. *infra*).



37 38 39 40

41 42 43 44

45 46 47 48 49

50 51 52 53

3.

(c. 18 km au nord-ouest de 'Ammān) avec deux adorants face à face sous un astre étoilé et, peut-être, de part et d'autre d'un pyrée[48];
- un conoïde anépigraphe de Tall al-Mazār avec une scène d'adoration de type néo-babylonien (c. 700 av. n. è. ?), avec la bêche de Mardūk et le stylet de Nabou (remplacés dans les sceaux moabites par une sorte de pyrée); il est difficile de préciser si ce conoïde a été importé de Babylonie ou gravé en Transjordanie[49].

**- Série 2: sceaux avec scène cultuelle à un seul adorant de profil, les mains tournées vers le ciel, devant une sorte de pyrée, en présence d'un astre étoilé et du croissant couché**

Cette iconographie, encore absente d'Israel et de Timm, apparaît aujourd'hui sur deux scaraboïdes publiés récemment:
- *lm'š*[50] où le schématisme évoque le style du groupe **c** de la série 1;
- *kpr* (FIG. 45) [51] où la représentation comporte d'autres éléments (motif végétal, sorte de bannière...).

A ces deux sceaux, il faut ajouter un scaraboïde de pierre blanchâtre et brune (agate?) du British Museum (n° 48505 = Galling 124; FIG. 46) comportant un adorant tourné à gauche vers un croissant couché et un astre étoilé au-dessus d'un pyrée. Son style évoque celui du groupe **a** de la série 1, tandis que les deux traits horizontaux vers le milieu du pyrée se retrouvent sur les sceaux *lm'š* (*supra*) et *l'zr'* (Israel XII). Sa légende, lue généralement *'bdkḥ//bn* [52], est plutôt à lire *'bdwḥbn* [53]. L'iconographie et la paléographie (*ḥ* à deux barres et *b*) rattachent ce sceau à la sigillographie moabite[54] vers 700 av. n. è., plus précisément à la série 2 ci-dessus.

La proportion importante de sceaux moabites inscrits avec scène cultuelle à un ou deux adorants devant un pyrée pourrait signifier que le pyrée jouait un rôle significatif dans le culte moabite[55].

## III - SIGILLOGRAPHIE ÉDOMITE

La sigillographie édomite reste encore mal connue. F. Israel[56] avait d'abord proposé d'y rattacher dix sceaux inscrits, qu'il a ensuite ramenés à huit[57], chiffre auquel sont parvenus aussi L. G. Herr[58] et J. R. Bartlett[59]. Ce résultat ne tient pas compte du fait que le *d* inversé et probablement le *m* en zigzag sont caractéristiques de la paléographie édomite[60], ce qui conduit à classer comme édomites certains sceaux considérés, jusqu'ici, comme moabites: *lmš' 'd'l* (Israel VI), *lmš* (Israel X; FIG. 47), *lḥkm** (Israel XV; FIG. 39), *lmnḥmt//'št pdmlk** (Israel XXVI), *(l?)qws'm dw l'd/r'l* [61], auxquels on peut ajouter le conoïde araméo-édomite *ḥtm qws* [62].

Plusieurs sceaux édomites comportent des motifs gravés de façon assez grossière, servant parfois de motifs de remplissage. Ainsi:
- de simples hachures sur le sceau *ltw* de Buṣayrah[63],
- trois motifs rectangulaires dans le registre supérieur de la bulle de Buṣayrah *lmlklb' 'bd hmlk* (FIG. 48)[64],
- un croissant couché et des hachures dans le registre supérieur et un motif indistinct dans le registre inférieur du sceau *lb'zr'l//'bdhb'l* (FIG. 49)[65],
- une sorte de motif ailé asymétrique (disque solaire ailé ou oiseau??) sur le sceau *lmš* (Israel X),
- plusieurs motifs entremêlés, dont probablement une sorte de sphinx couché et un signe de vie en diagonale, sur le sceau *lqws'* d'Aroër (FIG. 50)[66],
- peut-être un croissant et un astre étoilé dans le registre supérieur et une sorte de soleil ailé très schématique[67] à trois rayons inférieurs en forme de "trépied"[68] dans le

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48 Cf. Kh. Abu Ghanimeh, 'Abu Nseir Excavations', *ADAJ* 28 (1984), pp. 305-310, spéc. 310, n° 44, PL. LXII,44.

49 Cf. Kh. Yassine, *Archaeology of Jordan*, 1988, pp. 149-150.

50 Cf. N. Avigad, *Michmanim* 4 (1989), p. 16, n° 18·

51 Cf. P. Bordreuil, dans *Ancient Art...*, 1991, p. 17, n° 25·

52 Cf. Galling 124; L. G. Herr, *The Scripts of Ancient Northwest Semitic Seals*, HSM 18, Missoula, 1978, pp. 20-24, n° 24·

53 Cf. la forme similaire du *w* araméen et ammonite à cette époque. Il faut peut-être comprendre *'bdw <bn> ḥbn*, *'bdw* et *ḥbn* étant déjà attestés en nabatéen (cf. J. Cantineau, *Le nabatéen II*, Paris, 1932, pp. 93, 125), en palmyrénien (cf. J. K. Stark, *Personal Names in Palmyrene Inscriptions*, Oxford, 1971, pp. 20,41,87) et en arabe pré-islamique (cf. L. Harding, *An Index and Concordance of Pre-Islamic Arabian Names and Inscriptions*, Toronto, 1971, pp. 174-175, 401).

54 Cf. T. Ornan - B. Sass, *IMJ* 10 (1992), p. 65, FIG. 4.

55 Cf. A. Lemaire, 'Essai sur les religions ammonite, moabite et édomite (X-VIe s. av. n. è.)', *Revue de la Société Ernest-Renan* NS 41, 1991-1992, pp. 41-67.

56 'Miscellanea idumea', *RivBibIt* 27, 1979, pp. 171-203.

57 'Supplementum idumeum I', *RivBibIt* 35, 1987, pp. 337-356.

58 *The Scripts...*, 1978, pp. 161-169.

59 *Edom and the Edomites*, JSOTSS 77, Sheffield, 1989, pp. 211-215.

60 Cf. A. Lemaire, dans B. Sass - Ch. Uehlinger éd., *Studies in the Iconography...*, 1993, p. 18.

61 *Ibidem*, n. 17. Ce sceau avait été publié comme moabite avec la lecture *( )s'm l'd'l* dans *Objects with Semitic Inscriptions 1100 B.C. - A.D. 700, Auktion XXIII, 20 nov. 1989, Sternberg*, Zurich, n° 24 ·

62 *Ibidem*, pp. 13-14, n° 13, avec la lecture *ḥtm qrs*.

63 Cf. E. Puech, 'Documents épigraphiques de Buseirah', *Levant* 9, 1977, pp. 11-20, spéc. 17-18, n° 856·

64 Cf. C. M. Bennett, 'Buseirah', *RB* 81, 1974, pp. 73-76, PL. IVb; id., 'Excavations at Buseirah, Southern Jordan, 1972: Preliminary Report', *Levant* 6, 1974, pp. 1-24, spéc. 18-19. L'interprétation de l'anthroponyme reste très discutée, cf. dernièrement S. C. Layton, 'A New Interpretation of an Edomite Seal Impression', *JNES* 50, 1991, pp. 37-43.

65 Cf. G. R. Driver, 'Seals from 'Amman and Petra', *QDAP* 11 (1944), pp. 81-82; pour la lecture, cf. A. Lemaire, *Transeuphratène* 7 (1994).

66 Cf. A. Biran - R. Cohen, 'Aroër (Negev)', *RB* 84 (1977), pp. 273-275, spéc. 274, PL. IXd.

67 Cf. aussi Aufrecht 138 (FIG. 51), dont la dernière lettre de la lecture provisoire *y'l* doit maintenant être corrigée d'après N. Avigad, *Michmanim* 4 (1989), p. 18, n 23, qui a déjà noté la similitude de ce sceau avec celui de *šm''l:* peut-être faut-il lire y'z et, à cause du motif du registre inférieur, y voir un sceau édomite? Il semble préférable d'attendre une autre attestation de l'ibex bondissant pour se prononcer.

68 Comparer ce motif à celui d'Israel IV, XIX, XX, et à celui d'un sceau proto-arabe de Yale : F. Bron, *Semitica* 29 (1979), p. 135; B. Sass, *Studia alphabetica*, OBO 102, Freiburg, 1991, p. 62, FIG. 37.

registre inférieur du sceau *šm''l* pouvant provenir de Buṣayrah[69].

Un motif principal plus développé apparaît sur quelques sceaux. Ainsi,

- le sceau de Tall Kheleifeh *lytm* [70] où la légende pourrait avoir été rajoutée à un sceau gravé antérieurement, peut-être hors d'Edom;
- les deux sceaux *lḥkm* et lmnḥmt//'št pdmlk** comportant une scène cultuelle à deux adorants, similaire à celle de la série moabite 1, groupe **a** (*supra*); la coexistence d'une iconographie moabite avec une légende édomite pourrait s'expliquer par le fait que ces deux sceaux ont été gravés en Moab avec leur iconographie et qu'ils ont été ensuite acquis par un atelier édomite qui a rajouté la légende au moment de l'achat par le propriétaire;
- la bulle *qwsg(br)//mlk 'd(m)* (FIG. 52)[71] et le sceau *(l?)qws'm...* (*supra*) comportent un registre central illustré entre les deux registres de la légende, disposition bien attestée en sigillographie ammonite (*supra*). Bien plus le motif central représente un sphinx ailé passant comme dans la série ammonite 8. Cependant la qualité de la gravure de ces deux sceaux est différente: la bulle royale présente un kérub sans couronne de style classique, proche de celui d'Aufrecht 85, probablement aussi du premier tiers du VIIe s. environ, tandis que la gravure du sceau *(l?)qws'm...* paraît approximative et irrégulière. Pour expliquer cette différence, on peut penser que le sceau royal a été produit avec son iconographie dans un atelier ammonite puis acheté et légendé en Edom, vraisemblablement dans sa capitale, Busayrah, tandis que le deuxième sceau serait un essai d'imitation locale édomite[72], de qualité médiocre, à partir d'un modèle ammonite[73].
- le sceau *lqwsgbr (mlk 'd?)m* [74] comporte un motif central de séparation des lignes très bien attesté en sigillographie judéenne du VIIe - début du VIe s.[75]. Il pourrait avoir été acheté illustré en Juda et légendé, ensuite, en Edom.

Si notre interprétation est justifiée, la sigillographie édomite semble être restée peu abondante et assez pauvre. Les ateliers édomites gravaient des sceaux assez grossiers ou essayaient d'imiter la glyptique des pays voisins, se contentant assez souvent de graver la légende sur des sceaux produits par les ateliers ammonites, moabites ou judéens. Souhaitons que de nouvelles découvertes viennent infirmer cette appréciation provisoire!

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69 Cf. G.L. Harding, 'Some Objects from Transjordan', *PEQ* 69 (1937), pp. 253-255, spéc. 255.

70 Cf. N. Avigad, 'The Jotham Seal from Elath', *BASOR* 163 (1961), pp. 18-22; L. G. Herr, *The Scripts...*, 1978, p. 163, n°2·

71 Cf. C. M. Bennett, 'Fouilles d'Umm el-Biyara. Rapport préliminaire', *RB* 73 (1966), pp. 372-493, spéc. 399-401, PL. XXIIa.

72 Cf. la ressemblance des motifs rectangulaires de part et d'autre du sphinx avec ceux du registre supérieur de la bulle de Buṣayrah *lmlklb' 'bd hmlk.*

73 On peut se demander si Aufrecht 52 (FIG. 53) n'est pas aussi une imitation édomite médiocre d'un modèle ammonite, plutôt qu'un faux comme le pense U. Hübner, *UF* 21 (1989), pp. 224-225.

74 Cf. L. Jakob-Rost, *Die Stempelsiegel im Vorderasiatischen Museum*, Berlin, 1975, p. 44 n° 186·

75 Cf., par ex., N. Avigad, *Hebrew Bullae...*, 1986, n° 38,147, 152·

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# Le travail de l'os, de l'ivoire et de la coquille en Terre Sainte du 7e au 1er millénaires av. J.-C.

Dans le cadre d'une recherche générale portant sur les matières dures animales (abbréviation proposée: MDA) travaillées dans le Proche Orient ancien, nous procédons depuis plusieurs années à des examens et comptages sur le matériel des sites du Levant[1]. Un premier bilan permet d'apprécier les rapports entre les diverses sources de matériaux: ivoire d'éléphant et d'hippopotame, os d'anlmaux domestiques ou sauvages, coquille d'oeuf d'autruche[2], carapaces de tortue, coquillage marin. Il devrait permettre d'ouvrir des perspectives sur l'écologie et l'environnement, l'habitat des espèces donneuses de MDA, la circulation des matières brutes ou travaillées, les techniques de mise en oeuvre de la matière. Les découvertes récentes de l'archéologie jordanienne, notamment à Pella et 'Ammān, nous conduisent à tenter d'apprécier ces trouvailles par rapport à celles du littoral.

Dès le néolithique PPNB, les sites de la vallée du Jourdain se caractérisent par une importante industrie sur coquillage. Cette production semble réservée à des fins non utilitaires. On observe, par exemple à 'Ayn Ghazāl ou à Baṣṭa, que la majorité des parures a été réalisée dans des coquillages marins d'au moins une dizaine d'espèces, provenant de la Mer Rouge ou de la Méditerranée[3]: anneaux, grandes "paillettes" triangulaires, rondelles percées en forme de boutons. Les coquillages interviennent également dans les activités funéraires et religieuses: les crânes surmodelés de Jericho et de 'Ayn Ghazāl ont les yeux rapportés en cauries provenant de la Mer Rouge (?), tandis que certaines des statues de plâtre ont des yeux faits avec des clams[4]. Face à cette industrie sur coquillage, le travail de l'os au PPNB dans la vallée du Jourdain semble plutôt réservé aux objets utilitaires, bien qu'à Einan-Mallāḥa, des sculptures sur os d'animaux sauvages aient été mises au jour.

On constate ainsi l'existence d'une circulation des coquillages, pour une production d'objets non utilitaires, peut-être de prestige, impliquant l'existence d'une certaine forme de société hiérarchisée (?).

**Les origines: la période chalcolithique** (FIG. 1:1-2)
Durant la période chalcolithique, apparaît dans deux régions culturellement très apparentées un remarquable artisanat de l'ivoire: du Negeb et du désert de Judée proviennent des pièces dont l'iconographie, pour les célèbres figures anthropomorphes, est proche de l'Egypte pré-dynastique. L'ivoire d'hippopotame domine largement; l'ivoire d'éléphant n'est cependant pas absent. On ne sait si cette production s'est étendue jusqu'à la rive droite du Jourdain, ni si le travail du coquillage marin que l'on y observait au PPNB s'est poursuivi durant la période chalcolithique.

**Le 3e millénaire** (FIG. 1:3)
Les trouvailles d'ivoire sont plus rares pour la période du Bronze Ancien. Le style des quelques oeuvres conservées est distinctif et homogène: les sites de Jéricho, 'Aï, 'Arād, Khirbat al-Karak, ont livré des protomes de taureau et de lion qui présentent un même mode d'inscription dans des dents d'hippopotame[5]. L'emploi de ce matériau semble rester majoritaire, alors qu'en Syrie intérieure, sur l'Euphrate, le travail des MDA concerne essentiellement la coquille: on y voit des éléments gravés qui relèvent d'une technique de mosaïque spécifiquement mésopotamienne, bien illustrée à Our, très différente de l'artisanat de l'ivoire tel qu'il est alors pratiqué en Palestine.

**Bronze Moyen (début du 2e millénaire)** (FIG. 1:4)
Au cours du Bronze Moyen, cet art de la mosaïque semble passer de la Mésopotamie au Levant, mais sur os ou ivoire au lieu de coquille. Les pièces, composées de petits éléments juxtaposés, figurant des oiseaux stylisés et

[1] Caubet et Poplin 1987; 1992.
[2] Caubet 1983.
[3] Nissen *et alii* 1987: 109-114, FIG. 18; 1991: 27, FIG. 5.1-7.
[4] Rollefson, communication au colloque d'Irbid 1992.
[5] Caubet et Poplin 1992: 96 pour l'identification du matériau et de Miroschedji 1993.

des bandes de motifs géométriques (triangles, rangées de cercles pointés), étaient sans doute destinées à des objets composites, tels des coffrets et meubles en bois incrustés. Des exemples ont été mis au jour à Lachish, à al-Jisr, à Megiddo, à Jéricho et dans la citadelle de 'Ammān[6]. L'aire de répartition géographique de ces objets s'étend à l'ensemble de la Palestine, sur des sites qui seront également fertiles en oeuvres d'ivoire à la période suivante. Parallèlement, la coquille d'oeuf d'autruche gravée ou peinte est utilisée comme récipient et fréquemment placée dans des tombes, notamment à Jéricho[7].

**Le Bronze Récent** (FIG. 1:5-6)
La période du milieu du 2e millénaire est mal connue. Suit, lors de la dernière phase du Bronze Récent (fin du 14e début du 12e siècle), une magnifique floraison de l'artisanat de l'ivoire, une des composantes de la civilisation palatiale qui s'est épanouie sur le littoral syro-phénicien, à Chypre, à Ougarit, Megiddo, Lachish. Cet art se caractérise par un emploi majoritaire de l'ivoire d'hippopotame[8]. A cet égard, les découvertes de Pella[9] montrent que cette cité est bien intégrée, dès les débuts du Bronze Récent, dans l'aire de la civilisation palatiale. Elle compte parmi les centres de production ou de distribution des oeuvres d'art sur dent d'hippopotame. Nous avons en effet identifié comme de l'hippopotame[10] le matériau qui a servi pour la belle boîte aux lions. La question de savoir si ce chef-d'oeuvre est une importation, et dans ce cas, d'en établir la provenance, reste ouverte. Nous préférons pour notre part y voir un objet levantin plutôt qu'égyptien, oeuvre d'un artiste qui s'est attaché à exploiter l'ivoire d'hippopotame au meilleur de ses possibilités, tirant même parti des difficultés et des limites de ce matériau. On observera sur la boîte de Pella comment il a sû jouer avec la nécessité de fixer la plaque sur un fond au moyen de rivets qui ont disparu mais dont l'emplacement bien visible montre qu'ils ont servi à mettre en valeur l'oeil des lions affrontés et chaque "oeil" au centre de l'entrelac de serpents. Au lieu d'être dissimulés, ces pièces utilitaires deviennent éléments du décor.

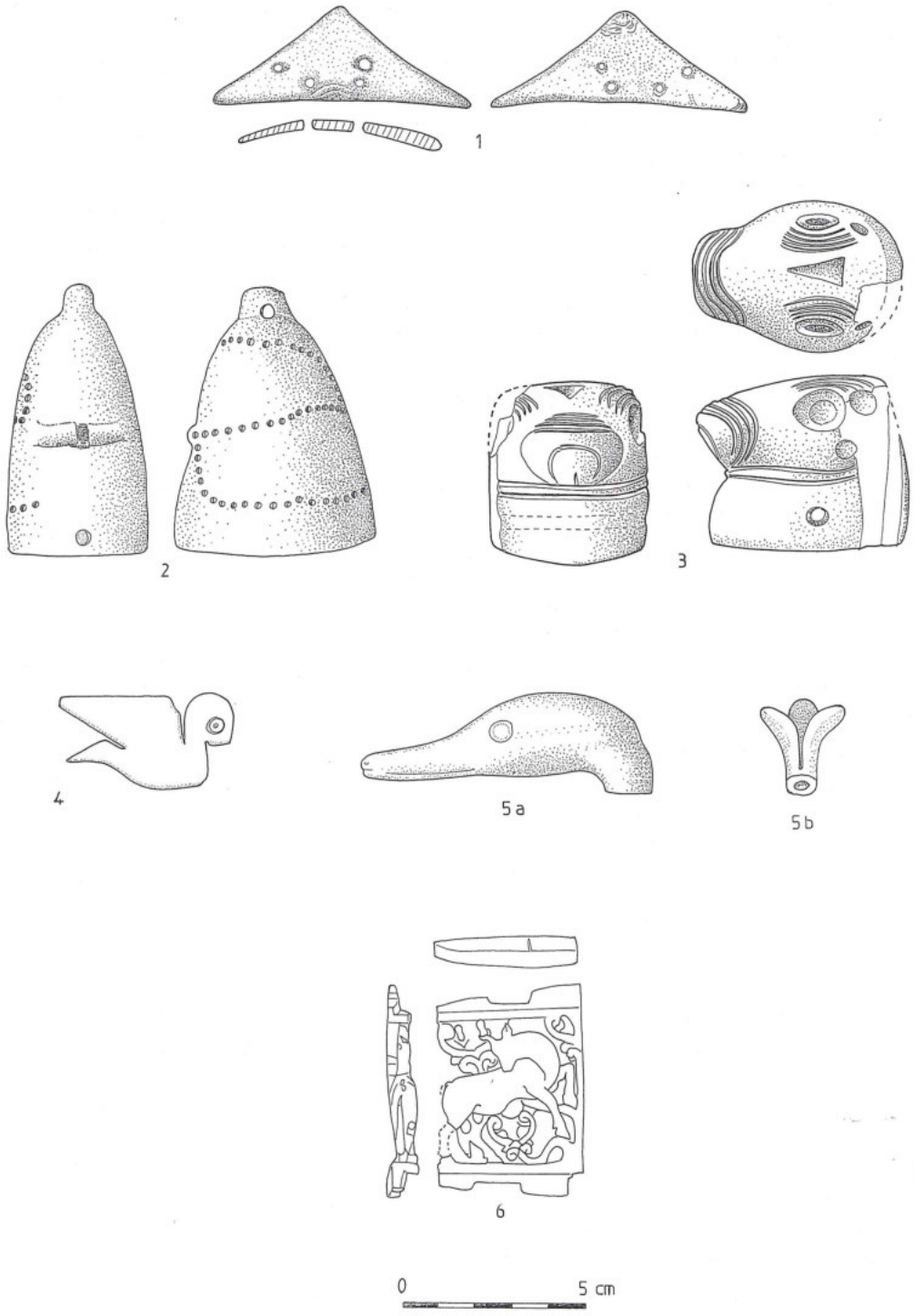
Toujours à Pella, une plaque ajourée découverte dans une tombe datée entre l'âge du Bronze Récent AII - début de l'âge du Fer[11] a été identifiée par les fouilleurs comme de l'ivoire d'hippopotame. La technique ajourée, le motif du taureau broûtant des palmettes, annoncent les plaques de meubles syro-phéniciens des 9e et 8e siècles av. J.-C. dont cette oeuvre serait un précurseur; par son matériau, en revanche, cette plaque de Pella appartient encore aux séries du Bronze Récent.

Bien que nous n'ayons pas pu examiner nous-même ces pièces, nous incorporons dans ce panorama les fragments provenant de Dayr 'Allā[12], un fleuron (peut-être une tête de fuseau) et une tête de canard. La comparaison avec des pièces analogues d'Ougarit nous fait penser qu'il s'agit là aussi d'ivoire d'hippopotame. La tête de canard est probablement un élément d'une de ces boîtes en forme d'oiseau aquatique dont nous avons expliqué le mode d'inscription dans une canine d'hippopotame[13] à propos d'exemplaires d'Ougarit. Nous n'avons pas non plus examiné le matériel Tall as-Sa'īdiyya, provenant de tombes du Bronze Récent[14]. Le peigne et le baton à kohl sont d'un type bien connu sur les sites du littoral syro-palestinien; la boîte à fard en forme de poisson est d'un modèle original, mais son fonctionnement est proche de celui des boîtes-canard.

**1200-1000, les "années de crise"**
La transition entre le Bronze final et l'Age du Fer, marquée en Palestine et dans le Delta égyptien par la crise des Peuples de la Mer, sonne le glas de la civilisation palatiale et la disparition de la clientèle pour les objets de luxe et les ivoires. Comme on s'y attendrait, cette période n'a livré que peu de vestiges d'ivoirerie. Cependant, on observe l'apparition d'un type de couteau bien particulier, à manche traitée en MDA et à lame de fer, innovation technologique qui en fait des possessions de luxe. Des exemples ont été trouvés à Chypre (Enkomi[15]) et sur le littoral palestinien, à *tall* Miqné-Ekron[16]. Le manche en est tantôt pris dans un os, tantôt dans de l'ivoire d'hippopotame, tantôt dans de l'ivoire d'éléphant: on assiste là au passage d'une tradition à l'autre, du bronze au fer, de l'ivoire d'hippopotame à celui l'éléphant.

**10e-7e siècles** (FIG. 2:7-10)
A partir des 10e-9e siècles, la renaissance des royaumes indépendants entraîne celle de l'ivoirerie. De nombreuses petites cours avides de prestige constituent une nouvelle clientèle pour les objets de luxe, où l'ivoirerie se marie à l'orfèvrerie. On sait qu'elle était la cible de la colère du prophète Amos, reprochant sa molesse à la cour de Samarie. Contrairement aux périodes précédentes, c'est l'ivoire d'éléphant qui s'impose alors, à côté d'autres matériaux, comme la coquille de *tridacna squamosa*. De superbes plaques de meubles en ivoire ont

[6] Najjar 1991: FIG. 6. Ces pièces nous ont été montrées par Mohammad Najjar à qui va notre reconnaissance.
[7] Caubet 1983.
[8] Caubet et Poplin 1992: 100, FIG. 1.
[9] Potts 1986.
[10] Lettre F. Poplin et A. Caubet à T. Potts 1987. Caubet et Poplin 1992: 97.
[11] Potts *et alii* 1988: PL. XIII.
[12] Homès-Fredericq 1987: 91, FIGS. 1. et 2.
[13] Caubet et Poplin 1987: FIG. 9.
[14] Tubb 1988b: PL. IV, 2.
[15] Caubet, Courtois et Karageorghis 1987.
[16] Dothan 1989.




1. Du néolithique au Bronze Récent. **1**: Paillette en nacre, Basṭa, d'après Nissen *et alii* 1991: 27; **2**: pendeloque en ivoire d'hippopotame, chalcolithique, d'après *Syria* 36 (1959): 13; **3**: tête de taureau en ivoire d'hippopotame, Bronze Ancien, Jericho, d'après Miroschedji 1993: FIG. 4; **4**: elément d'incrustation en os, Bronze Moyen, Citadelle de 'Ammān, d'après Najjar 1991: FIG. 6; **5a:** tête de canard en ivoire d'hippopotame, Bronze Récent, Dayr 'Allā, d'après Homès-Fredericq 1987: FIG. 2; **5b**: fleuron en ivoire d'hippopotame, Bronze Récent, Dayr 'Allā, d'après Homès-Fredericq 1987: FIG. 1; **6**: bovidé, plaque découpée à jour en ivoire d'hippopotame, Bronze Récent, Pella, d'après Potts *et alii* 1988: PL. XIII.

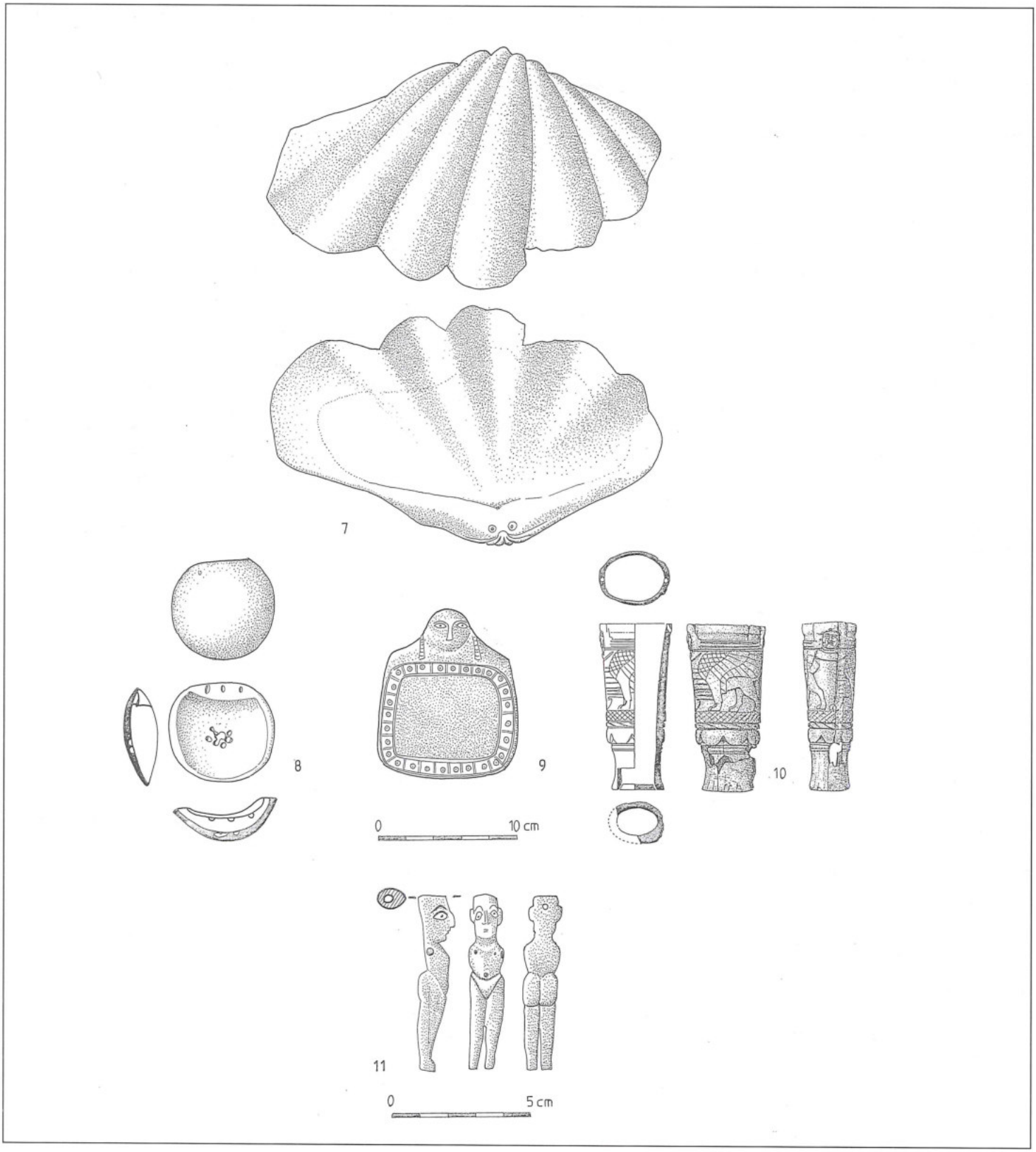
été découvertes dans les palais à Arslan Tash, Samarie, Nimroud ou dans les tombes royales, à Salamine. A cette catégorie appartiennent sans doute les fragments en forme de fleurons de palmette, mis au jour dans la citadelle de 'Ammān[17]; ils montrent que la cour ammonite jouissait elle-aussi d'un mobilier précieux. L'iconographie du décor de ces plaques, mêlant éléments égyptisants et phéniciens, devait être familière aux artisans ammonites: ils l'ont adaptée à la sculpture officielle en pierre, comme en témoignent les stèles ornées de masques hathoriques, motif "classique" des ivoires.

Le *tridacna squamosa*, grand bivalve que l'on trouve dans les eaux du Golfe arabo-persique[18], a été utilisé à partir du 7e siècle av. J.-C. pour un groupe d'oeuvres très homogène. Polie mais non retaillée, la coquille conserve sa forme anatomique qui en fait une coupe de large dimension, sans doute destinée à contenir des fards. La surface reçevait ensuite un décor gravé d'entrelacs de lotus stylisés dans lequel figure une créature mythologique ailée dont la tête humaine coiffée de longues mèches en forme de plumes occupe toujours la charnière du coquillage: cette tête tournér vers l'intérieur de la coquille, constitue le trait le plus distinctif de ces tridacnes décorés qui ont été retrouvés à travers toute la Méditerranée orientale; ils ont été aussi diffusés vers l'est, en Mésopotamie et jusqu'à Suse[19]. On s'accorde en général pour attribuer cette production à des artistes du littoral méditerranéen. Plusieurs exemples ont été trouvés en Transjordanie, à 'Arād, à Buṣayra[20]. Au moins deux viennent de la citadelle de 'Ammān[21]: le premier est du type canonique décrit ci-dessus. Le second ne présente pas de décor gravé mais l'intérieur de la charnière est creusé de deux yeux incrustés de pâte colorée. Ce visage stylisé le rattache à la série et nous amène à évoquer quelques-uns des substituts et imitations qu'ont suscité les tridacnes décorés. Des dérivés simplifiés ont été fabriqués dans des coquillages plus petits: une coupelle d'Abū al-Kharaz, site de la vallée du Jourdain au sud de Pella, a été taillée dans un bivalve dont la charnière sciée a été percée de trous, peut-être pour ajuster un couvercle[22]. D'autre part, une série de palettes palestiniennes en albâtre ou calcaire se caractérise par la présence d'une bélière saillante décorée de la tête coiffée de plumes, si distinctive des tridacnes gravés[23]. Des exemples ont été retrouvés à 'Ammān et Umm al-Biyāra. Tridacnes et palettes en pierre ont connu sans doute un même usage comme ustensile de toilette et leur matière blanche et froide présente un même aspect extérieur. L'analogie est encore mise en évidence par l'iconographie du visage humain tourné vers la partie fonctionnelle de l'objet.

**Epoques perse, hellénistique et romaines** (FIG. 2:11)
Vers la fin de l'époque assyrienne, on constate dans tout le Levant une brutale raréfaction de la production d'ivoirerie dont la tradition remontait au 2e millénaire, raréfaction qui affecte également la Palestine. On peut s'interroger sur les causes de cette mutation[24], transformations écologiques, changement de goût, dérivation des routes de circulation des matières premières. C'est peut-être à l'époque perse que se développa une nouvelle production sur os, remarquablement par le style sur un grande aire géographique et appelée à une longue durée d'existence, jusqu'à la période sassanide peut-être. Depuis l' Egypte jusqu'à Suse, on trouve sur la plupart des sites orientaux, des petites figurines en os, représentant des femmes nues plus ou moins stylisées[25]. La plupart sont taillées dans des métapodes de mouton/chèvre. Les fouilles de Jarash en ont livré un bel exemplaire[26] qui relève d'une tradition orientale. A l'époque romaine et byzantine, certaines de ces figurines montrent un style classique gréco-romain, qui inspire également certaines petites sculpture en ronde bosse sur os, comme le Ganymède de Samarie[27] et de nombreuses plaques de coffret. Prises dans des métapodes de boeuf, ces plaques sont sculptées en bas relief de scènes mythologiques empruntées au cycle dionysiaque: le coffret d'Amosas[28] trouvé dans la nécropole de Jaffa est caractéristique du travail de l'os au Levant durant l'antiquité tardive.

**Conclusion**
Ce bref survol nous permet de constater que l'industrie sur os, ivoire et coquille s'inscrit dans la longue durée au Levant et notamment en Jordanie. La comparaison entre la Jordanie et le littoral amène à faire quelques observations. En ce qui concerne la coquille d'oeuf d'autruche, l'ivoire d'hippopotame et l'ivoire d'éléphant, la situation semble à peu près analogue dans ces deux régions, avec une même prépondérance de l'hippopotame à l'âge du Bronze et de l'éléphant durant les premiers siècles du 1er millénaire. En revanche, si l'on considère l'industrie sur coquille marine, on constate que, paradoxalement, la Jordanie offre un corpus plus riche que les sites du littoral

17 Inédits? photos vues sur un "poster" IFAPO, Amman 1992.
18 Stucky 1974.
19 Amiet 1976.
20 Bennett 1977.
21 Zayadine 1986. Le second exemplaire inédit, AG TH90 NE 4095 loc 16, nous a été montré par Mohammad Najjar nous remercions de sa coopération.
22 Fisher 1991: 83, FIG. 7.14. Nous remercions Peter M. Fisher de nous avoir procuré les photographies de cette oeuvre.
23 Culican 1970; Hart 1986: FIG. 43.
24 Caubet et Poplin 1992: 95.
25 Rahmani 1981: PLS. 15-14 pour des exemples de la région de Gaza.
26 Dans une fosse sassanide. Nous remercions J. Seigne de nous avoir signalé cet objet.
27 *Samaria-Sebaste III*: PL. XIV, 5; Rosenthal 1976.
28 Dussaud 1912: n° 120




2. De l'âge du Fer à l'époque romaine. **7**: Tridance avec "yeux" incrustés en verre, 8e-7e siècles, Citadelle de 'Ammān, d'après Zayadine 1986: 19, FIG. 25; **8**: boîte à fard pratiquée dans un bivalve, 8e-7e siècles, Tall Abū al-Kharaz, d'après Fischer 1991: FIG. 7.14; **9**: palette à fard en albâtre, 8e-7e siècles, Citadelle de 'Ammān, Musée archéologique jordanienne; **10**: manche en os; 8e-7e siècles, Tall Abū al-Kharaz, dessin dû à la courtoisie de P. M. Fischer et G. Herrmann (d'après Fischer 1994: 135, FIG. 4); **11**: statuette féminine, ivoire non identifié, époque romaine (?), dessin dû à la courtoisie de J. Seigne.

syro-palestinien. Bien que riverains de la Méditerranée, ces derniers n'ont livré de coquillage sculpté que pendant une durée limitée et encore s'agit-il d'un matériau importé de mers lointaines. La Jordanie, qui ne touche à la Mer Rouge que par une pointe, a apprécié et travaillé les coquillages quasi sans interruption depuis le Néolithique jusqu'à nos jours, où prospère encore un artisanat de la nacre très prisé des touristes.

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# Lithic Technology and Settlement Pattern Variability within the Levantine Mousterian: A Comparison of Sites WHS 621 and WHS 634 from Wādī al-Ḥasā

## Introduction: The Model

In their long term studies of Middle and Upper Palaeolithic settlement patterns in the central Naqab highlands, Marks and Freidel (1977) have recognized two distinctive patterns. The first, associated with the Early Mousterian (>90,000-45,000 years BP), consists of relatively "permanent" residential base camps near reliable water sources surrounded by a series of ephemerally occupied quarry, hunting, and foraging "limited activity" satellites. This has been called a "radiating" pattern of exploitation and is similar to what Binford (1980) has called a "logistical strategy". This radiating pattern is argued to be an adaptation of mesic climatic conditions. The second pattern, associated with the Upper and early Epipalaeolithic (45,000-16,000 years BP), consists of a "circulating" pattern of smaller, essentially similar, multi-purpose camps established throughout a foraging range (Marks and Freidel 1977: 150; cf. Binford's [1980] notion of "forager"). Site distribution studies indicate that Upper Palaeolithic groups were habitually exploiting larger territories than their Middle Palaeolithic predecessors (Marks 1987: 5). Upper Palaeolithic sites appear to be functional and morphological replicates of one another (i.e., no base camp/satellite distinctions are evident).

In general, then, Marks and Freidel (1977) see an increase in residential mobility coinciding with long term climatic desiccation from mesic/Mediterranean to xeric Irano/Turanian steppe vegetation during the Middle to Upper Palaeolithic in the southern Levant. Palaeoenvironmental data from an-Naqab suggest that the Early Middle Palaeolithic environment was considerably wetter than today, with climatic belts distributed 200-250 km south of their present locations. Limited evidence from the later Middle Palaeolithic from both an-Naqab and south Jordan indicate increased aridity during this period. This trend seems to have continued up through the Middle to Upper Palaeolithic transition (c. 40 kyr BP) and into the Upper Palaeolithic (Clark *et al.* 1987: 215).

Although to some it might not be reasonable to suppose that Mousterian foragers (i.e., archaic *Homo sapiens*) behaved like ethnographically-known "logistical collectors" during the early phases of the Middle Palaeolithic (Clark 1984), it is reasonable to look at relative degrees of mobility across a long temporal span (from approximately 120-50 kyr), for a major climatic trend of this duration and magnitude would almost certainly have had some effect on settlement mobility, and upon raw material procurement, over time. This study compared two Middle Palaeolithic sites, one relatively early — WHS 634 ('Ayn Difla), and one relatively late, WHS 621, from the Wādī al-Ḥasā region in west-central Jordan. It was expected that the assemblage from the later site would demonstrate greater signs of curation (*sensu* Binford 1979), a technological hallmark of increased residential mobility, relative to the earlier site (Bamforth 1986; Parry and Kelly 1986). The earlier Middle Palaeolithic site, in contrast, was expected to exhibit a more "expedient" lithic technology in response to its proposed greater occupational stability (Bamforth 1986; Chatters 1987; Parry and Kelly 1986).

## The Middle Palaeolithic in Wādī al-Ḥasā

Wādī al-Ḥasā is located in west-central Jordan, some 100-120 km east and slightly north of the central Naqab highlands. This major wadi system, which was, in the Upper Pleistocene, characterized by a series of shallow alkaline lakes flanked by a multitude of smaller tributary drainages, ultimately empties into the Dead Sea depression near the Jordanian town of aṣ-Ṣāfī (Clark 1984; Clark *et al.* 1988). The archaeological site surfaces, which span a period of approximately 100,000 years, correspond to various lake shore and flood plain environments that can ultimately be linked to a series of Upper Pleistocene and Early Holocene climatic changes (Donahue and Beynon 1988).

*The Wadi Hasa Paleolithic Project (WHPP),* under the direction of G. A. Clark, recovered, during the 1984 and 1986 field seasons, excavated samples from six sites, including two Middle Palaeolithic sites: WHS 621 and

WHS 634.

*WHS 621*

The first site WHS 621 is an extensive (4000 m²) scatter of (predominantly) Middle Palaeolithic artifacts. It is an open-air site on the shore of Pleistocene Lake Hasa, and lies at about 807-810 m, close to the estimated maximum elevation of the lake (+ 815 m) (Clark 1984). The abundance of Middle Palaeolithic material and the lack of clearly Upper Palaeolithic material or later industries lead Clark *et al.* (1987: 23) to suggest that the site is essentially unmixed and represents the lithic component of a slightly derived Mousterian camp site (or series of camp sites). Since it has a so-called "Tabun B" type assemblage, WHS 621 is thought to fall in the 60-40 kyr interval, relatively late in the Levantine Middle Palaeolithic sequence (Jelinek 1983).

*WHS 634 ('Ayn Difla)*

The second site, WHS 634 ('Ayn Difla), is a small pocket of sediment at one end of a huge rockshelter in Wādī 'Alī, a southern tributary of al-Ḥasā. It is the remnant of a much larger site, the contents of which have been eroded away. The site now covers about 40 m². It is located at c. 780 m above sea level and, unlike WHS 621, is not directly associated with Pleistocene Lake Hasa. The site contains up to 5 m of stratified *in situ* Middle Palaeolithic deposits and apparently no later material (Lindly and Clark 1987). The site has produced a "Tabun D" type assemblage, which has been TL-dated by Oxford University from 90-120 kyr BP (Lindly and Clark 1987; Clark pers. comm.)

Since *sample size* is in many ways more important than *sample fraction*, the samples analyzed from each site for this study were equal in number (N = 1600) (Cowgill 1975). These samples were chosen randomly in an attempt to preserve artifact proportions within each assemblage (for instance, the ratio of tools to debitage).

**Mobility and the Organization of Technology**

For hunter-gatherers, Binford (1980) has proposed a distinction between residential and logistical mobility. This distinction is a rough correlate of Marks and Freidel's (1977) notion of "circulating" and "radiating" settlement patterns (or at least would result in roughly similar patterns). Residential mobility refers to the simultaneous movement of most of the members of a camp. Highly mobile groups, termed "foragers", move consumers to resources and make relatively frequent moves. "Collectors", on the other hand, practice a highly logistical strategy: small, specially organized task groups leave the residential base to procure specific resources. Collectors occupy residential bases for a relatively longer period of time (e.g., several weeks, months, or an entire season), and transport resources to consumers through this kind of logistical organization. The comparatively low residential mobility of collectors is accomplished by storing resources and effectively "creating" a resource at the residential base.

Binford (1980) has argued that lithic procurement is "embedded" in settlement/subsistence systems, and that lithics can be used to monitor the extent of those systems. Mobility plays a large part in determining the nature and role of tools (Parry and Kelly 1986). High mobility should place constraints upon technology by imposing carrying costs. Since neither tools needs nor raw material availability can always be precisely anticipated, mobility simultaneously plays a part in dictating tools needs and access to raw material (Kuhn 1990). A technology based upon *curation* may fulfil many of the requirements of a highly mobile adaptation. A curated technology consists of tools that are effective for a variety of tasks, are manufactured in anticipation of use, maintained through a number of uses, and recycled to other tasks when no longer useful for their primary purposes (Chatters 1987). One significant advantage of a curated technology is its relative portability, because it permits a fixed set of tool needs to be fulfilled with a smaller number of tools and from a smaller weight of raw material.

Among more sedentary populations, portable/curatable tools would no longer have such a high degree of utility and they might instead choose to emphasize the production of new tools (rather than resharpening) as a source of fresh edges. An *expedient* technology is one that produces tools on an "as needed" basis that are used until dull, broken, or no longer required, and then discarded. It is a technique that minimizes manufacture effort, but is wasteful of raw material compared to a curated technology. Increased sedentism may allow for the "embedded procurement" of large quantities of raw material to a residential location with little extra expenditure of time or energy, and thus simultaneously relieve both the constraints of high mobility and raw material availability (Kuhn 1991: 79).

It was expected that the lithic assemblage from WHS 621, the later Middle Palaeolithic site, would exhibit greater signs of having been curated, for settlement/subsistence strategies during this time period should be more similar to the Upper Palaeolithic pattern of high residential mobility, which would tend to require higher degrees of curation. This would be manifest as (1) a high relative frequency of formal retouched tools (Dibble 1987); (2) a high relative frequency of resharpening "tertiary" flakes (Bamforth 1986); (3) a high frequency of exhausted cores (i.e., small, broken) and tools (i.e., those that are heavily utilized, broken, and/or have steep edge angles) (Shackley 1986); and (4) greater diversity of raw

materials, both in terms of richness and evenness (Goodyear 1989; Kintigh 1989).

In contrast, the assemblage from WHS 634 ('Ayn Difla) was expected to exhibit signs of expediency. This would consist of (1) a high frequency of waste material (i.e., shatter, debris, minimally utilized flakes and blades) (Shackley 1986); (2) a low incidence of retouch and core preparation (Bamforth 1986); (3) all stages of core reduction, including primary/cortical debitage and cores of variable reduction intensity (Shackley 1986); and (4) a more intensive use of local raw materials (Bamforth 1986).

## Results

The assemblage for WHS 621, the later Middle Palaeolithic site, conformed remarkably well with the expected patterns of a mobile/curated assemblage (TABLE 1). The assemblage exhibited greater diversity of raw material types than the earlier site, both in terms of the number of different material types represented (richness), as well as the "evenness" of the distribution (Kintigh 1989). Most notable, however, was the degree to which the assemblage from WHS 621 was fragmented, as well as the frequency of visible edge damage on the artifacts, as compared with WHS 634. WHS 634 had about 4.6 times as many complete as broken artifacts, while WHS 621 had about 1.4 times more *broken* than *complete* ones (TABLE 2). The chi square statistic associated with these data is 258.7 ($\rho$ <0.0001). Although post-depositional processes may account for some of the fragmentation at WHS 621, heavy patination of a majority of the breaks, and a high frequency of fragmented cores, suggest that much breakage occurred close to the time of deposition and in fact resulted *in* the discard of artifacts (Baumler 1985). Additionally, the WHS 621 assemblage had edge damage on 64.3% of the artifacts, and 42% of the artifacts exhibited edge damage on more than half of the margin (i.e., they were used more than once). In contrast, WHS 634 artifacts were minimally utilized. Thirty-four percent of the assemblage showed signs of use, only 14% of which was considered intensive (TABLE 3).

Edge angle data from WHS 621 also support the mobile/curated hypothesis for the site. Fifty-nine percent of the assemblage demonstrated an edge angle greater than or equal to 45 degrees, compared with 43% of the WHS 634 assemblage.

Formal tools comprise only 9% of the WHS 621 assemblage, compared with 13% of the WHS 634 assemblage. This low percentage at WHS 621 may be due mostly to the difficulty of identifying formal tool types in such a fragmented assemblage. However, the diversity of formal tool types at WHS 621 was greater, both in terms of *richness* and *evenness* (Kintigh 1989) (TABLE 4). Approximately *90%* of the formal tools from WHS 634 are Levallois (type nos. 1-4 in the Bordes typology). The WHS 621 formal assemblage consisted of relatively fewer Levallois elements, and more retouched elements

**Table 1.** Summary of results.

| *WHS 621 (more mobile)* | | *WHS 634 (less mobile)* |
|---|---|---|
| greater diversity of raw material types | C | lesser diversity of raw material types |
| larger, heavier artifacts | NC | smaller, lighter artifacts |
| high frequency of unidentified core fragments | C | low frequency of unidentified core fragments |
| highly fragmented artifacts | C | mostly complete artifacts |
| few complete blades many complete flakes | C? | many complete blades fewer flakes |
| heavily utilized | C | not heavily utilized |
| heavily retouched | C | not heavily retouched |
| incidence of retouched pieces (9%) | - | incidence of retouched pieces (13%) |
| more diverse retouched tool assemblage | C | less diverse retouched tool assemblage |
| edge < steeper - more retouch | C | edge < sharper - less retouch |
| spine-plane < varies from edge < | C | spine-plane < consistent with edge < |
| dorsal characteristics | - | dorsal characteristics |
| fewer prepared platforms | NC | more prepared platforms |

C = consistent with hypothesis

NC = not consistent

- = no difference

**Table 2.** Condition of artifact.

**WHS 634**

| *Condition* | *Frequencies* *Flake* | *Blade* | *All Artifacts* |
|---|---|---|---|
| Complete | 601 | 428 | 1072 |
| Proximal Fragments | 31 | 73 | 105 |
| Distal Fragments | 27 | 59 | 86 |
| Medial Fragments | 18 | 24 | 43 |
| Total Fragments | 76 | 156 | 234 |
| Complete/Fragment Ratio | 7.91 | 2.74 | 4.58 |

**WHS 621**

| *Condition* | *Frequencies* *Flake* | *Blade* | *All Artifacts* |
|---|---|---|---|
| Complete | 447 | 103 | 619 |
| Proximal Fragments | 191 | 91 | 295 |
| Distal Fragments | 176 | 61 | 242 |
| Medial Fragments | 212 | 69 | 329 |
| Total Fragments | 579 | 221 | 865 |
| Complete/Fragment Ratio | 0.77 | 0.47 | 0.72 |

**Table 3.** Extent of utilization.

**WHS 634**

| *Extent of Utilization* | *Frequency* | *Percent* |
|---|---|---|
| >50% of Margin | 228 | 41.2 |
| <50%, >25% of Margin | 138 | 25.0 |
| <25% of Margin | 124 | 22.4 |
| Sporadic | 63 | 11.4 |
| Total Utilization | 553 | 100.0 |
| No Utilization | 1048 | |

Utilization/No Utilization Ratio = 0.52

**WHS 621**

| *Extent of Utilization* | *Frequency* | *Percent* |
|---|---|---|
| >50% of Margin | 670 | 65.0 |
| <50%, >25% of Margin | 220 | 21.3 |
| <25% of Margin | 109 | 10.6 |
| Sporadic | 32 | 3.1 |
| Total Utilization | 1031 | 100.0 |
| No Utilization | 573 | 35.7 |

Utilization/No Utilization Ratio = 1.80

(e.g., various side scrapers, notches, and denticulates) (TABLE 4).

Contrary to the expectations, there was a low incidence of resharpening or "trimming" flakes associated with the WHS 621 assemblage. This was probably due to the fact that WHS 621 is a slightly derived, open-air site and that post-depositional erosional processes carried away most of the smaller artifacts.

Nonetheless, these data are remarkably consonant with much of what is expected from an assemblage that represents the remains of behaviors associated with the discard of exhausted, used-up tools, and the maintenance activities associated with the gearing-up of tool kits for the next move.

In contrast, the WHS 634 assemblage, as indicated above, was, in many respects, a more expedient assemblage, exhibiting a higher frequency of shatter, little utilization and retouch, and fewer broken/exhausted pieces, all of which were manufactured from a more limited set of raw material sources than was the case at WHS 621. However, the assemblage also demonstrated aspects of variability that were not consistent with the "effort minimization" goal, which is usually part of the notion of expedience. For instance, the frequency of blades in the assemblage was remarkable. Of the 1600 artifacts analyzed from WHS 634, 584 of them were blades (about 37% of the total assemblage). Not only was the frequency of blades notable, but also the difference with which they were manufactured, compared to WHS 634 flakes, as well as the artifacts from WHS 621. Forty percent of the WHS 634 blades had prepared (dihedral or multi-faceted) platforms; no other artifact category from either site had an incidence of faceted platforms greater than 16% (TABLES 5 and 6). This suggested an attempt at obtaining greater control over the size and shape of blades at WHS 634. In addition, the thickness and edge angle of WHS 634 blades vary little compared with the other artifact categories. Correlation coefficients were high for length, width, and thickness of flakes at WHS 634 and flakes and blades at WHS 621 (TABLES 7 and 8). However, for WHS 634 *blades*, thickness predicted length and width poorly (Pearson's r = 0.307 and 0.327 respectively — TABLE 8). This was due to the fact that, while blade lengths and widths varied predictably with the size of the core being reduced, thickness did not. And lastly, WHS 634 blades had edge angles which were remarkably symmetrical and narrow in distribution (Potter 1991). This leptokurtosis was most likely associated with their unvarying, "standardized" thickness. This suggested a real effort to optimize the number of blades struck from a core (without making them so thin that they break when manufactured or used), yet preserving an edge sharp and strong enough for the anticipated range of functions.

**Table 4.** Formal tool frequencies.

| *Bordesian Type* | *WHS 634* | *WHS 621* |
|---|---|---|
| 1 Typical Levallois Flake | 52 | 38 |
| 2 Atypical Levallois Flake | 3 | 1 |
| 3 Levallois Point | 103 | 21 |
| 4 Retouched Levallois Point | 6 | 6 |
| 6 Mousterian Point | 0 | 2 |
| 9 Straight Side Scraper | 2 | 5 |
| 10 Convex Side Scraper | 4 | 10 |
| 11 Concave Side Scraper | 2 | 7 |
| 12-17 Double Side Scraper | 0 | 10 |
| 19 Other Side Scraper | 0 | 3 |
| 32 Burin | 2 | 11 |
| 38 Naturally Backed Knife | 2 | 0 |
| 42 Notch | 6 | 9 |
| 43 Denticulate | 0 | 21 |
| 44 Alternate Flaked Tip | 0 | 1 |
| 47 Piece with Alternate Retouch | 0 | 1 |
| Total Sample | 182 | 146 |

## Discussion

In an expedient lithic technology, sharp but not particularly durable, fresh edges are the primary objective, often with little regard for raw material waste or for the potential reuse of tools. A curated technology, on the

**Table 5.** Blade platform frequencies.

| *Platform Type* | *WHS 634* | | *WHS 621* | |
|---|---|---|---|---|
| | *count* | *%* | *count* | *%* |
| Unmodified | 14 | 03.3 | 1 | 00.9 |
| Plain | 189 | 44.6 | 74 | 73.3 |
| Dihedral | 49 | 11.6 | 10 | 09.9 |
| Multi-faceted | 172 | 40.5 | 16 | 15.8 |
| Totals | 424 | 100.0 | 101 | 99.9 |

**Table 6.** Flake platform frequencies.

| *Platform Type* | *WHS 634* | | *WHS 621* | |
|---|---|---|---|---|
| | *count* | *%* | *count* | *%* |
| Unmodified | 52 | 08.7 | 8 | 01.8 |
| Plain | 422 | 70.7 | 333 | 75.5 |
| Dihedral | 58 | 09.7 | 26 | 05.9 |
| Multi-faceted | 65 | 10.9 | 74 | 16.8 |
| Totals | 597 | 100.0 | 441 | 100.0 |

**Table 7.** Correlation matrices (Pearson's r) for variables length, width, thickness for flakes.

**WHS 634**

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| *Length* | 1.000 | | |
| *Width* | 0.532 | 1.000 | |
| *Thickness* | 0.581 | 0.532 | 1.000 |

**WHS 621**

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| *Length* | 1.000 | | |
| *Width* | 0.653 | 1.000 | |
| *Thickness* | 0.614 | 0.617 | 1.000 |

**Table 8.** Correlation matrices (Pearson's r) for variables length, width, thickness for blades.

**WHS 634**

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| *Length* | 1.000 | | |
| *Width* | 0.667 | 1.000 | |
| *Thickness* | 0.307 | 0.327 | 1.000 |

**WHS 621**

| | *Length* | *Width* | *Thickness* |
|---|---|---|---|
| *Length* | 1.000 | | |
| *Width* | 0.780 | 1.000 | |
| *Thickness* | 0.642 | 0.559 | 1.000 |

other hand, produces tools that can be reused. Large wide flakes are best suited for curation and reuse. The larger and wider the flake, the more it can be resharpened. Following this line of reasoning, Marks (1987) and Kuhn (1990) suggest that "ovoid" blanks, rather than elongated ones, may be produced in an attempt at curation (i.e., they can be reworked more intensively than lamellar blanks). Blades are not so well suited for curation. They are, by definition, less than half as wide as they are long. If, however, the objective is a lot of fresh edges (e.g., if there is a functional preference for long, sharp cutting edges) and one does not have to carry the core around (as a more mobile adaptation necessitates), a reduction strategy that produces blades of a standardized thickness maximizes fresh, usable edges that can be efficiently replaced rather than resharpened.

It is obvious from the above that the assemblage from WHS 634 cannot simply be considered an "expedient" assemblage. It appears that something other than the minimization of "manufacture effort" selected for some of the technological behaviors represented in the rock-shelter deposits. The "bladey-ness" of the assemblage suggests an attempt to maximize the amount of cutting-edge in relation to volume. It is suggested here that a less mobile adaptation might allow for the manufacture of less portable/curatable, but functionally more efficient tools, and that blade core reduction is just such a technique.

Blade- and flake-based technologies, then, seem to be different answers to different problems. In the Levant this is especially important because, unlike Europe, the transition from the Middle to the Upper Palaeolithic was not a simple "flake to blade" transition (but cf. Clark and Lindly 1989 for a different view of the European transition). Blades dominate many assemblages very early in the Levantine Palaeolithic sequence, and spatial variability seems to muddle the picture as well (e.g., "Tabun D" type assemblages, an early Levantine Mousterian assemblage type in the north that is, by definition, very elongated and "bladey", persists very late in some parts of the southern Levant). Thus it is important to understand why an assemblage is flake- or blade-dominated rather than simply noting that it is and then proceeding to date it using this empirical observation.

Marks and Volkman (1983), based upon work at Ksar Akil and other sites in Lebanon, as well as data recovered from Boker Tachtit, suggest that, rather than the European-based notion of lithic technologies "evolving" from a flake to a blade technology over the Middle to Upper Palaeolithic transition, artifact morphologies in the Levant cycled back and forth through time between flakes and blades:

> This cycle goes from on-axis preparation, producing elongated "Levallois" points and blades during the Early Levantine Mousterian (e.g., Tabun D), to quite typical Levallois peripheral preparation of cores, producing ovoid Levallois flakes and broad-based Levallois points in the later Levantine Mousterian (e.g., Tabun C and B) and finally, back to a tendency toward unidirectional preparation and the production of elongated blanks in the transitional assemblages of Lebanon (1983: 14).

This cycling back and forth between blade and flake-dominated assemblages suggests that the environmentally driven model proposed by Marks and Freidel (1977) is probably too simplistic. Much of the data used to monitor environmental changes during the Middle and Upper Palaeolithic in the southern Levant is either nonexistent or is so coarse-grained as to result in gross oversimplification. Although there is little doubt that a major long-term drying trend took place during the later Middle and throughout the Upper Palaeolithic in the southern Levant, there were also most likely some relatively significant, short-term fluctuations through time, as well as much variation across space. The observed cycling between flake and blade technologies through time and the variable rates of cycling across space were probably adaptive responses to the different problems imposed upon the prehistoric Levantines by these archaeologically less-visible climatic fluctuations. Without more fine-grained environmental data for a more extensive area than that now available, this scenario will unfortunately remain just that, a scenario. It can only really be tested when southern Levantine palaeoclimatic data of sufficiently high resolution become available.

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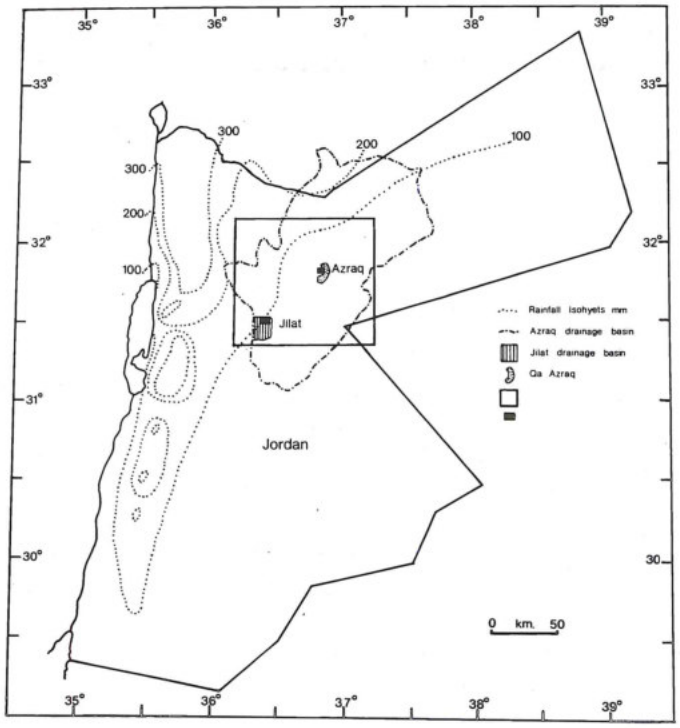
# Chipped Stone Raw Material Procurement and Selection in the Neolithic Azraq Basin: Implications for Levantine Neolithic Cultural Developments

Recently, there has been a tendency to direct attention to procurement and the selective use of raw materials in chipped stone studies (Binford 1979; Torrence 1989). Studies of Neolithic chipped stone assemblages from the Levant have also been concerned with raw material use and procurement. Analysts have reported evidence of the use of distinctive materials, selected for the manufacture of specific items, notably points, sickles and burins, in Neolithic chipped stone assemblages (Lechevallier 1978: 41; Gopher 1989: 16, 74; Nishiaki 1992: 340-346). Shifts in the use of raw materials have been seen as part of the widespread changes in behaviour at the end of the seventh and in the first half of the sixth millennium BC. In occupations apparently spanning these periods at 'Ayn Ghazāl, Baṣṭa and Būqrās knappers shifted from the use of significant quantities of tabular slabs or large, flat, unrolled cobbles to the use of smaller, irregularly surfaced, wadi cobble material (Rollefson 1990: 123; Nissen *et al.* 1987: 98; 1991: 23; Roodenberg 1986: 205 and FIG. 9). In all these cases it is reported that the wadi cobbles are of poorer quality. This pattern has also been detected in sequences of shorter term occupations spanning these periods (Gopher 1989; Nishiaki 1992: 340-346).

The distinctiveness of these two main raw material types (tabular slabs and wadi cobbles), their visibility in the landscape and proximity to the sites, makes the situation in Wādī al-Jīlāt (henceforth Jīlāt) (FIG. 1) particularly favourable for the study of raw material procurement and use. This is because we can assess the relative expenditure of energy in procurement and the role of the variability of the material in the manner of its use. We can, thus, reconstruct behaviour in terms of the choices made by the prehistoric producers. Further, the settlement pattern in Jīlāt is characterised by a series of short term occupations punctuating the period from the eighth to the early sixth millennium BC. We can, therefore, assess the nature of changes in procurement and raw material selection through time.

In particular we have an opportunity to investigate the nature of the transformation at the end of the seventh and beginning of the sixth millennium BC in the light of raw material usage and the extent to which deliberate choices by prehistoric producers were involved in the shifts in raw material use patterns. Two alternative hypotheses might account for a widespread change in raw material use patterns and thus any related technological changes. 1) Such changes might be contingent merely upon a change in certain activities in which raw material procurement was embedded. In other words access to raw materials might change as an indirect reflection of the changing nature of the exploitation of the landscape, in conjunction with the differential distribution of raw material types across the landscape. Nishiaki (1992: 346-




1. Location of Wādī al-Jīlāt.

352) has advanced just such an explanation to account for technological change at the end of the seventh millennium BC. 2) Such changes might reflect a deliberate choice as part of a change in production requirements.

The detailed chronology of the Jīlāt sites has been outlined elsewhere (Garrard *et al.* 1994a; 1994b). A brief resumé is offered in TABLE 1 for the purposes of this paper.

**Table 1.** Chronology of the Wādī al-Jīlāt sites.

| *Site* | *Phase* | *Period* | *Date b.c.* |
|---|---|---|---|
| WJ7 | I | Early PPNB | 7,600-7,200 |
| WJ7 | II | Middle PPNB | 7,200-6,500 |
| WJ7 | III | Middle/Late PPNB | 7,200-6,000 |
| WJ26 | | Middle PPNB | 7,200-6,500 |
| WJ32 | | Middle PPNB | 7,200-6,500 |
| WJ13 | I | Early Late Neo | 6,000-5,600 |
| WJ13 | II | Early Late Neo | 6,000-5,600 |
| WJ25 | | Early Late Neo | 6,000-5,600 |

There are indications in the chipped stone assemblages (Baird 1993: 84-106 and in Garrard *et al.* 1994a) that: 1) WJ7 Phase III may not long post-date Phase II; 2) WJ26 probably does somewhat post-date WJ7 Phase II; 3) WJ32 is broadly contemporary with WJ7 Phase II; 4) WJ25 probably post-dates WJ13 Phase I and may pre-date WJ13 Phase II.

Seven main types of raw material were distinguished in Jīlāt. These raw material categories were: 1) tabular, 2) wadi, 3) nodular, 4) exotic red, 5) exotic translucent, 6) obsidian. The tabular and wadi material was all readily available in Jīlāt. Only one source of nodular material was located in Jīlāt, next to WJ32, and the assemblage at this site was the only one that saw extensive use of this material. Nodular material was very similar in character to the wadi cobbles and it seemed appropriate to group it with wadi material in analysis.

The tabular material consisted of slabs with plane, upper and lower surfaces, usually flat, occasionally uneven, covered with thick, white or beige cortex. Most wadi cobbles are rounded nodules with curving and uneven surfaces, quite distinct from the tabular material. The cortex on wadi cobbles consists of the altered, heavily patinated and battered main body of the material, unlike the tabular flint. In addition, some wadi material is transported, and thus modified, tabular flint. Tabular material thus captured in wadi systems soon loses its characteristic surface qualities. For the most part the wadi material was of the same quality as the tabular. However, material with flaws is encountered more frequently amongst the wadi cobbles. Whilst their morphology is different the size range of the tabular slabs and wadi cobbles is similar. If tabular material was quarried then the size of slabs would be, to some degree (Baird 1993: 236), at the discretion of the miners. Cores of each of these material types fall in the same size range (Baird 1993: 178).

A range of materials were considered as exotics because they were uncommon on Jīlāt and al-Azraq sites and because they were not encountered in raw form in a raw material source survey of Jīlāt. These exotics include material which, for ease of reference, I have labelled exotic red material. This material is, in fact, lustrous, yellow, orange, dark purple, pink, and red brown in colour. It derives from both nodular and tabular sources. Its colouration and lustre strongly distinguishes it from any of the other materials so far mentioned. The common component of colouration, using the Munsell colour system, is an element of red. The cortex of the exotic red materials is different from that found on the common wadi and tabular materials on Jīlāt sites. All this material is characterized by very smooth fracture surfaces. The reddish component in the colouration might indicate colour changes attendant upon the oxidization of iron in flint/chert that can be induced by heat treatment (Domanski and Webb 1992). Observation of heated Jīlāt tabular and wadi material, and the differences in cortex, suggest that it may not be heated Jīlāt material. However, it may be heat treated material from outside of Jīlāt.

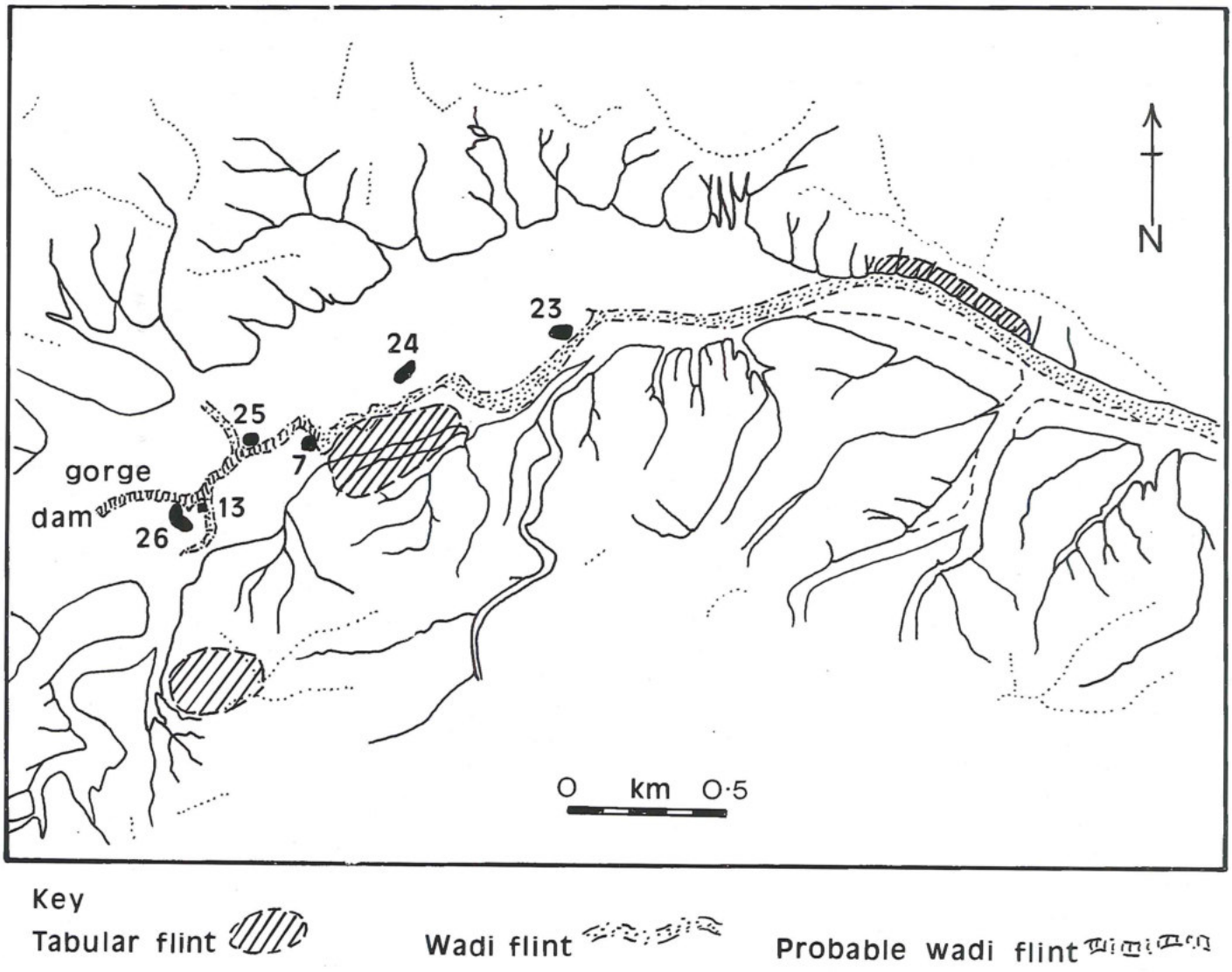
There is also an exotic translucent yellow material. It derives from tabular and wadi cobble sources. The partially translucent character of this material, along with its yellow to yellow white colour, distinguishes it clearly from all other materials in Jīlāt or al-Azraq.

Having documented discrete material types encountered in Jīlāt and al-Azraq Neolithic assemblages, we can outline the distribution of the various raw material sources across the landscape in relation to the sites. By comparing acquisition patterns with availability, we can assess whether acquisition was directed or possibly directed/possibly random and thus search for factors which may have produced any choices evidenced. To document correctly past availability and choice, we must be sure we have identified the location of all proximate sources and the sources of all the most important materials used on sites. We must be sure no sources have been significantly altered, i.e. disappeared, appeared, become significantly more or less abundant. As may be appreciated our ability to satisfy these conditions in most areas is very difficult. In Jīlāt we have what is perhaps a unique opportunity to satisfy all conditions. The reasons for this are:

1) the abundance of suitable raw material sources in Jīlāt and their proximity to the sites;
2) the visibility of material sources in this desert environment lacking significant vegetational or soil cover;

3) the absence of Holocene depositional or erosional events of sufficient order to mask or remove sources;
4) the permanent or predictable character of the sources in the relevant geological and geomorphological terms;
5) our consequent ability to determine fairly precisely the distance of sites from sources;
6) the ability to make significant distinctions in raw material type applicable to the archaeological material on an extensive scale.

The position of choice in relation to each site in Jīlāt is summarised in TABLE 2. All the sites almost certainly had relatively immediate access to some supplies of wadi cobbles. Tabular material was located c. 500 m from




2. Distribution of flint sources in relation to Neolithic sites in Wādī al-Jīlāt.

**Table 2.** Degree of access to main Jīlāt raw material types from each site.

| | *Sites* | | | | |
|---|---|---|---|---|---|
| | WJ7 | WJ13 | WJ25 | WJ26 | WJ32 |
| *Material* | | | | | |
| Wadi | Immediate | Immediate | Immediate | Immediate | Immediate |
| Tabular | Immediate | 500m | 500m | 500m | 3km |

WJ13, 25 and 26; 3 km from WJ32 and immediately adjacent to WJ7 (FIG. 2; TABLE 2).

It remains to compare the actual procurement of raw material, occupation by occupation, with availability, in the light of reduction strategy preferences, to assess procurement practices. It seems advisable to reconstruct procurement on the basis of proportions of cores of each material type. Cores provide an indication likely to be closer to raw material nodules procured than any measure based on proportions of debitage. At least that is the case when there is clear evidence for on site production, through all stages of the reduction sequence, for all material categories, as there is on the Jīlāt sites. TABLES 4-6 document raw material use in each occupation in relation to the main reduction strategies. By reduction strategy is meant the broad approach to the reduction of a block of raw material. That is the nature of preparation, location of striking platforms and order of removals. Based on extensive analyses (Baird 1993: Section 6) it appeared that the number and relative location of platforms on cores was the best guide to strategies. Three main categories were used: 1) single platform cores; 2) change of orientation cores, where new platforms were created by rotating the core in a number of directions; and 3) opposed platform cores, with two platforms directly opposite one another. This last category was dominated by naviform cores. There are a variety of reasons for suggesting that change of orientation strategies represent an extension of single platform strategies. Therefore, when evidence for similar relationships between raw material use for single platform and change of orientation strategies exists, these strategies are considered together in contrast to opposed platform strategies.

A consideration of all cores from all the Azraq project Neolithic sites tends to suggest that there are relationships between opposed platform strategies and tabular material, and wadi material and single platform and change of orientation strategies over a considerable time period (TABLE 3). If naviform and related cores are considered separately, an even stronger relationship can be documented between naviform strategies and the use of tabular material. Thus there are 114 naviform and related cores of tabular raw material, but only 36 of such naviform cores that are wadi material. These relationships are strong enough to suggest some preference in the use of certain raw materials for certain strategies, procurement practices aside. In this light, procurement practice and evidence for selectivity can be considered in each occupation in Jīlāt.

If we compare the use of raw material on the different sites during the different phases, as attested by cores (TABLE 4), with the available resources the following becomes clear:

1) In the Early PPNB on WJ7 Phase I, a pattern occurs that differs significantly from that which might be expected in a random use of local sources. If random acquisition occurred from the adjacent sources, or sources in the general area, roughly equal proportions of tabular and wadi types might be expected. In this occupation wadi material outnumbers tabular by more than 2:1 (TABLES 4 and 6). In this case procurement appears directed. In this phase there is also an indication of the selective use of raw material which suggests procurement was directed to fulfil the requirements of the different reduction strategies. Tabular material occurs as a disproportionately large proportion of opposed platform cores compared to the proportion of tabular material in the overall assemblage (TABLE 6). Opposed platform cores make up disproportionate proportions of tabular material compared to their occurrence in the total assemblage (TABLE 5). A relationship appears to exist between opposed platform production and tabular material which may reflect a preference on the knappers part. Thus, it may well be that because single platform and change of orientation strategies dominate reduction in the Early PPNB here, wadi material dominates material acquisition. Clearly wadi material was used for opposed platform cores and tabular material for single and change of orientation cores, so these relationships reflect only preferences. It seems probable that here the minority reduction strategy had to operate in the procurement environment of the dominant strategy. The other notable feature is the relatively high proportion of exotic material exploited; exotic red material forms 16.5% of cores. Exotic translucent yellow material was also used, but no cores were retrieved.
2) In Middle PPNB WJ7 Phase II (seventh millennium BC), there is some indication of a preference for the procurement of tabular material (TABLES 4 and 6). If

**Table 3.** Relationship between main reduction strategies and raw material used for all cores from the Azraq Project Neolithic sites.

| *Core platform class* | *Raw material* | | | |
|---|---|---|---|---|
| | Wadi | Tabular | Exotic red | Translucent |
| Opposed | 74 | 164 | 9 | 2 |
| Single | 96 | 47 | 6 | 0 |
| Change of orientation | 91 | 34 | 9 | 3 |

**Table 4.** Raw material use in relation to reduction strategies in each occupation.

| *Occupation* | *Wadi* | *Tabular* | *Exotic red* | *Exotic translucent* |
|---|---|---|---|---|
| WJ7 Phase I | | | | |
| Opposed | 15 | 11 | 5 | |
| Single | 20 | 4 | 2 | |
| Change | 13 | 4 | 6 | |
| WJ7 Phase II | | | | |
| Opposed | 1 | 5 | | |
| Single | 1 | 1 | | |
| Change | 2 | 1 | | |
| WJ7 Phase III | | | | |
| Opposed | 13 | 18 | 2 | |
| Single | 6 | 5 | 3 | |
| Change | 4 | 3 | 1 | |
| WJ26 | | | | |
| Opposed | 13 | 91 | 1 | 2 |
| Single | 10 | 18 | | |
| Change | 4 | 13 | | |
| WJ32 | | | | |
| Opposed | 1 | 1 | | |
| Single | 3 | 1 | | |
| WJ13 Phase I | | | | |
| Opposed | 2 | 8 | | |
| Single | 4 | 4 | 1 | |
| Change | 4 | 2 | 1 | |
| WJ13 Phase II | | | | |
| Opposed | 24 | 25 | | |
| Single | 31 | 7 | | |
| Change | 34 | 7 | 1 | |
| WJ25 | | | | |
| Opposed | 5 | 5 | 1 | |
| Single | 21 | 7 | | |
| Change | 30 | 4 | | 1 |

procurement was directed it may have been for the use of tabular material for opposed platform strategies, as a disproportionate proportion of tabular material was used for opposed platform strategies (particularly naviform strategies; TABLES 4 and 6). Exotic red cores are absent. Caution must be exercised as the sample size is small.

3) There are indications of relationships between tabular material and opposed platform strategies, and wadi material and single platform and change of orientation strategies in WJ7 Phase III (seventh millennium BC), but these relationships do not appear strong (TABLES 4-6). Exotic red material occurs in lower proportions than in WJ7 Phase I and there are indications, particularly in core type and size, that many of these cores are residuals. There is, however, at least one exotic red material naviform core and Byblos points made of this material occur occasionally in this phase. Both are good indicators that exotic red material continued to be used, but to a limited extent, in the seventh millennium BC on WJ7.

4) The evidence from Middle PPNB WJ26 (seventh mil-

**Table 5.** Proportions of each of the main reduction strategy categories in each raw material category compared to the proportions of each core type in each phase.

| | *(Percentage of each material type)* | | |
|---|---|---|---|
| | Wadi | Tabular | Core Type |
| WJ7 Phase I | % | % | % |
| Opposed | 31.25 | 57.89 | 38.81 |
| Single platform/ change of orient | 68.75 | 42.10 | 61.19 |
| WJ7 Phase II | | | |
| Opposed | 25. | 71.43 | 54.55 |
| Single platform/ change of orient | 75. | 28.57 | 45.45 |
| WJ7 Phase III | | | |
| Opposed | 56.52 | 69.23 | 63.27 |
| Single platform/ change of orient | 43.48 | 30.77 | 36.73 |
| WJ26 | | | |
| Opposed | 48.14 | 74.59 | 69.80 |
| Single platform/ change of orient | 51.85 | 25.41 | 30.20 |
| WJ32 | | | |
| Opposed | 25. | 50. | 33.33 |
| Single platform/ change of orient | 75. | 50. | 66.67 |
| WJ13 Phase I | | | |
| Opposed | 20. | 57.14 | 41.67 |
| Single platform/ change of orient | 80. | 42.86 | 58.33 |
| WJ13 Phase II | | | |
| Opposed | 26.97 | 64.10 | 38.28 |
| Single platform/ change of orient | 73.03 | 35.90 | 61.72 |
| WJ25 | | | |
| Opposed | 8.93 | 31.25 | 13.89 |
| Single platform/ change of orient | 91.07 | 68.75 | 86.11 |

lennium BC) is unequivocal. In a situation where the most proximate and abundant sources were wadi cobbles, tabular flint dominates to a dramatic extent (TABLES 4 and 6). Such an acquisition profile can only be seen as a result of directed procurement. On WJ26, where interest in tabular material was clearly strong, tabular material even outnumbers wadi material in single platform and change of orientation cores (TABLES 4 and 6). However, wadi material is used disproportionately for these strategies, disproportionate that is to its overall frequency in the assemblage (TABLE 6). The extra efforts to obtain tabular material, but relationship between wadi and single platform and change of orientation strategies, suggest that procurement was driven by reduction strategy preferences and directed towards satisfying the needs of opposed platform production, and that occasional single and change of orientation production then had to function in that procurement environment. A similar argument, in reverse, is made for the situation on Early PPNB WJ7. Exotic red material was obtained very

**Table 6.** Proportions of each raw material category in opposed platform and single platform/change of orientation core categories compared to proportions of each raw material category in each phase.

| | Wadi | Tabular |
|---|---|---|
| WJ7 Phase I | % | % |
| Opposed | 57.69 | 42.31 |
| Single platform/ | | |
| Change of orientation | 80.48 | 19.51 |
| % of total material | 71.64 | 28.36 |
| WJ7 Phase II | | |
| Opposed | 16.67 | 83.33 |
| Single platform/ | | |
| Change of orientation | 60. | 40. |
| % of total material | 36.36 | 63.64 |
| WJ7 Phase III | | |
| Opposed | 41.94 | 58.06 |
| Single platform/ | | |
| Change of orientation | 55.56 | 44.44 |
| % of total material | 46.94 | 53.06 |
| WJ26 | | |
| Opposed | 12.5 | 87.5 |
| Single platform/ | | |
| Change of orientation | 31.11 | 68.89 |
| % of total material | 18.12 | 81.88 |
| WJ32 | | |
| Opposed | 50. | 50. |
| Single platform/ | | |
| change of orientation | 75. | 25. |
| % of total material | 66.67 | 33.33 |
| WJ13 Phase I | | |
| Opposed | 20. | 80. |
| Single platform/ | | |
| change of orientation | 57.14 | 42.86 |
| % of total material | 41.67 | 58.33 |
| WJ13 Phase II | | |
| Opposed | 48.98 | 51.02 |
| Single platform/ | | |
| change of orientation | 82.28 | 17.72 |
| % of total material | 69.53 | 30.47 |
| WJ25 | | |
| Opposed | 50. | 50. |
| Single platform/ | | |
| change of orientation | 82.26 | 17.74 |
| % of total material | 77.78 | 22.22 |

rarely (TABLE 4). Whilst exotics are relatively rare compared to WJ7, including consideration of the obsidian recovered from WJ7 and not WJ26, an interest in exotic translucent yellow raw material is much more marked than on WJ7 (TABLE 4).

5) At Middle PPNB WJ32 an analogous, although dissimilar phenomenon, may exist. Here the very small core sample is dominated by nodular material from the surrounding hillside, but tabular raw material occurs in significant proportions (Baird 1993: 240, TABLE 6.10). The small core sample size may make conclusions suspect. To counterbalance this reference is made to the debitage. The fact that a considerable interest existed in obtaining tabular material at some distance (c. 3km), when perfectly worthy local sources were available, is indicated by the relatively high proportion of flakes attesting to the preparation of tabular slabs (Baird 1993: 259-261). It seems clear that extra efforts must have been expended in procuring significant quantities of this material. Tabular material occurs as a disproportionate proportion of opposed platform cores (TABLE 6) and opposed platform cores occur as a disproportionate portion of tabular cores (TABLE 5), suggesting a preference for tabular material for opposed platform production possibly directing procurement.

6) On Early Late Neolithic WJ13 Phase I, more tabular than wadi material is present (TABLES 4 and 6). This is in an environment where abundant wadi material is available immediately adjacent to the site and tabular material must be procured at a distance of c. 500m (FIG. 2). It seems extra efforts were expended on the procurement of tabular material. Tabular material was clearly preferred for opposed platform strategies (TABLES 4 and 6). Wadi material was used more frequently for single platform and change of orientation strategies relative to its occurrence in the total assemblage (TABLE 6). It is significant, however, that in a situation where single platform and change of orientation strategies considered together are the most important, tabular material still dominates overall. The needs of opposed platform production may have had considerable influence on procurement.

7) In Phase II on WJ13 (Early Late Neolithic), there is a clear shift to the acquisition of the immediately available wadi material (TABLES 4 and 6). Extra effort was still taken to procure a significant quantity of tabular material. Disproportionate quantities of the tabular material were used for opposed platform production (TABLES 4 and 5).

8) At WJ25 (Early Late Neolithic), there is a more extreme version of the pattern observed for WJ13 Phase II. Locally abundant wadi material completely dominates, some of it, in this case, of poorer quality. However, an interest in tabular material is still maintained, procured probably with extra effort (FIG. 2 and TABLE 4). A disproportionate amount of this tabular material was used, for the now less frequent, opposed platform strategies (TABLE 4). In the cases of both WJ13 Phase II and WJ25 it is interesting that extra energy was still expended to acquire material considered most suitable for a subsidiary component of the reduction repertoire.

A marked feature of this data is the dramatic decline in the use of exotic red material after the eighth millennium BC.

Throughout the Jīlāt sequence there is evidence that raw material was used differentially for different reduction strategies (TABLES 3-6). Since opposed platform reduction is quite separate from single platform and change of orientation reduction strategies, the knapper would have had to choose which strategy to execute upon a given block of raw material. Such relationships can only indicate preferences upon the part of the knappers. The strength of such preferences appear to have varied greatly. The reasons for such choices are easy to appreciate, however. The overall morphology of the tabular slabs is well adapted to the development of opposed platform removal surfaces, with minimal preparation. Further, single platform production would represent only a limited use of available surfaces of such slabs. The irregularity in the surface contours of wadi cobbles might favour single platform reduction or the positioning of platforms, in change of orientation strategies, to optimise production with given surface contours.

There is some evidence that these preferences influenced procurement patterns. Extra efforts were made to acquire tabular material when it was clearly preferred for opposed platform strategies (WJ26, WJ32, WJ13 and WJ25). Non-random procurement from adjacent sources (WJ7 Phases I and II) also seems to reflect reduction strategy preferences.

This data suggests that in certain settings marked differences in the availability of different raw material types, cobble as opposed to tabular/large, flat cobble sources, for example, might influence frequency of use of particular reduction strategies. In Jīlāt extra efforts were made to procure materials desired for required production strategies, but these efforts were not great. Tabular sources were located only a little further from some sites than wadi sources. At other seventh millennium BC sites in the Levant, what were almost certainly extra efforts were invested to obtain tabular or tabular-like material from a distance greater than that at which wadi material was located. Examples of this are Bayḍa (Mortensen 1970: 14-15), 'Ayn Ghazāl (Quintero and Wilke, pers. comm.), Baṣṭa (Nissen *et al.* 1987: 98) and Būqrās (Roodenberg 1986: 6). On this evidence, if tabular or tabular-like material became less accessible for some reason, it is

plausible that this might induce a change in the relative importance of single platform and change of orientation strategies.

In Jīlāt the situation at the beginning of the Late Neolithic is instructive because access to alternative sources was relatively easy. Minimal extra effort was required to acquire tabular material; in other words access was not an issue. At WJ13 in Phase I, despite the growth in importance of single platform and change of orientation strategies, such limited extra efforts were made to acquire tabular material, which was used more frequently overall. At WJ13 Phase II and WJ25, despite the lesser role of opposed platform production relative to single platform and change of orientation strategies considered together, extra efforts were still made to acquire tabular material, which was used disproportionately in opposed platform production. The situation in Jīlāt suggests that access to material was not necessarily a major factor in the growth in importance of single platform and change of orientation strategies and disappearance of naviform strategies at the beginning of the sixth millennium BC. There are, further, clear indications that extra efforts might still be made to procure material appropriate to particular strategies in the Early Late Neolithic.

The evidence of Jīlāt is that changes in procurement are intimately related to changes in overall production requirements and that reduction strategies are not conditioned by procurement factors.

However, an alternative hypothesis might still allow a role for procurement factors in the changes at the beginning of the Late Neolithic. If tabular and large, flat, cobble material was much more difficult of access in many areas of the Levant, a diminished desire to invest in the procurement of this material might promote an increase in importance of single platform and change of orientation strategies and the disappearance of naviform strategies by many communities. In which case the behaviour of the communities using Jīlāt might be a reflection of the broader technological context in which their behaviour was based and in which they as mobile communities had to operate. In this case a diminished willingness to invest in procurement in general, excluding reduction strategy preferences, would have to be explained.

If raw material supply/procurement factors may not have been responsible for the changes in the relative importance of reduction strategies at the beginning of the sixth millennium BC, then other factors must be examined. Opposed platform production, in particular naviform production, required considerable initial investment in preparation. In the case of naviforms this involved the creation of an elaborate, specifically shaped preform with multiple crests. This was followed by the problematic creation of suitably angled platforms. This was time consuming, required skill, and (preferably) suitable raw material, the acquisition of which in itself was often time consuming. The purpose of this effort was the obtainment of considerable numbers of relatively long, flat blades. The disappearance of naviform, and decline in opposed platform strategies, is likely to be ascribed to: 1) a diminished willingness to invest the necessary energies in preparation; or 2) a diminished interest in the production of long, flat blades.

The replacement of large Byblos and Amuq points with smaller and more elaborately flaked versions of these types, and the appearance of more elaborately shaped sickle segments, clearly for the manufacture of composite sickles (Gopher and Tsuk 1991: XVI-XVII), are an indication of the decline in importance of long, flat blanks. However, it is unclear whether they are the reason for it. An actual preference for these new tool types could be responsible, but we lack evidence for this. A lack of interest in maintaining previous investments of energy in chipped stone production might also be a factor.

Evidence for any shifts in the demands upon communities' energy expenditure may well be pertinent to this last issue, and also pertinent if a general reduction of investment in procurement is envisaged as responsible. In Jīlāt, at least, one major new factor at the beginning of the sixth millennium BC is the appearance of pastoralism (Baird *et al.* 1992; Garrard *et al.* 1994b). It appears as an *addition* to existing subsistence practices, as elsewhere. It seems likely that the exigencies of integrating new subsistence practices into existing behavioural systems may well have required redispositions of energy. A major question, then, is whether pastoralism generally appears around the end of the seventh/beginning of the sixth millennium BC in the southern Levant or whether it is present some time earlier. At Azraq 31 it may be present in the Late PPNB, but this issue is highly problematic (Baird *et al.* 1992). At Baṣṭa it is claimed to be present in the Late PPNB (Becker 1992), but it seems this occupation can placed at the very latest in the seventh millennium BC. At 'Ayn Ghazāl it may be present considerably earlier, as is claimed, but the evidence is problematic (Köhler-Rollefson *et al.* 1988: 425; Köhler-Rollefson 1989: 145); at 'Ayn Ghazāl pastoralism can only be confirmed at the beginning of the sixth millennium BC (Köhler-Rollefson *et al.* 1988: 426; Köhler-Rollefson 1989). Pastoralism is apparently not present at a number of other PPNB sites in the southern Levant (Horwitz 1989: 169) or Sinai (Bar-Yosef 1984). It is plausible that the appearance of pastoralism, and the demands it made upon the way in which society organized its activities, was ultimately responsible for technological change. However, we require better evidence of the date of the appearance of pastoralism before we can con-

firm or deny such a proposition.

Whether or not we eventually confirm or deny this proposition, we are still required to account for the changes in tool types. Such an account might have a role in explaining broader technological and behavioural change.

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# Burin Variability at Neolithic 'Ayn Ghazāl, Jordan

## Introduction

Burins constituted the predominant tool class at Neolithic 'Ayn Ghazāl (Rollefson *et al.* 1992: TABLE 4), and this situation is repeated at most Neolithic sites in the Near East. The role of burins remains enigmatic, but the importance this tool class held for Neolithic social groups must not be ignored because of this difficulty. For the moment, at least, we are left to consider specific changes in burin manufacture and how these standards relate to other patterns of socioeconomic developments during the Neolithic of the region.

## Burin Typology

One problem that inhibits meaningful assessments of changes in burin manufacture is the absence of a standardized typological classification of burin types found in Neolithic assemblages. While some sortings appear to be oversimplified (e.g., Mortensen 1971: 29, which includes only three burin types), others are more elaborate, although none are satisfactorily defined. Syntheses of site reports dealing with burin types are therefore necessarily flawed, since one person's "double burin" is another's "mixed burin" type. The lack of such rigor became evident when I tried to reconstruct the burin "classes" I published in an earlier report (Rollefson 1988) based on the original data: the type definitions were simply too vague to provide repeatable results.

The situation demanded a new approach, and the fruits of that effort are presented in TABLE 1. Limited space prevents a definition for each type here, but the type-names are perhaps sufficient for the time being (see Rollefson n.d. for a more thorough description).

FIG. 1 displays the cumulative graphs of burin types at 'Ayn Ghazāl and how the popularity of burin types changed during the major phases of occupation. Clearly, there is a change through time from an emphasis on a "convex trajectory" in the MPPNB to an increasingly "diagonal trajectory" by the Yarmoukian period. But by itself, FIG.1 is not explanatory, for all we see are the details of change, not the reasons for patterns of change.

**Table 1.** Burin typelist for analysis of combined 1983-89 burin samples from 'Ayn Ghazāl.

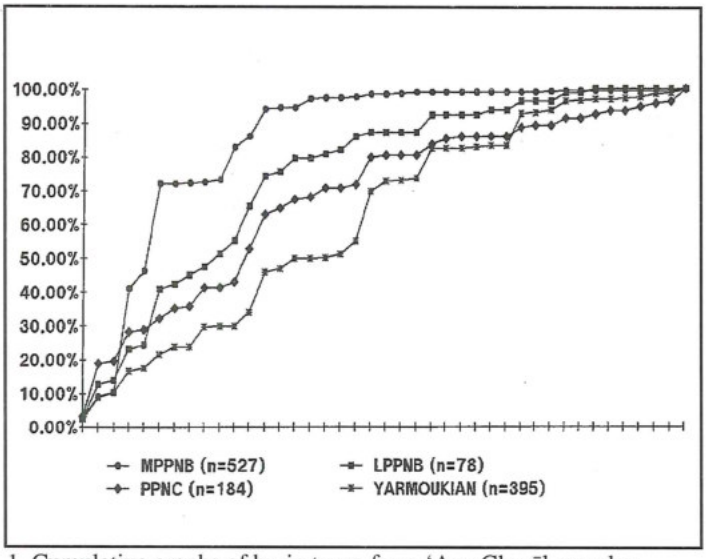
*Group I. Simple Burins*
1. Simple (no platform)
2. On break
3. Angle
4. Double simple
5. Double on break
6. Opposed simple-simple

*Group II. Transverse Burins*
7. Simple transverse
8. Transverse on a notch
9. Transverse on lateral retouch
10. Opposed simple-transverse
11. Opposed transverse-transverse

*Group III. Dihedral Burins*
12. Straight dihedral
13. Canted dihedral
14. Opposed dihedral-dihedral
15. Opposed simple-dihedral
16. Opposed transverse-straight dihedral
17. Opposed transverse-canted dihedral

*Group IV. Truncation Burins*
18. Straight truncation
19. Oblique truncation
20. Concave truncation
21. Convex truncation
22. Double straight truncation
23. Double oblique truncation
24. Double concave truncation
25. Double convex truncation
26. Opposed straight-oblique truncation
27. Opposed straight-concave truncation
28. Opposed oblique-concave truncation
29. Opposed oblique-convex truncation
30. Opposed concave-concave truncation
31. Opposed concave-convex truncation

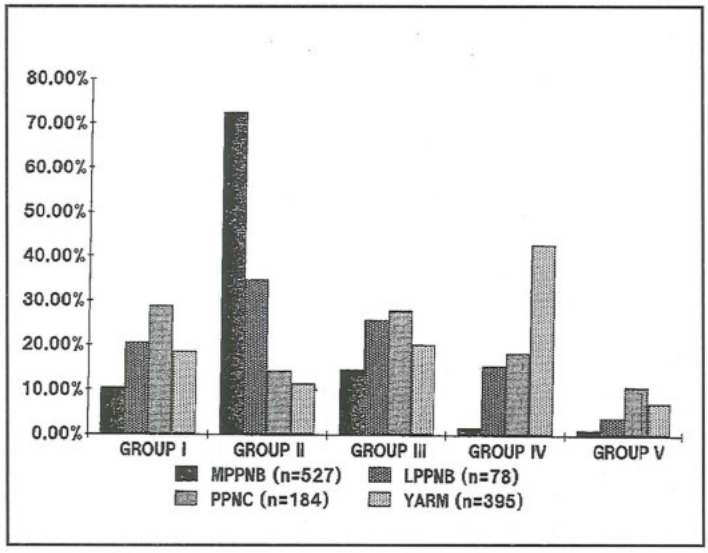
*Group V. Mixed Truncation Burins*
32. Opposed simple-oblique truncation
33. Opposed simple-concave truncation
34. Opposed simple-convex truncation
35. Opposed transverse-concave truncation
36. Opposed transverse-convex truncation
37. Opposed dihedral-straight truncation
38. Opposed dihedral-oblique truncation
39. Opposed dihedral-concave truncation
40. Opposed dihedral-convex truncation
41. Atypical/Other




1. Cumulative graphs of burin types from 'Aay Ghazāl samples.

In essence, the 40 burin types (plus Type 41, "atypical, other") are unmanageable in terms of interpreting the trends of FIG. 1. Because of the technological basis of the burin typelist, the 40 types can be "collapsed" into four burin "groups" that reflect the technological emphases during the different phases (TABLE 1). FIG. 2 and TABLE 2 show that while there is considerable diversity in changes through time at 'Ayn Ghazāl, at least one major trend is evident: the overwhelming dominance of transverse burins (Group II) in the MPPNB decreases sharply, replaced to a great extent by an increasing production of truncation burins (Group IV).

There is another trend visible in FIG. 2 that is less striking, but one that still needs comment. The replacement of the transverse groups by the truncation group coexists with a pattern that is similar among simple burins (Group I) and dihedral burins (Group III). In




2. Comparison of Burin Group indices from the principal phases at 'Ayn Ghazāl.

these three burin groups, there is a steady increase from the MPPNB through the PPNC periods, although a sudden surge of Group IV (truncation) burins in the Yarmoukian breaks the otherwise consistent temporal trend.

## Metric Variables

There are also consistent patterns of change in the absolute dimensions and ratios of measurements of the 'Ayn Ghazāl burins (TABLE 3). While burin length decreases steadily through time, thickness increases absolutely, with corresponding changes in the long section (IL = Th/L) and cross section (IX = Th/W). Based on 2-tailed t-tests, differences in mean length are statistically significant for all but the MPPNB:LPPNB comparison. For thickness variability, MPPNB samples are significantly different from all other samples, but the t-test results indicate that the other samples are possibly within the range of a single population. The strength of the change in length is shown by the IL changes: all means are significantly different from all others. Cross-section comparisons (IX) are also statistically meaningful except for the LPPNB:PPNC and PPNC:Yarmoukian tests.

Changes in width, although suggesting a general increase through time, are statistically significant only for MPPNB:PPNC and PPNC:Yarmoukian sample comparisons; the index of surface area (IA = W/L) matches the trend in width, and t-tests indicate that the MPPNB and LPPNB burin samples differ meaningfully from their PPNC and Yarmoukian counterparts, but not between themselves.

## Interpreting the Trends

If "form (=group) equals function", then clearly the needs served by the various burin groups were changing, even radically, during the more than 2000 years of the occupation of 'Ayn Ghazāl. While specific uses of burin types are enigmatic in any event, the functions of the burin groups may be related generally to changes in environmental exploitation, which in turn may relate to changes in the ecological situations faced by the resident population at different times.

Based on the analysis of faunal remains (Köhler-Rollefson *et al.* 1988), there was an undeniable and continual degradation of the environment in the immediate vicinity of 'Ayn Ghazāl during its occupational history. The forest and woodland animal species so frequent in the MPPNB became scarcer during the LPPNB period, and they were absolutely rare by PPNC and Yarmoukian times. This ecological change corresponds with a decrease in transverse burins and a corresponding increase in the other four burin groups.

There is the untested suggestion, then, that the transverse burin group (II) may be related to the exploitation of wood and/or woodland-associated animal species. The

**Table 2.** Burin Group indices for the various cultural phases at 'Ayn Ghazāl.

| *Phase* | *Group I* | *Group II* | *Group III* | *Group IV* |
|---|---|---|---|---|
| Yarmoukian | 18.72 | 11.54 | 20.51 | 49.03 |
| PPNC | 29.94 | 14.69 | 28.82 | 26.55 |
| LPPNB | 20.51 | 34.62 | 25.64 | 11.54 |
| MPPNB | 10.89 | 74.92 | 12.54 | 1.65 |

**Table 3.** Mean dimensions (mm) and ratios of burins from the various cultural phases at 'Ayn Ghazāl.

| *Phase* | *L* | *W* | *Th* | *IL* | *IA* | *IX* |
|---|---|---|---|---|---|---|
| Yarmoukian | 38.33 | 19.55 | 8.60 | 0.148 | 0.544 | 0.464 |
| PPNC | 42.60 | 21.51 | 8.91 | 0.191 | 0.551 | 0.444 |
| LPPNB | 48.26 | 20.60 | 8.22 | 0.232 | 0.437 | 0.411 |
| MPPNB | 51.25 | 19.99 | 6.85 | 0.239 | 0.436 | 0.354 |

consistent increase of truncation burins (Group IV) mirrors a trend towards a growing dependence on more xeric resources, correlated with a general increase of simple (Group I) and dihedral (Group III); the dominance of truncation burins in the Yarmoukian and surface artifact collections at 'Ayn Ghazāll reflects close similarities with the "Desert Neolithic", for example (Rollefson 1988).

Changes in burin groups are paralleled by developments in metrics and metric ratios. The initially longer and more delicate burins of the MPPNB gradually give way to increasingly chunkier, stubbier tools by the Yarmoukian period, when cross- and long- sections are similar to generally contemporaneous "burin site" collections from the eastern deserts of Jordan (Rollefson 1988). This is strong support for the argument that burin-related activities at Yarmoukian 'Ayn Ghazāl were similar to those at the apparently transhumant sites in the steppe and desert. Placed in the opposite perspective, the burin sites of eastern Jordan are likely associated with pastoral nomadism in view of the strong correlations among burin types and evidence of the increased importance of pastoralism at 'Ayn Ghazāl (Rollefson and Simmons 1987; Köhler-Rollefson 1988; Simmons *et al.* 1988).

Changes in burin dimensions and metric ratios at 'Ayn Ghazāl represent more than changes in intended function, for the lithic technology employed by the residents of 'Ayn Ghazāl underwent considerable change from the end of the eighth millennium to the end of the sixth (Rollefson *et al.* 1992; Rollefson n.d.). The use of specially prepared blade cores characteristic of the MPPNB and LPPNB periods gave way to a new method that resulted in thicker blades and flakes (Rollefson n.d.). Why lithic manufacturing techniques changed so radically remains speculative, but the effects of the technological change were necessarily related to the shapes and sizes of tools that resulted.

The consistent change in "delicacy" vs. "robusticity" of burin types from the MPPNB through the Yarmoukian periods at 'Ayn Ghazāl reflect, we maintain, changes in *both* lithic technology and intended function. The absence or rarity of burins at ceramic Neolithic farming sites (e.g. Jericho and Tall Abū Thawwāb), on the one hand, and pastorally-oriented sites such as burin-rich Yarmoukian 'Ayn Ghazāl and the eastern desert "burin sites" on the other hand reflect major contrasts in the need for burins (especially truncation types) in the two separate kinds of subsistence economy.

## Concluding Remarks

Ethnographic analogies to interpret the use of burins are rare and of questionable applicability to interpret the Levantine Neolithic archaeological record. Several recent edge-wear studies on burins have led to some degree of confusion (e.g. Moss 1983; Newcomer *et al.* 1986; Finlayson and Betts 1990). Simply put, there remains little in the way of direct or semi-direct evidence to judge the role of burins in the Neolithic tool kit.

It appears nevertheless that what the thin and relatively fragile burins of the MPPNB served gave way to demands of more rugged burin configurations through time, probably related to the gradual cultural degradation of the local environment. It is important to note that at 'Ayn Ghazāl simple (Group I) and transverse (Group II) burins always constituted important components of the burin inventory, even in the Yarmoukian period. One of the few ecological zones to be essentially undisturbed was the riverine vegetation bordering Wādī az-Zarqā'. It is possible, then, that simple and/or transverse burins

were used to process such plants as reeds for mats and basketry, materials useful to sedentary farmers and nomadic pastoralists alike.[1]

But regardless of the "burin function" dilemma, the stratified burin assemblages from 'Ayn Ghazāl have shown a utility of the burin type/group description for general temporal ascriptions of lithic scatters encountered during surveys, enabling a more precise relative dating than simple "aceramic/ceramic Neolithic", and for discerning M/LPPNB and PPNC sites in the absence of other distinguishing criteria.

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[1] Indirect evidence of the importance of woven mats is especially rich at Jericho (e.g., Kenyon 1981: 271), and reeds were certainly abundant near 'Ayn as-Sulṭān in PPNB times (with high Burin Group II counts; cf. Rollefson n.d.). Reeds were also undoubtedly abundant during the PNA period at Jericho, but there is little evidence at all for reed use during that time, which coincides with an absence of simple/transverse burins. The use of reed mats/basketry is less certain at 'Ayn Ghazāl, but reed-impressed clay is relatively common there during the MPPNB, and the use of reeds in fashioning the "skeletons" of the plaster statues from the site is well attested (Rollefson 1983; Rollefson and Simmons 1986). At Tall Abū Thawwīb, the local landscape today suggests that reeds did not grow within the immediate vicinity of the site.

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# The Early Bronze Age at Faynān/Wādī 'Arabah: A Period of New Technology in Copper Production

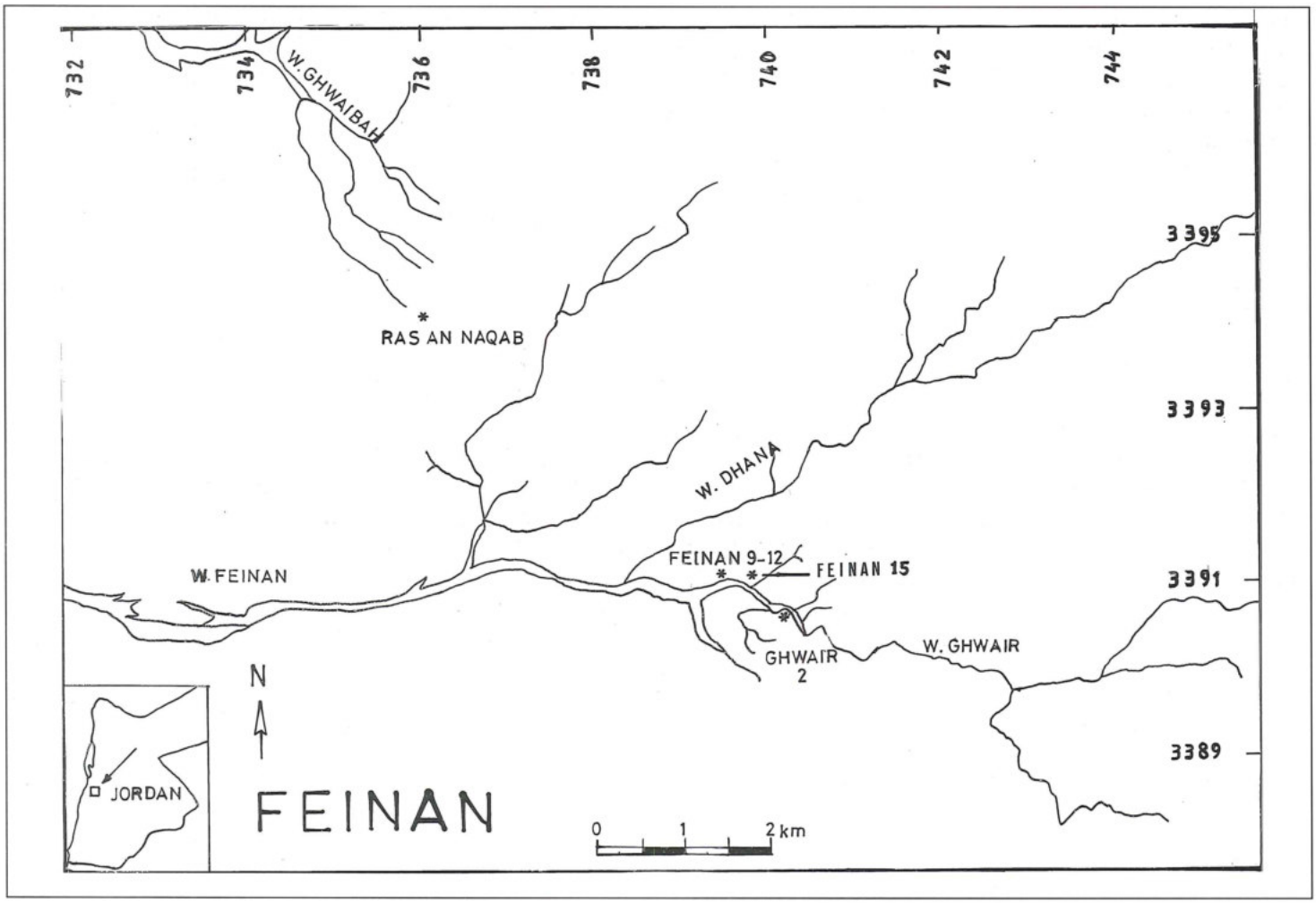
Copper production represents one of the many socioeconomic changes that characterized the history of Jordan with the beginning of the Bronze Age. The emphasis on copper production derives from the necessity for determining when and how copper was produced at Faynān on the one hand and how did copper production at Faynān fit into the general economy of the southern Levant on the other. Mining started very early in the Pre-Pottery Neolithic (Hauptmann 1991), but smelting activities began much later. The use of copper ores can be traced to the PPNB, when "greenstone" beads and green powder for cosmetics became popular all over Transjordan and Palestine. Greenstones from Pre-Pottery Neolithic levels at Jericho, 'Ayn Ghazāl and Bayḍa consist very often of copper ores from the Faynān district (unpublished results, Faynān Project).

The tradition of working metal extends back into the Chalcolithic (Hauptmann 1989; Weisgerber and Hauptmann 1988) – and maybe earlier in the Neolithic – when copper ore was followed down from where it outcropped at the surface with the help of primitive stone hammers and chisels. The distinctive marks made by the tools can be clearly seen on the walls of the galleries of the mines at Jabal Khālid and Umm al-'Amad. In this period smelting took place on a small scale within the settlements, in bowl-like crucibles (Khalil 1985) heated from above. For this kind of household-metallurgy malachite was mainly used, but it was not until the early third millennium BC and the advent of smelting, that copper production reached its highest point. Of secondary importance is the copper mineralization along veins in the Massive Brown Sandstone Unit (MBS), which was intensively mined during the Chalcolithic and later in Roman times. Here the main copper carrying minerals are malachite, with relics of chalcocite and tile ore, and paratacamite, but the main ore body in Faynān consists of a 1-2m layer of secondary copper ores in the Dolomite-Limestone-Shale Unit (DLS) which was mainly exploited during the Early Bronze and Iron Ages. Predominant copper minerals are Cu-silicates and malachite. The mineral content and the intimate inter-growth with black manganese oxides give the ores a distinctive appearance that allows to tell them apart from all other copper occurrences in the Levant.

In the history of copper smelting at Faynān, the technology which led to the production of 300-500 tons of copper during the early Bronze Ages is of particular interest and that is why the reconstruction of this technology became one of the main goals of the Faynān Project. Methods of extractive metallurgy apparently reached a first high technological level then. From that point onwards, metal smelting was not limited to the use of pure copper minerals only. The ability to smelt lower grade ores (inter-growth with host rocks) facilitated the exploitation of huge resources. These facts mark a certain revolutionary development of copper metallurgy and caused a considerable expansion of mining and smelting. Therefore, it seems that copper production at Faynān in the middle of the third millennium had far extending effects on the economy and trade relationships in the early phases of the Bronze Age for the entire region. Possibly, the importance of copper metallurgy was such that it may have served as a catalyst for the emergence of urbanism in southern Palestine and Transjordan in the Early Bronze Age (Kempinski 1989; Ilan and Sebanne 1989).

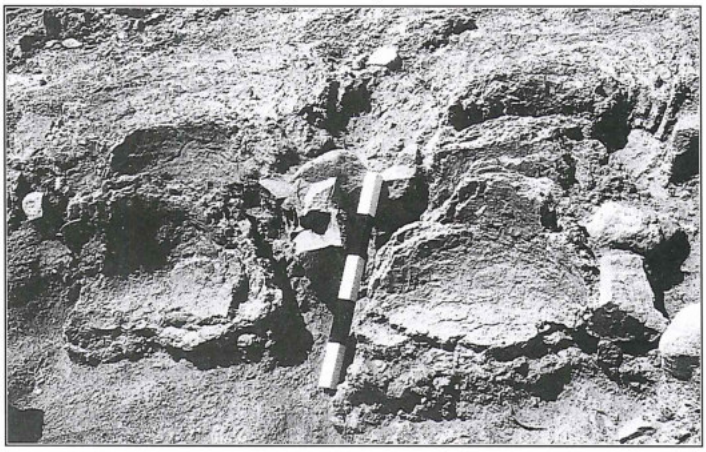
The Jordanian-German team at Faynān worked between 1986-1990 (Hauptmann and Weisgerber 1987; Najjar 1990; Najjar *et al.* 1990) at 12 smelting sites, where metal was produced leaving the earliest, and so far the largest slag heaps known in southern Levant. The amount of slag heaps found at different sites clearly demonstrates a copper production on an industrial scale.

Faynān 9 and 15 (FIG. 1) were discovered and excavated between 1986-1988, the later site is situated on a slope facing east. From there it has an open view to the East Jordanian Plateau over Wādī Ghwair. This seems to be quite a typical situation for an Early Bronze Age smelting site. The slags extend to the east of the furnaces, over an area of about 600 square metres and to a




1. Location map of Faynān (Feinan).

depth varying between 20 and 40cm. The heaps are very eroded and flattened. Fragments of furnaces were found in the slag heaps at Faynān 5, 15 and Rās an-Naqab. Our excavations had the good fortune to discover several of these furnaces almost intact, buried in the slags. More than 50 smelting furnaces were discovered. All of them were built on tops of hills facing the strong seasonal winds. The excavation revealed a unique design of furnaces compatible with operations by natural draught. The early furnaces were of clay-lined stones and there is evidence of relining up to more than 20 times. The furnaces would have been a simple cylinder open from the front and of about 20cm preserved height . The diameter can be estimated at about 50cm. The best parallel to the form of the furnaces could be the "tractor seat" (FIG. 2). Heavily tempered with straw and sometimes with tiny fragments of slag, lining fragments show a considerable degree of vitrification penetrating for several centimetres, suggesting a high temperature maintained for many hours. In almost all of the cases, the back clay walls of the furnaces were renewed many times. The unique design of the furnaces provides the possibility to reach temperatures up to 1200 degrees Celsius, and that is high enough to produce copper and slag in the liquid state. The use of mixed copper/manganese ores from the Early Bronze Age onwards was intimately connected with the development of fluxing. This made the separating of copper from the host rocks in the liquid state possible, although at the beginning the separation from the slag was



2 . Early bronze furnaces.

not carried through to completion mainly because of the not fully liquid state of the slags during the smelting process under primitive conditions. Having smelted the ore, the raw copper has to be separated from the slags. First the slags were crushed, and this was usually done in the immediate vicinity of the furnaces – around the furnaces at Faynān 15 and Rās an-Naqab the excavations revealed a series of mortars carved into the rocks – then after that the prills and lumps of copper most probably were melted into bigger pieces and finally cast into copper ingots. The copper produced at Faynān was rather pure except for a minor lead content. The chemical composition of the metal enables a clear distinction from any deliberately or unintentionally produced alloys such as As/Sb-copper or Sn-bronze, which were common in the southern Levant during the Early Bronze Age. The work on the archaeometallurgy of copper in the Faynān area sponsored by the Volkswagen Foundation/Germany began as a joint research project between the Department of Antiquities of Jordan and the German Mining Museum to investigate the remains of early copper production at Faynān/Wādī 'Arabah.

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# The Same but Different: A Comparison of Middle Bronze Age Metalwork from Jericho and Tall aḍ-Ḍab'a

## Introduction

Traditional typological study and the investigation by scientific means of technological aspects of archaeological material can both produce data of value to the relevant specialist as shown below. However, when these methods are used in combination, they can generate new information of greater interest to the wider archaeological community. The aim of the present paper is to illustrate the information obtained using both approaches, and then to draw together the two data sets and to assess their combined implications for wider archaeological questions.

While a consideration of archaeological context should play a part in any overall comparative analysis, this aspect of the material is not treated here for the following reasons:

1. The bulk of the Jericho material comes from tombs containing multiple, successive interments rendering difficult any attempt to detect patterning among the mixed-up artefacts.
2. As far as Tall aḍ-Ḍab'a is concerned, an explication of patterns of artefact deposition, and age-sex associations of the metalwork from graves at this site is scheduled to appear elsewhere (Philip, in press). As a result, I have decided not to repeat this information in the present study.

Recent work (Philip 1989: 169-172) has shown that the metalwork of the southern Levant and the eastern Nile Delta shows a remarkable degree of stylistic homogeneity during the MB II period. However, it has not been possible to establish whether this material represents the widely traded products of a single centre, or whether similar artefacts were being made over a wide geographical area. Each solution to this problem has its own implications for the socio-economic organization of the region during the Middle Bronze Age. While such material has been recovered from numerous sites, only two, Jericho and Tall aḍ-Ḍab'a, have produced sufficiently large bodies of chemical analyses to permit us to move beyond the obvious typological resemblances, and to consider the comparative technology of the two groups of material. This aspect of the material may have important implications for the organization of production and distribution of metalwork during the Middle Bronze Age.

## Typology

One group comes from Tall aḍ-Ḍab'a in the eastern Nile Delta, a site which has produced much MB II metalwork in Syro-Palestinian style, much of this from graves. The site is probably to be identified with Avaris, capital of the Hyksos (Bietak 1991: 28). This material is currently being prepared for publication by the present writer. The other comes from the Middle Bronze Age tombs at Jericho, excavated by Kenyon (1960; 1965). Metallurgical work was carried out by Khalil (1980), whose invaluable study of the Jericho metalwork remains the only substantial body of such analyses from a site in the southern Levant. It is a great pity that more information of this kind is not presently available.

Extant Middle Bronze Age metal objects from Jordan are few, but those reported resemble closely their Palestinian counterparts: e.g. material from graves on the 'Ammān Citadel (Najjar 1991: 110, and unpublished material seen courtesy of the Department of Antiquities of Jordan) or Pella (McNicoll *et al.* 1982: 39, PL. 111: 6-8; 42, PL. 111: 20; Smith and Potts 1992: 81, PL. 61: 16-20). Additional examples will doubtless be found as more Middle Bronze Age cemeteries are excavated. Unfortunately, with the exception of Khalil's (1980) pioneering work, little Middle Bronze Age metalwork from the region has been analysed.

Typologically, the Middle Bronze Age metal repertoires of Jericho and Tall aḍ-Ḍab'a are very similar. Both sites produce axes, daggers, curved knives, metal belts, toggle-pins, and other material typical for the south Levantine Middle Bronze Age. Compare for example the published material from Jericho (Kenyon 1960: FIGS. 117, 128, 177; 1965: FIGS. 111, 114, 174) with a selection of that from Tall aḍ-Ḍab'a (Bietak 1979: PL. 36; 1985: Abb. 12). In the case of the Tall aḍ-Ḍab'a metal-

work some types do show stronger Levantine parallels than others. Weapons in particular exhibit a high degree of stylistic conformity throughout the southern Levant and the Delta during the later Middle Bronze Age (Philip 1989: 168-72). The wide spatial distribution of metal objects in what are intrinsically unusual styles, indicates that the homogeneity of metal artefacts is deliberate. A case in point is provided by those daggers with broad, flat midribs (Philip 1989, Type 17) where it is doubtful if objects from the two sites could be distinguished by eye if mixed together.

All of the metalwork from Jericho comes from tombs dated to the MB IIB/C period, a period of no more than 200 years. That from Tall aḍ-Ḍab'a covers the later part of the MB IIA period and all of MB IIB/C, perhaps nearer 250 years in all. Given the size of the samples, and the mixing of material within the Jericho tombs, no attempt has been made to provide more refined chronological sub-divisions.

There must have been a reason for the employment of standard designs throughout the southern Levant and eastern Delta during this time. Fashion provides only a superficial explanation as we might reasonably ask by what mechanism these fashions spread so successfully. Jericho is a long way from the Nile Delta, and the two sites were located within very different physical and cultural settings. There is a noticeable difference between the ceramic assemblages from the two sites: compare the range of MB IIB/C vessels from Jericho (Kenyon 1960; 1965) with those from Tall aḍ-Ḍab'a (Bietak 1991: FIGS. 10, 11). However, there is a significantly closer resemblance between their metal repertoires. The reason for this may lie in the symbolic meaning of certain metal artefacts, and their social contexts of production and use.

**Limits of the Typological Approach**

While typological comparisons show that both Jericho and Tall aḍ-Ḍab'a (and a number of other sites for which, alas, no archaeometallurgical data are available) have very similar metal repertoires, this approach can take us little further. We cannot for example tell if the archaeological distribution owes to the widespread trading of goods manufactured at a single centre, or whether artefacts were being produced to highly standardized designs at two (or more) centres. In order to pursue this aspect of the material further, archaeometallurgical work is required.

**Archaeometallurgy**

In the process of investigating the problems outlined above, new data relevant to archaeometallurgical studies will be produced. These will have considerable intrinsic interest as our analytical database is still very limited. In addition they should shed additional light on patterns of production and distribution of metalwork. These results will be discussed below.

Attempts to trace metal artefacts to specific ore sources through study of their trace element patterns are fraught with problems as Craddock (1976) has pointed out. More sophisticated techniques such as lead isotope analysis may offer more hope in this direction (Sayre *et al.* 1992). However, researchers advocating this method of analysis have still to acknowledge fully both the scale of the problem presented by the recycling of scrap metal, and that posed by the deliberate addition of lead to tin-bronzes. The subsequent re-introduction of this lead to the metal pool, through the recycling of leaded, copper-alloy scrap could have potentially serious implications for the validity of lead isotope measurements taken from finished artefacts. The data from Jericho and Tall aḍ-Ḍab'a suggest that these are real problems and requiring serious consideration. Useful information relevant to matters of production and distribution, however, should be obtainable from an examination of the nature of the alloys employed at the two sites.

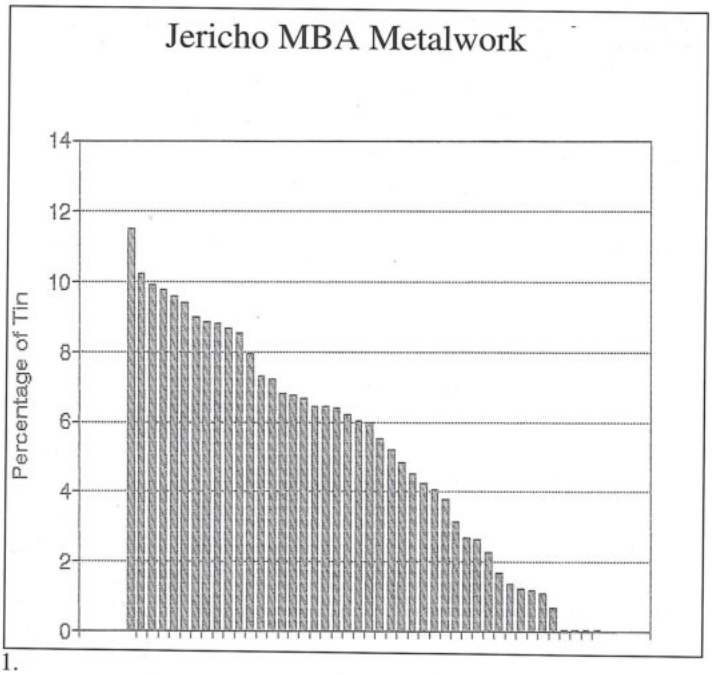
*Discussion of Analytical Results*

All objects discussed below were analysed by the same method: Atomic Absorption Spectrophotometry (AAS) on drilled samples. The analytical methods employed on the Tall aḍ-Ḍab'a material are those described by Hughes *et al.* (1976). Included are 44 objects from Jericho analysed by Dr Lutfi Khalil (Khalil 1980) and 41 objects from Tall aḍ-Ḍab'a analysed by Mr Mike Cowell of the British Museum Research Laboratory in preparation for the final publication of the metalwork from the latter site.

In the case of the Tall aḍ-Ḍab'a samples, the precision of the AAS technique is typically about 1-2% relative for most major and minor components and 10-50% relative for trace components, this depending on how closely the measured concentration approaches the detection limit. A description of the procedures employed on the material from Jericho is provided elsewhere (Khalil 1980: 55-57).

The data-sets described above are compared by means of a series of simple statistical methods, namely histograms for the display of single variables, and scatter plots where it is desired to explicate the relationship between two alloying elements.

*Tin (Sn):* Histograms showing the percentage of tin indicate that the material from both sites includes a number of good tin-bronzes. However, while the material from Jericho (FIG. 1) shows a relatively wide spread of tin contents, with few objects containing less than 2% Sn, and a median value of around 6% Sn, that from Tall aḍ-Ḍab'a (FIG. 2) shows a more marked division into tin-copper alloys, and a second group containing very low



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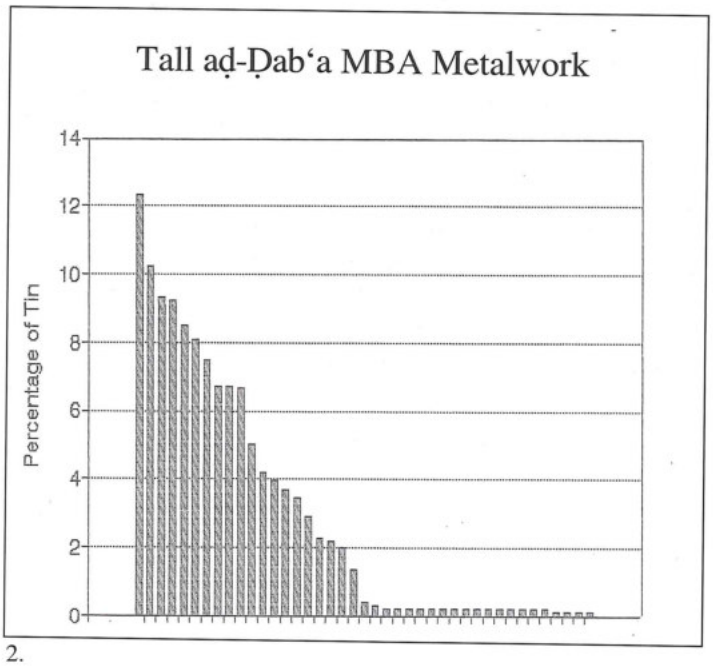

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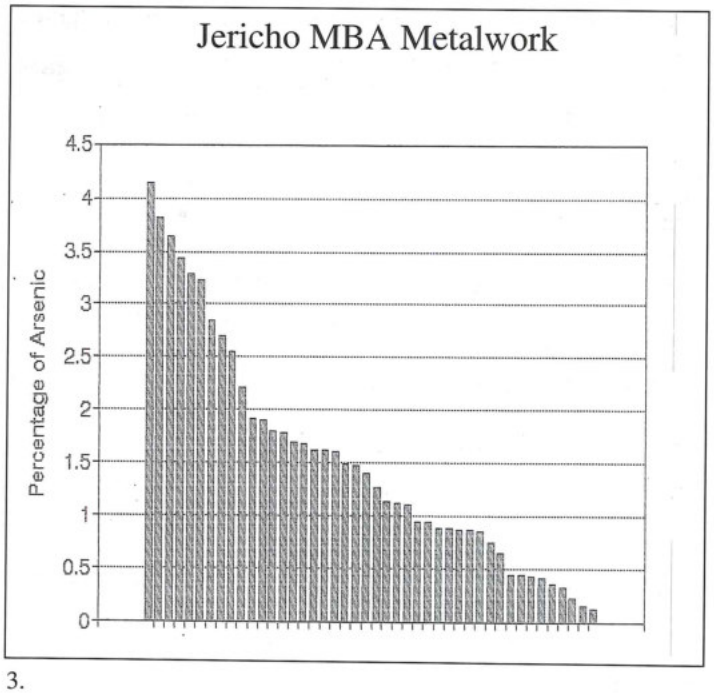

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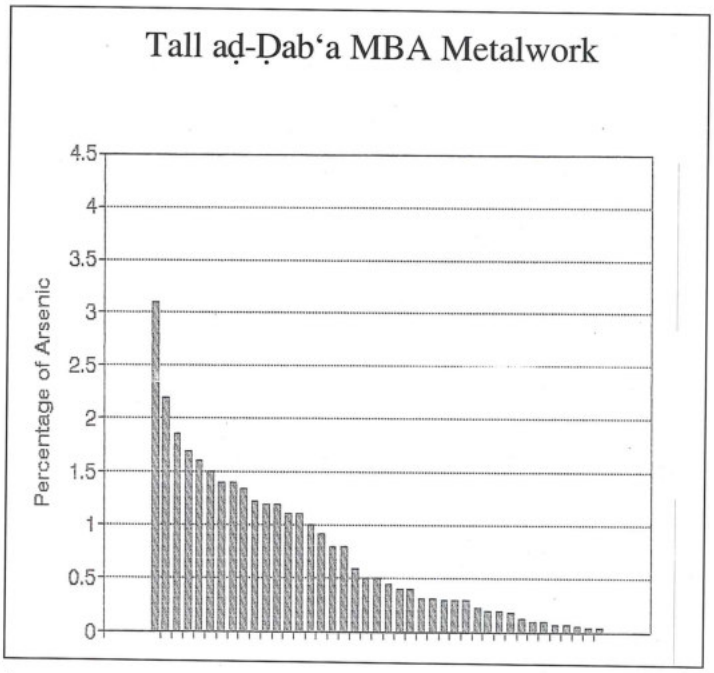


4.

quantities of tin. Here the median value is c. 0.2% Sn.

*Arsenic (As):* When the content of arsenic is plotted in the same way, the objects from Jericho (FIG. 3) can be seen to contain generally higher levels of arsenic, median c. 1.3% As, than do objects from Tall aḍ-Ḍab'a (FIG. 4), median 0.5% As. Almost 50% of the objects from Jericho contain more than 1.5% As, while only 20% contain less than 0.5% As. The Tall aḍ-Ḍab'a material reveals a different picture (FIG. 4), with just under 15% containing more than 1.5% As and around 55% less than 0.5% As. This difference should be significant.

Recent work on the comparative properties of copper-tin and copper-arsenic alloys (Northover 1989: 113), suggests that the presence of around 2-4% arsenic is required to significantly improve the toughness and hardness of a worked copper object, although arsenic retains its effectiveness as a de-oxidant at lower levels. In the case of the Tall aḍ-Ḍab'a objects, only 5% lie within this range, although, around one quarter of those from Jericho do so.

Arsenic is volatile and can easily be removed from molten metal by heating under oxidizing conditions, dur-

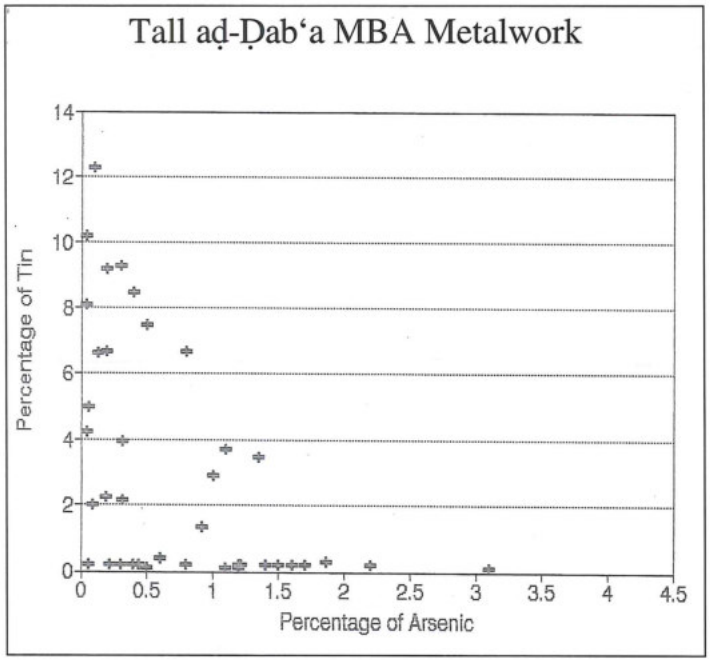
ing recycling or hot working for example (McKerrel and Tylecote 1972). As many of the Jericho objects contain arsenic at concentrations of less than between 1 and 2%, it seems likely on balance that the presence of arsenic in many of the objects from Jericho owes to its presence in the original copper ore, rather to deliberate addition. At Tall aḍ-Ḍab'a on the other hand, a good number of the objects seem to have been made from copper which was derived from a low-arsenic ore, or had been recycled so often as to have reduced significantly the original arsenic content. Other artefacts contain arsenic at levels more akin to those found at Jericho, perhaps indicating that copper from two different ore sources were in use at Tall aḍ-Ḍab'a, or that the metal employed for these had been subject to less extensive recycling.

A comparison of the pattern of co-occurrence of tin and arsenic in artefacts from the two sites is revealing. In the case of Tall aḍ-Ḍab'a (FIG. 5), objects containing tin at above 4% or so, nearly always contain arsenic at levels of 0.5% or less. Equally, those objects containing levels of arsenic over 1.5%, generally contain less than 0.5% tin. Pieces containing marked quantities of both tin and arsenic are relatively few, suggesting that a real distinction was made at the site between tin-bronzes and copper alloys containing arsenic above a certain level. Finally, the Tall aḍ-Ḍab'a plot shows a group of objects low in both tin and arsenic. These represent the objects made from low-arsenic copper discussed above.

Low-arsenic coppers are all but absent from the plot of the equivalent data from Jericho (FIG. 6), suggesting that much of the raw copper coming to Jericho may have originated from arsenical ores. A general trend is detectable. A good proportion of objects containing 6% or more tin show arsenic at less than 2.0%, while most of those containing arsenic at greater than 2.5% contain less than 3% tin. While a good proportion of the objects from Tall aḍ-Ḍab'a contain very low levels of tin (FIG. 2), these are relatively rare at Jericho, where all but four objects contain at least 1.0% tin. The bulk of objects from Jericho therefore contain some tin, a good number between 2 and 6% most of which also contain arsenic levels ranging between 1 and 2%. At Jericho then, there is rather more mixing of tin and arsenic in individual pieces than at Tall aḍ-Ḍab'a.

The suggested use at Jericho of copper with a higher natural arsenic content than that employed in many of the artefacts from Tall aḍ-Ḍab'a, would explain the generally higher arsenic levels noted in objects from the former site. However, this does not account for the more frequent co-occurrence of tin and arsenic in copper alloys at Jericho. Perhaps the answer lies in the role of scrap at the two sites. Tin is far less volatile than arsenic. Because of this, scrap tin-bronze will pass most of its tin content directly into the new alloy (Cowell 1987: 98).

Perhaps the underlying pattern at Jericho is that of smiths employing copper derived from arsenical ores, with the addition of a certain amount of tin through the mixing of this material with recycled metal, including scrap tin-bronze. The metal used at Jericho seems to have undergone considerably more mixing than that employed at Tall aḍ-Ḍab'a, where a rather different alloying pattern can be observed, and where a significant number of objects are low in both arsenic and tin. This suggests that copper from a low-arsenic ore was in use alongside

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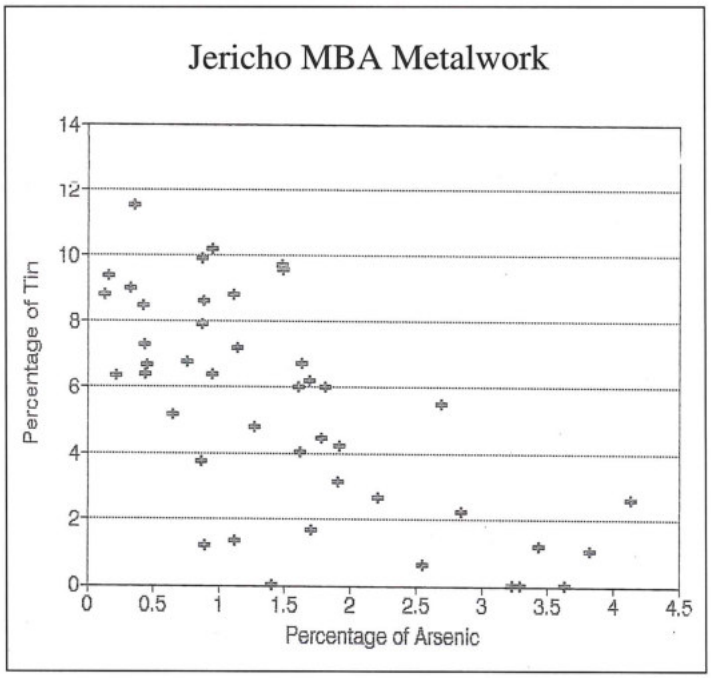



6.

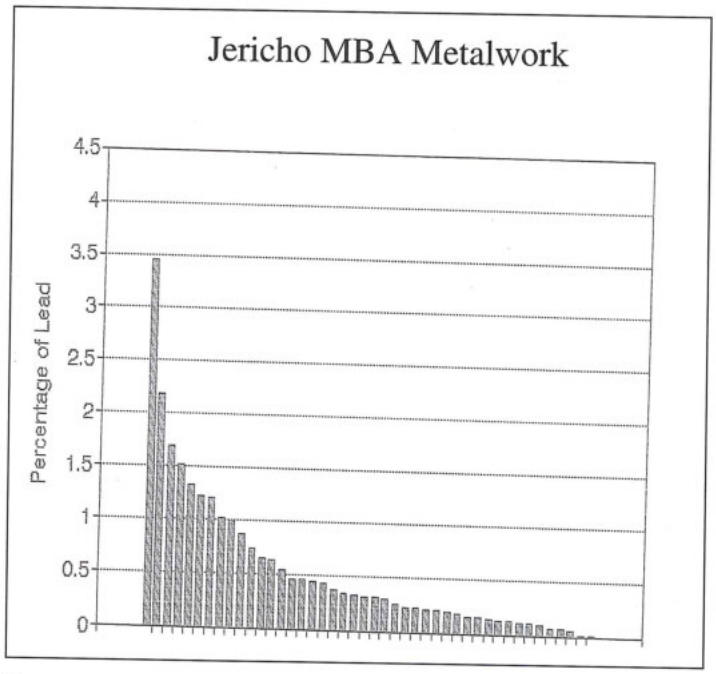
copper with a rather higher arsenic level. We might also argue that the relatively low tin levels of most unalloyed and arsenical copper objects from Tall aḍ-Ḍab'a indicate that scrap tin bronze was re-used in a more systematic manner than at Jericho. Perhaps there was a greater use of new metal at Tall aḍ-Ḍab'a, or perhaps scrap tin bronze was often kept aside, for use as an ingredient in new batches of tin-bronze, rather than being added to a common pool of scrap.

The evidence then suggests that more recycling of scrap took place at Jericho. Of course, we do not know the origin of the metal used at Jericho. Some of it may have arrived at the site as brought-in scrap, originating elsewhere, perhaps already a mixture of new and recycled metal. Whatever the exact mechanism, the general distribution of alloy types at the two sites suggests that we do indeed have two distinct industries, producing artefacts to highly standardized designs.

*Lead (Pb):* Recent work (Philip 1991: 101) has argued that there is evidence that lead was, on occasion, deliberately added to copper alloys at least as early as the Middle Bronze IIA period. While the addition of around 2% Pb to bronze both improves the fluidity of the cast metal and lowers the melting point, the presence of lead in greater quantities, however, adds little to the properties of the final product (Craddock and Giumlia-Mare 1988: 319). Although advantageous in cast metalwork, lead is not normally added to metal intended for sheet working, as it is insoluble in copper and the resulting globules of lead will form lines of weakness when hammered (Giumlia-Mare 1992: 108). In the majority of cases, the lead contents of the artefacts from both Jericho (FIG. 7) and Tall aḍ-Ḍab'a (FIG. 8) are low, typical of the trace amounts normally associated with copper ores.

However, there is one dagger from Jericho containing almost 3.5% Pb. It is of an unusual design (Philip 1989, Type 19: the only parallel is from al-Jib near Jerusalem [Pritchard 1963: 138, FIG. 51.39]). Furthermore, one axe from Tall aḍ-Ḍab'a contains more than 4% Pb. Both are tin-bronzes and may well represent genuine leaded bronzes. In addition to these clear examples, each site produced several artefacts containing lead at a level of around 1%. Cowell (1987: 98) has suggested that concentrations of lead above 1% found in analysed artefacts from ancient Egypt indicate its deliberate addition to alloy; levels below this represent its presence in the original copper-ore. The extension of this 'rule of thumb' to the material discussed here would indicate that the deliberate addition of lead was practiced, on occasion, at Jericho and Tall aḍ-Ḍab'a during the Middle Bronze Age.

In his study of Egyptian metalwork, Cowell (1987: 98, FIGS. 3 and 4) observed that lead contents of over 1% are associated exclusively with tin-bronze, rather than arsenical copper. When the lead content of our artefacts is plotted against those of tin and arsenic, a similar situation emerges. In the case of Jericho (FIG. 9), the few objects containing more than 1.5% lead, all contain at least 4% tin. The same picture exists among the Tall aḍ-Ḍab'a material (FIG. 10). At neither site were examples found of leaded high arsenic-copper alloys (FIGS. 11 and 12). In fact at Jericho, those objects containing 2% or more arsenic, contain lead levels of 0.5% or less (FIG. 11). At

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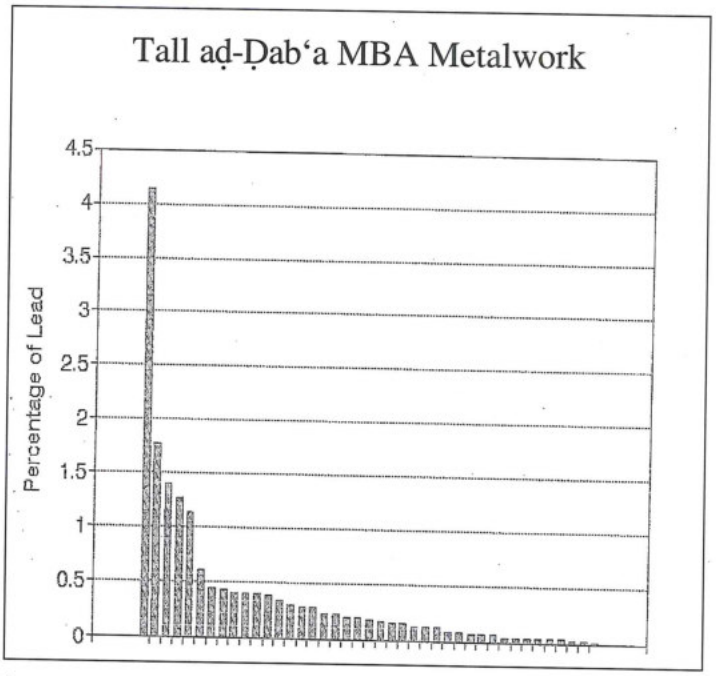


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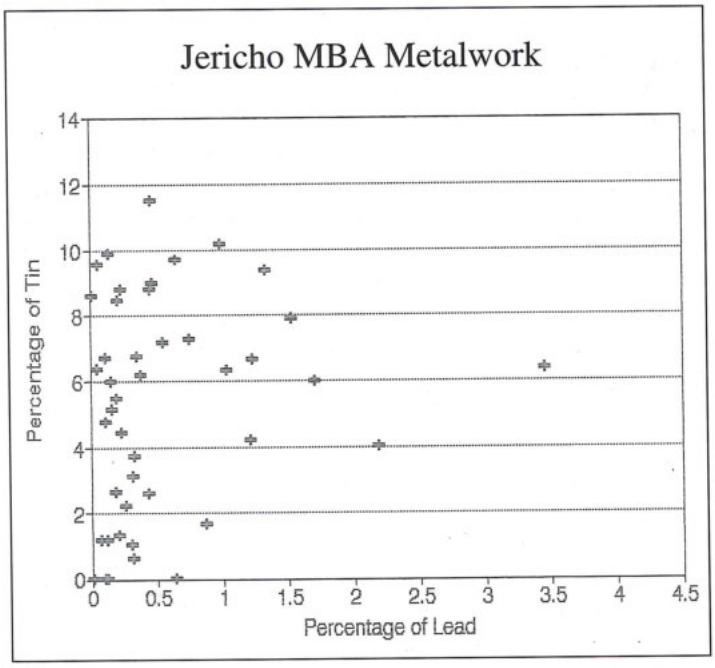


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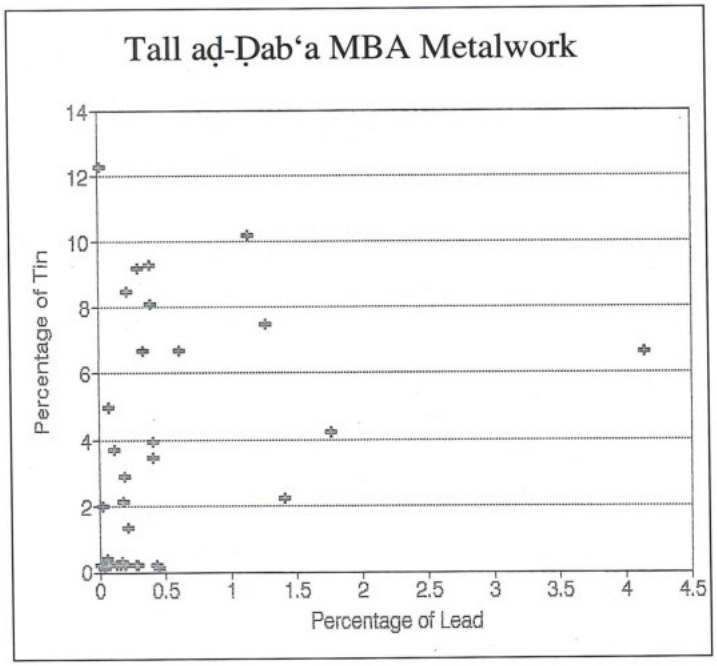


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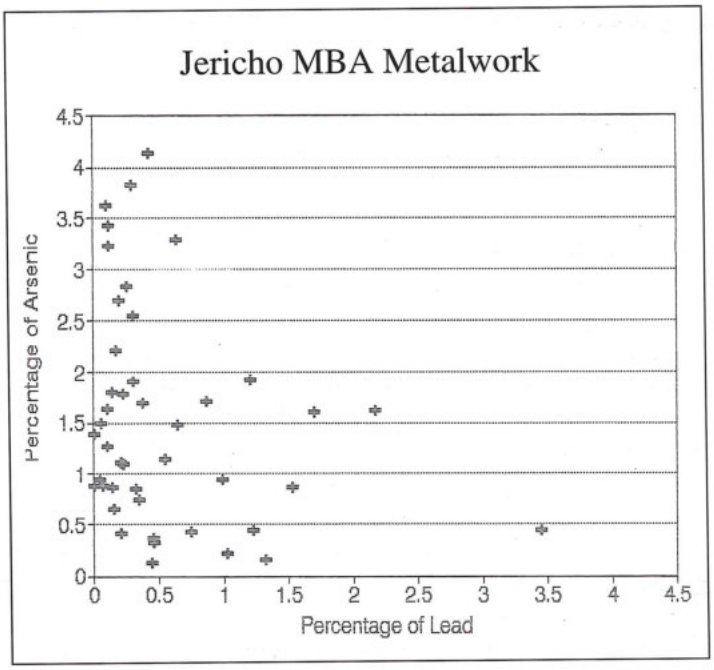


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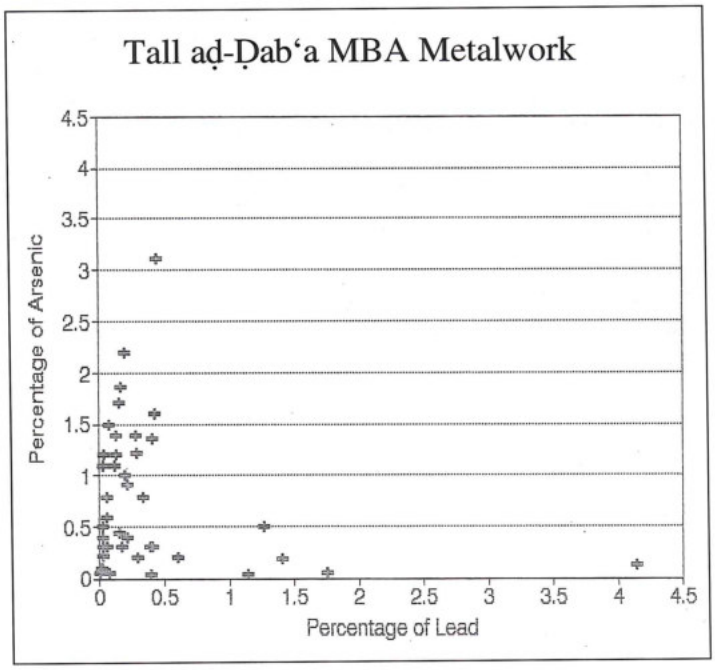


12.

Tall aḍ-Ḍab'a as well (FIG. 12), those objects which are high in lead are low in arsenic.

Although the data are limited, I suspect that we have at least a strong hint that increased levels of lead occur in association with the presence of significant amounts of tin. Therefore, the presence of lead in these artefacts cannot simply be explained away as owing to the presence of lead in the original copper ores. Rather, lead must have been added selectively to tin-bronzes. This picture holds for both sites, although the impression given by the data is that lead use in MB IIB/C artefacts was erratic. A similar pattern was suggested for the MB IIA period (Philip 1991). No clear correlation between the addition of lead and specific artefact types can be observed. This rather erratic occurrence is exactly the situation described by Craddock and Giumlia-Mare (1988: 319) as a consistent feature of the use of leaded bronzes in the Mediterranean region from the second millennium until the end of the Roman period. Returning to chronology, it is of interest to note that Cowell (1987: 98) observes that the majority of Egyptian leaded alloys are of Middle Kingdom or later date, and so begin to appear

contemporaneously with the Levantine Middle Bronze Age.

## Conclusions

What conclusions can be drawn from the comparison of these two bodies of data? The relatively low level of mixing of tin and arsenic at Tall aḍ-Ḍab'a suggests that much of this material was made from new metal, perhaps of two different 'kinds' or from two separate sources, or at least that scrap was recycled systematically. Jericho on the other hand, shows a greater co-occurence of tin and arsenic, suggesting an industry based on copper derived from arsenical ores. The frequent occurrence of low levels of tin suggests the widespread mixing of scrap tin bronze with new metal, or other forms of scrap.

The data from both sites add additional weight to the view (Cowell 1987; Philip 1991) that lead was added to copper-alloys as early as the Middle Bronze Age, albeit in a rather erratic fashion. Furthermore, there is a correlation between the use of lead and copper-tin alloys. Lead was not added to all types of copper-alloy. This association between lead and tin further reinforces the argument that the addition of lead was deliberate. The presence of lead cannot be dismissed simply as representing an impurity in the copper-ore. When due allowance is made for likelihood of scrap recycling on a substantial scale, as the evidence from Jericho would seem to imply, this fact has serious implications for the applicability of lead-isotope techniques as a means of relating copper-alloy artefacts to their source.

The integration of the typological and metallurgical data provides important evidence for the reconstruction of socio-economic developments in the Middle Bronze Age of the region. Perhaps smiths at smaller sites such as Jericho relied on the recycling of scrap to a greater extent than did those at the large, rich site of Tall aḍ-Ḍab'a. Such a place may well have had a more reliable supply, and higher quality, of raw materials. In fact, the pattern of alloy selectivity, and the likely degree of recycling at any one site, might, when more data is available, form a useful indicator of that site's access to raw materials, and its relative position vis-a-vis inter-regional trade systems generally.

The different alloying patterns confirm that (at least) two separate metal industries were producing stylistically similar objects. Moulds for certain types are already known from Tall aḍ-Ḍab'a (Bietak 1985: Abb. 10 and additional unpublished examples). Jericho has not produced such moulds, leaving open the question of whether the metalwork from the tombs there was made at the site, at some larger Palestinian regional centre, or a combination of both.

We can now answer our original question. It is clear that smiths in Palestine and in the Delta were making items to the same designs. Elaborate metalwork was not being produced and traded from a single source, although a degree of trading cannot be ruled out. It is fairly certain then, that these artefacts, the weapons in particular, were made with special roles in mind. This in turn, implies a degree of common symbolic expression understood throughout a wide area, embracing the eastern Nile Delta, Palestine and Transjordan, during the later MB IIA and MB IIB/C periods. As much of this material comes from the richer male burials, it is not unlikely that we are seeing a system of expressing male high-status, that was common throughout the southern Levant and the eastern Delta. Elucidation of the exact relationship between these artefact style zones, and the political organization of the later Middle Bronze Age in this region is the next task.

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# Punch Technique of Umayyad Copper Coinage in Syria

The Germanic hordes who invaded Europe in AD 476 put an end to the Western Roman Empire and thus began the so-called Dark Ages. The Eastern Roman (Byzantine) Empire, however, survived for nearly a millennium afterwards.

The political disasters of the fifth century were accompanied by economic crisis in the course of which much of the reformed system of Constantine disappeared (Grierson 1982: 2). Gold coins continued in circulation while silver coinage passed out of normal use, and copper coins show crudeness of manufacture when compared with Roman and Greek coins of the earlier epochs.

The Byzantine coinage was essentially a continuation of the late Roman coinage, but soon developed its own style. However, from the very beginning the images were conventional and symbolic. The coin design had essentially a two dimensional character (Clain-Stefanelli and Clain-Stefanelli 1974: 85).

As a result of the decline in art, or rather shifts in artistic modes of production, dies were no longer manufactured with the skill and care exercised in classical times, and many of the minting practices became relatively crude (Cooper 1988: 19). In the Middle Ages the designs became more simple and in low relief, and the use of graving-tools was largely replaced by that of punches (Grierson 1975: 435).

On June 15, AD 622 the prophet Muḥammad left Makka to seek security and join his supporters at Yathrib. This *hijra* marks the first year of the Islamic calendar. Fourteen years later the forces of the Byzantines were routed in the decisive battle at Wādī al-Yarmūk, and the victorious Muslims advanced to Damascus, the future capital of the Umayyad Caliphate (42-132 AH / AD 661-750).

The Arabs had no indigenous coinage and no monetary traditions of their own. Byzantine gold and bronze pieces, the Sassanian silver dirham and some Himyarite silver coins were circulating in the area. Initially, the existing coinage in the Empires seized by the Muslims, which had two separate economics, continued to be used.

In Persia, where the mints were still operating, the Arab governors continued to issue silver dirhams similar to those struck by the last Sassanian kings. They differ, however, in that an Arabic inscription is found in the observe margins, normally reading "In the name of Allah" or "Excellent". These series are known as the Arab-Sassanian series.

In Syria the situation was different due to the absence of any Byzantine minting activity. Here the Arabs issued new gold and bronze series having the familiar attributes of Byzantine money and then added to the bronze coins the mint name in Greek, and later in Arabic, or in both scripts together. These coins circulated together with Byzantine coinage and became known as the Arab-Byzantine coinage.

The result was the development of two parallel coinages, one in copper and gold, struck at the mints of Syria, Egypt and North Africa, and known as Arab-Byzantine, and the other an almost entirely silver system in Iraq and Iran known as Arab-Sassanian coinage.

'Abd al-Malik ibn Marwān restored the unity of the Islamic World after years of chaos and fighting between rival contenders for the Caliphate. The defeat of the Byzantine army at the battle of Sebastopolis freed him from sending gold tribute to Constantinople as the price of peace, while enabling him to direct his attention and resources to his opponents.

'Abd al-Malik was known as a grand reformer. By the year 72/692, he was firmly on the political saddle and controlling most of the Islamic realm. He was able to reform the monetary system. He also employed Arabic as the official language of all government documents, displacing Greek, Latin, Coptic and Pahlavi.

Philip Grierson calls our attention to the fact that "Arab-Byzantine coinage (the predecessors of the reformed coinage) differs from German pseudo-imperial coinage (coinage of the Germanic tribes who occupied the Western Roman provinces in the sixth and seventh centuries) in three important respects. In the first place, it was mainly a copper coinage, while the Germanic co-

inages were almost exclusively of gold. Secondly, it was very largely municipal, the coins usually bearing the names of the places where they were minted but no name of a ruler. Finally, the Arabs brought with them a religious prejudice against representational art which led to various modifications in the traditional Byzantine types and ultimately to complete abandonment of pictorial design in favour of the purely epigraphic designs which characterise the vast bulk of Islamic coinage." (Grierson 1982: 144).

Thus in 77 AH/AD 697 the purely Islamic gold coinage bearing only religious inscriptions appeared and no more pictorial coins were produced.

This ideological background, that is the prejudice against representational art, deprived the historians and numismatists from pictorial evidence and knowledge of minting process or of the instruments used as they are shown in pictures, sculptures and on coins by artists of the ancient world or Medieval Europe. There are few historical sources about the details of Umayyad central administration or administration of Syria or about economic life of the provinces (Bates 1989: 180).

Actually we know nothing about the minting techniques of the Umayyads or the instruments used. There are also no dies preserved from that period to study or investigate, so we are left in the dark, and the only reliable material at our disposal is the issues themselves which were produced before and after the coinage reform of ʿAbd al-Malik.

Due to the perfection of engraving the dies of Umayyad gold and silver coinage, it is extremely rare to find any deficiency in the design or any sort of error. This convinces me to seek evidence of errors in die engraving from copper coinage, which was struck locally in the municipalities of the *ajnād* without direct supervision of the Caliph.

In this paper, I will deal with the post-reform copper coinage of Syria which in the Umayyad period was divided into five *ajnād* (military administrative districts) (Bates 1989: 216). The Syrian post-reform copper coinage is quite extensive, having been minted in at least twenty eight different locations (Qedar 1988-89: 29, FIG. 1).

According to S. Qedar (1988-89: 30, 35, 36), these coins belong to three distinct phases. The first two phases to which the Arab-Byzantine coins belong are not included in the present discussion, which is limited only to the coins of phase III — The Post-Reform copper coins:

*Series H*

Bear the formula of faith, the *shahāda,* and the mint name in horizontal lines. The largest group in this series are anonymous coins bearing the *shahāda* with or without decoration in the field.

*Series I*

These coins are of the *shahāda* type bearing legend within a triple circle on the obverse and a mint formula around the *shahāda* on the reverse. Dated coins belong to this series as well.

*Series J*

This series reflects the development of specific types for each mint. Every mint displays an identifying design in addition to the inscriptions such as a lion in Ṭabariya, a snake in Udhruḥ and fleur-de-lis in ʿAmmān. A few dated coins from mints of Ḥumṣ and Ṭabariya belong to this series.

*Series K*

This series comprises of small sized, anonymous coins with a central representation of objects, animals, floral patterns, birds, fish, etc.

As mentioned previously, the Byzantine silver passed out of normal use. Copper coins were the most useful of all other coins and in fact short supply of those would have shut down all trading activities (Qedar 1988-89: 27). Large quantities were expected to be produced by the Arabs in order to compensate the increase in demand for the small change, and this explains why these copper coins are found today in considerable quantities not far from where they were issued.

The copper coins of the Umayyads, both in the Arab-Byzantine and the Post-Reform series, exhibit more traces of individuality than the standard gold and silver minted by the Caliph's direct command in the East and West respectively. Sometimes the name of the governor who ordered the minting is recorded (Walker 1956: LXVIII).

As copper production in the *ajnād* was not directly supervised by the Caliph, it is reasonable to say that less care and attention was practiced in the production of these coppers and engraving their dies. Therefore it is only natural to find specimens with marks of faulty processing and defects which betray the method of die preparation, making blanks or striking.

A good example of erroneous die linkage is mentioned by M. Bates (1989: 214) who points out what can occasionally happen in the mint during copper production. For example a unique coin with the mint name TIBERIADO on one face and DAMASCUS on the other is found in a private collection. Another example from the author's collection shows the extreme confusion between dies; a copper coin of eagle type with the usual inscription on the reverse "Muḥammad is the apostle of God" is repeated on the reverse, which should bear the usual *shahāda* formula "There is no God but God alone".

We know that three different methods were used in ancient and medieval times to prepare dies:

1- Direct engraving into the die surface. David Hendin (1978: 19) states: "In ancient times dies were engraved by hand, the engraver had to work completely backward — the shallowest points on the die became the deepest points on the coin, and vice versa. Finally, the dies had to become a mirror image of how the coins would eventually look, since the striking process reverses the design. Interestingly, some beginning die cutters in ancient times apparently had a difficult time understanding this principle, and instead of engraving the mirror image of the inscription they desired, they inscribed the true image into the die. Thus when the coins were struck they carried the inscription in mirror images, known to numismatists as (retrograde)". This method could have been used for both bronze and iron but it is not deployed when great quantities of currency is needed (Babelon 1901: 906ff).

2- Casting the dies from a matrix mould. This method is employed when many dies were needed, the method of the die manufacture was to engrave a lead matrix first. The matrix was used to prepare clay patrices as required, and presumably these were placed at the bottom of a short hollow clay cylinder. Bronze was cast into the hollow to produce a die, it is well known that bronze dies are less durable than iron dies. This method was rarely used in Western coinage (Grierson 1975: 485).

3- Engraving the design into the die surface by punching. This method accelerates die production and was used in cases when great quantities of coinage were needed. The fundamental of this technique is setting the design diagrammatically on the plain working surface of the die (Cooper 1988: 19), sometimes this is done with a pair of compasses to outline the circumference of the whole field and divide the field according to the desired design. Then using several small positive punches to execute the required design. In the case when a pair of compasses is used, their central leg will produce a round cavity on the die surface which appears as a raised pellet on the produced coins (Grierson 1975: 491). It was suggested that after the piece punch had been struck into the die, the details were opened out enough to give semblance of reality by using the tip of an abrasive stick (Cooper 1988: 19).

An important statement about Umayyad die production technique comes from Walker (1941: CLVI): "In the Umayyad period there is definite Pehlevi influence discernible in the outline of certain letters due no doubt to the employment of old Pehlevi punches in the production of the coin dies."

Another important statement comes from Miles (1950: 97): "Careful study of the execution of the inscriptions convinces me that from the outset punches were used in constructing the die. Most of these punches are simple horizontal and vertical strokes, curves, circles ... etc. which where combined to make various letters of the alphabet, others contain whole letters and still others carried group of letters forming a word or even a group of words."

It is a well known fact that the process of making the die has often left traces on the coin (Grierson 1975: 490). Therefore any misplaced strokes, imperfection, maladjustment, wrong-placed punches or unaccomplished part of the design — e.g. a letter or a word in case of Umayyad dies — will be apparent and clear on the produced positive likeness of the die which is the coin, and any deviation in the normal inscriptions or faults and defects in the design, serve as a guide in determining the method of die preparation and will be helpful to reveal the shape of individual punches.

During the last seven years I examined more than 15,000 Umayyad coins and selected from them 134 pieces with different mint errors. The following are general observations based on internal evidence of the coins:

1- Most of the examined coins were struck by dies, some are cast. We should remember that it is not possible to differentiate between Umayyad and early Abbasid coppers if they are undated or do not bear the name of the governor.

2- There is no fixed relationship between the obverse and reverse of the used dies, which means fixed dies were not used.

3- There is a unique coin in my collection where the die engraver became confused and inscribed an obverse word (*waḥdahu)* on the reverse die instead of the word (*Allah*).

4- I have in my collection two specimens where the coin-striker became confused and the result was a coin bearing two obverses and another coin bearing two reverses.

5- Some specimens show different styles on the obverse and reverse of the same coin. The obverse is much better engraved than the reverse, and in some cases there are different styles on the same face of the coin.

6- Many mint names have a missing letter and many mint names and legends were engraved in retrograde.

7- Most mint errors were found in series H, i.e. anonymous coins bearing the *shahāda* with or without decorations in the field, and no mint errors were found in series J which bears specific types for each mint.

Examples that betray the use of punches to engrave the dies are:-

1- A deficient letter or word on the obverse or reverse of the coin. One stroke or more are needed to correct the legend (FIG. 1).

2- In many instances the use of simple horizontal or vertical strokes, curves and circles that were combined to make various letters are apparent (FIG. 2).

3- A unique example where part of a letter is straying upward from its proper position, which proves the use of punches (FIG. 3).
4- There are many instances of over-lapping and over-extending of rectilinear punches which resulted in joining together of all the letters and words (FIG. 4).
5- Careless use of punches has resulted in illegible inscriptions (FIG. 5).
6- Sometimes lack of space forced the engraver to miss a word or part of a word (that is he failed to estimate correctly the amount of space required) (FIG. 6).
7- There are many specimens with a raised pellet in the centre of the coin, which resulted from the use of dividers to measure the circumference and mark the working surface of the die (FIG. 7).

It is clear from these examples that the dies for the Post-Reform Umayyad copper coins were prepared by workmen and artists, using the punch method, who had no knowledge of Arabic and were permitted to practice on copper coins only and not on gold and silver coins. This explains why the later two coinages were free from errors or deficiency in the design as they were under direct supervision of the Caliph, and were apparently executed by trained engraves.

It may be concluded from the study of copper coins that the earliest minted coins had many errors while the later ones were almost free from errors. This is due to the experience and better workmanship gained through train-

1.



2.



3.



4.



5.



6.





7.

ing and long practice.

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# Glass Bracelets From Tall Abū Ṣarbūṭ

Although glass bracelets are found on most excavated Islamic sites as well as in tombs from the late Roman and Byzantine periods, until recently not much attention has been given to these humble objects. At Tall Abū Ṣarbū almost 200 fragments of glass bracelets were excavated during the first three seasons, a collection large enough to permit a typological and technological study. The preliminary results of this analysis are presented here; a full report will be published later.

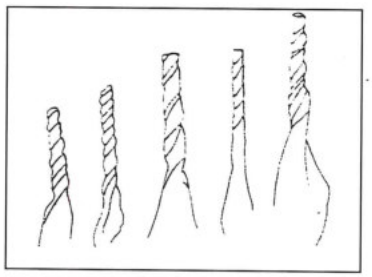
Tall Abū Ṣarbūṭ is situated in the Jordan Valley some kilometres northwest of Tall Dayr 'Allā. Since 1988 three seasons of excavations have been conducted here by a Dutch team, uncovering occupation layers of the Roman/Byzantine and later Islamic periods (de Haas *et al.* 1989; 1992 —the results of the fourth and final season in 1992 are not reported here).

The glass bracelet fragments as well as some glass finger rings and more than 850 fragments of glass vessels were found mainly in the upper levels of the *tall*, dating from the 10/12th to 15th centuries AD. Glass bracelets have also been found on the nearby site of Tall Abū Qurdān, excavated in 1964 (Franken and Kalsbeek 1975), and in the cemetery on top of Tall Dayr 'Allā, the unpublished data of which have kindly been made available to me. All bracelet fragments are being analyzed according to the standards set by Spear (1988), which includes a description of shape, decoration, colour, translucency and dimensions, as well as an analysis of the techniques used.

## Techniques

Technologically two basic methods were used. The first involves the bending and closing of a glass cane, which can be either plain or twisted, monochrome or multicolored. Such plain and twisted glass canes, probably used as kohl sticks, were already produced in Jerusalem in the first century BC (Avigad 1983: 186-191) (FIG. 1).

In principle this type can be easily recognised by a seam where the cane was closed. However, reheating of the bracelet sometimes resulted in concealing this seam, and from fragments it is often difficult to establish the technique used.



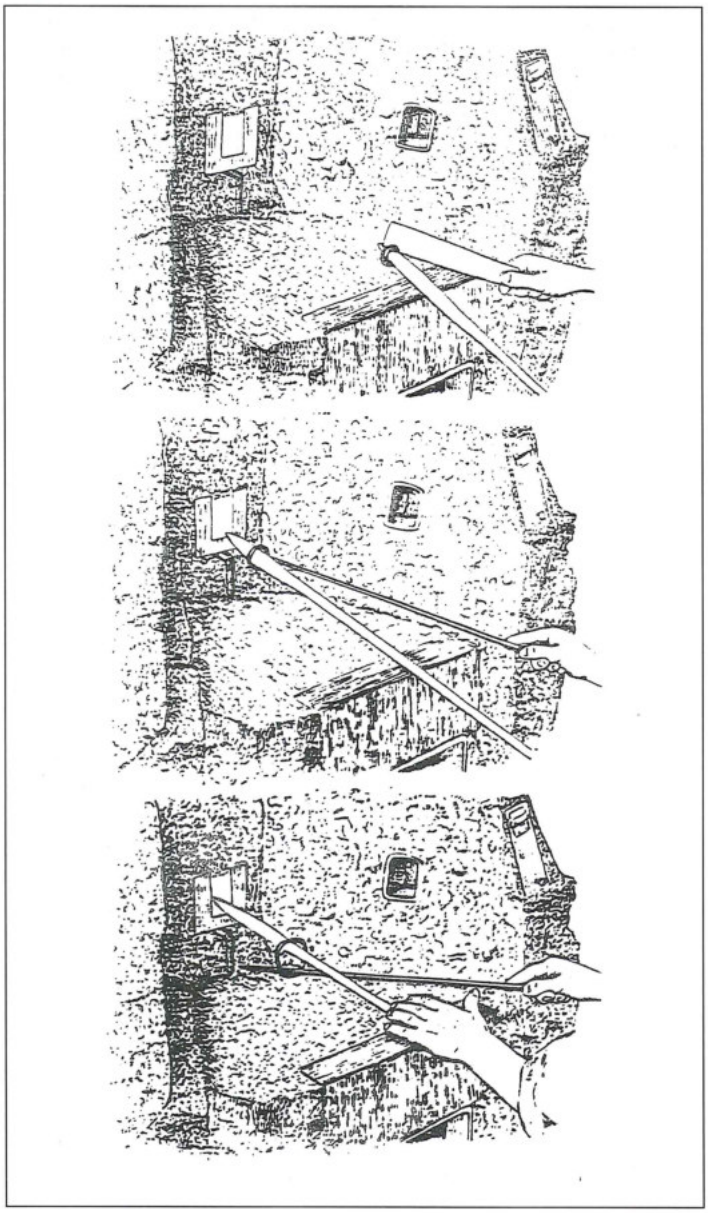
1. Twisted glass canes from Jerusalem. First century BC (after Avigad 1983).

Twisted bracelets are always made from a cane. In the Abū Ṣarbūṭ collection about three fourths of the bracelets are of the twisted variety. These are mostly multicoloured, a result obtained by winding thin glass threads of different colours around the cane. The central cane is made of a dark blue or brownish colour, sometimes a very pale green, with threads of yellow, brown, grey, red, green, light blue and white in every possible combination. No two identical bracelets have been found. Non-twisted bracelets made from a cane were also produced, as is borne out by two (monochrome) fragments with a seam.

The second technique resulted in a "seamless" bracelet. A small piece of molten glass was pierced by a metal rod, after which a larger ring was formed by rotating it on the rod with the help of a second tool (Korfmann 1966: 48-61) (FIG. 2). This technique was already used to form the famous bracelets of the La Tène period in Europe (last half of the first millennium BC). This type can be recognized by its D-shaped or flat cross-section and the tool marks on its inner side (if not smoothed away after forming the bracelet). Sometimes a decoration was applied by adding drops or stripes of molten glass in different colours.

## Production

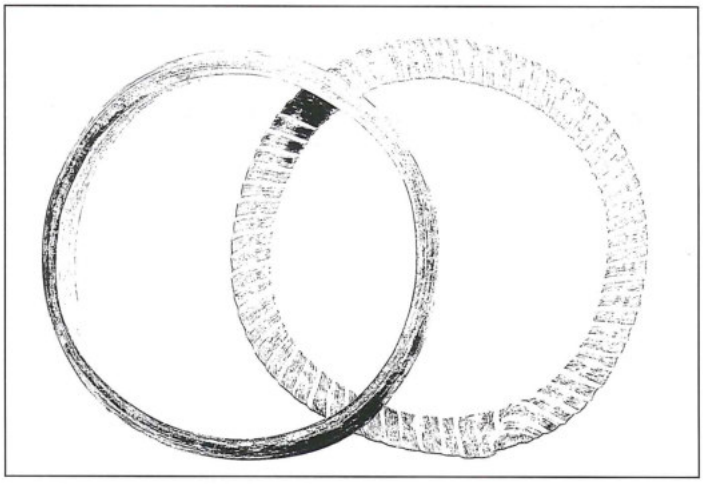
As so many bracelets have been found on Tall Abū Ṣarbūṭ, Tall Abū Qurdān (66 examples) and in the cemetery of Tall Dayr 'Allā (35 examples), the question



2. Production of a "seamless" glass bracelet in Hebron (after Korfmann 1966: FIGS. 6-8).

arises whether they were produced locally. In the period under consideration Tyre, Hebron, Aleppo, Acre, Sidon, Raqqa, Cairo, Alexandria and Damascus were famous glass production centres, although smaller centres existed as well (Weinberg 1987). Hebron seems to have been especially famous for its glass bracelets, and bracelets of both techniques were still made there and sold in Jerusalem until quite recently (FIG. 3).

At Tall Abū Ṣarbūṭ no remains of local glass production (oven, waste, cullet) have been discovered *in situ,* although some finds indicate that glass was produced in the neighbourhood. Worth mentioning is a piece of glass slag found in the disturbed top layers of the *tall* and a fragment of a glass cane, not yet formed into a bracelet, from the courtyard of a house.



3. A "seamed" twisted bracelet, made from a light blue cane with white decoration, and a "seamless" bracelet produced of the same light blue glass, bought in Jerusalem in 1964.

## Use

From anthropological literature it is known that bangles of bronze, silver and glass were worn on wrists, upper arms, elbows and ankles (Dalman 1937: 341). At Tall Dayr 'Allā 35 glass bangles were found in ten graves, worn on the left and right arm and on the ankle. In one grave five bangles were found "near the vertebral column"; these were possibly sewn to a head scarf or woven into the hair. Glass bracelets were worn together with metal ones. In one grave a woman wore one iron and four glass bracelets on the left arm, and a glass and iron bracelet on the right arm. In another grave six glass bracelets were found together with two bronze ones. Twisted and plain glass bracelets were worn together.

## Future Research

Future research will concentrate on providing a complete repertoire of the glass bracelets of Tall Abū Ṣarbūṭ, gathering evidence for (or against) the possibility of a local production centre for glass bracelets in the neighbourhood of the *tall*, and on comparing the data from Abū Ṣarbūṭ, Abū Qurdān and Dayr 'Allā with those of other excavated villages and cemeteries from the Islamic period.

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# Pottery Technology: The Bridge Between Archaeology and the Laboratory

## Introduction

In this paper I present some considerations that have kept me occupied for some time at the Institute of Pottery Technology at the University of Leiden, where I succeeded Prof. Franken as director. These considerations stem from certain publications of archaeological ceramics, but above all from discussions with colleagues visiting the Institute.

At present, some archaeologists are too easily inclined to resort to scientific analyses of small samples of pottery. Laboratory analysis of excavated pottery is useful for archaeological interpretation. However, the technological investigation of pottery, as developed by H. J. Franken and J. Kalsbeek in their study of the Early Iron Age pottery of Dayr 'Allā (Franken 1969), is the principle bridge between archaeology and the laboratory because of its explanatory character.

## Archaeological Pottery Studies

### *Descriptive Studies*

The archaeological study of pottery has focussed above all on the study of ceramic shapes. For a long time archaeologists were mainly interested in pottery because they recognized its importance for chronology. In addition to colour and texture, the shape of the pottery vessels was the main characteristic for dating. It would not be difficult to mention examples of these typo-chronological studies. Most of such typological studies of pottery are descriptive, in which the pottery is classified on the basis of various characteristics or attributes with no attempt to explain them. Specifically, the shape, after being described and drawn, is not explained in terms of manufacturing technique. For example, a round base of a pot could have been thrown and scraped afterwards, thrown closed, or made in a mould. In a descriptive typology this is not explicitly discussed.

### *Explanatory Studies*

For archaeology to be a science, the observed phenomena have to be explained. Attempts have been made in the past to explain certain characteristics of pottery technologically. For example, the study of J. L. Kelso and J. P. Thorley was one of the first attempts to examine the manufacturing techniques of Iron Age pottery from Palestine, at W. F. Albrigh's request (Kelso and Thorley 1943). H. J. Franken and J. Kalsbeek systematically elaborated on this kind of approach to make it generally applicable (Franken 1969). The development of technological ceramological research in archaeology helped to change the mainly typo-chronological descriptive kind of study. The maker behind the pot became visible.

The study of pottery technology tries to explain the various aspects of the potter's craft within the framework of the archaeological discipline by examining the relationships between the technical, functional and scientific aspects of ancient pottery. An explanatory analysis of the observed phenomena can be made. Reconstruction of the manufacturing technique of the pottery from the preparation of the clay up to, and including, the firing is the goal and is the basis for the pottery classification (Franken 1983; van As 1984).

In the technological analysis at the Institute of Pottery Technology, the observed features of the pottery are explained independently as well as in relation to each other. In some cases the shapes can be explained by the raw materials, the related manufacturing technique and/or function. As a result, the shapes are no longer accidental. In other cases the various shapes within a pottery repertoire can be considered variants of one and the same manufacturing technique, but the differences apparently reflect, among other things, chronological or regional distinctions. For example, we are now preparing a corpus of Mesopotamian pottery (van As 1989). The diversity of shapes within the second millennium BC repertoire from four archaeological sites in Iraq can be reduced to a very few technological types (van As and Jacobs in prep.). Nevertheless, recording the various shapes is important for establishing tendencies of change through time or local variation. In the same second millennium BC pottery

repertoire we explain how and why the bases of the goblets were tempered with abundant organic material to best resist cracking (van As and Jacobs 1987). In the first half of the second millennium BC (Old Babylonian period) base cracks were repaired with an extra organically tempered clay body added after drying. In the subsequent Kassite period the technology changed: the extra organically tempered clay body was used during the manufacturing technique in order to prevent cracks.

With respect to decorative motives, tradition plays an important part. Changes in the techniques of decoration, however, can often be explained through technological analysis. The relationship between painted Neolithic A pottery and Neolithic B pottery decorated with "herringbone" incisions from Jericho can be explained on technological grounds (Franken 1974: 204-205). Each decoration coincides with a particular raw material. The pottery decorated with "herringbone" incisions has a coarse mineral temper in contrast to the organic temper of the painted pottery. Large amounts of coarse temper reduce the porosity of the sherd, thereby making painting more difficult. Another example of a possible technological explanation for a change in decoration technique comes from Ta'as in northwestern Syria in the Early Islamic period (van As 1984: 138). During this period painting on jars disappears. The jars were painted with a brush and an iron-oxide (red colour) diluted with water before firing. The colour of the decoration is not bright because of the high percentage of lime present in the clay. For this reason the iron becomes volatile above a certain temperature, which causes the pale surface colours. People probably thought the painted decoration not successful enough and returned to a decoration of incisions, as used before.

**Pottery Technology: Its Methods**

To give a technological interpretation of the characteristics of pottery requires knowledge of the various aspects of the potter's craft. Cooperation with a potter is essential for a thorough technological analysis of excavated pottery. Because of their practical experience, potters know how to interpret the various technological features that have been left in the pottery. Potters are also able to verify the reconstructed technique, by practical experimentation with clays of a quality that is comparable with that used in antiquity. For this reason it is important to take samples of clays found in the vicinity of the excavation – clays that could have been used for pottery production in antiquity. "Workability tests" are carried out on these clays – experiments to determine their behaviour in relation to the potter's craft, e.g. the firing colour, the measure of shrinkage when dry or fired, porosity and so on. A visit to local potters, if present in the vicinity of the excavation, is useful for understanding the possibilities of the local raw materials. Even short visits to the potter of Dimini (Greece) (van As *et al.* 1988) and the potter of Örnekköy (Turkey) (van As and Wijnen 1989-90) yielded useful information for our technological analysis of Neolithic pottery from Sesklo and from Ilipinar Hüyük respectively (van As and Jacobs 1988; van As and Wijnen in press). The observations of the potter's workshops near Baghdad were also relevant to the archaeological-ceramological research of Mesopotamian pottery (van As and Jacobs 1986).

Today not only the purely technological concerns of the production of pottery, but also other aspects such as the organisation of production, the function and the distribution of the products can still be taken into consideration. M. B. Annis (1983: 13-14) pointed out that the heart of the question for archaeological-ceramological research is to explain the interplay of determinants of the features that characterise production. It is, in her opinion, the archaeologist's task to distinguish between the various aspects and to define them, and finally to reconstruct these features in order to make the latter explicable and render to them their own historical value. Towards this goal Dr. Annis started her ceramic ethno-archaeological research in Sardinia with the aim of investigating a complete entity, not a fragmentary one like the ancient finds (see the annual contributions on this subject in the *Newsletter, Department of Pottery Technology, Leiden University).*

Beside the reconstruction of the techniques (forming, decoration, firing), the analysis of the raw materials used forms an important part of the technological investigations of the Institute of Pottery Technology. It involves the analysis of the quantity, the grain size and the quality of the (added) non-plastics present in the clay body (Stienstra 1986). Following the successive steps in the process of pottery making, Y. Hemelrijk (1987) classified the so-called non-diagnostic pottery sherds from al-Lāhūn based on elements that are progressively less fundamental for the potter. The study of the size and quantity of the mineral inclusions was the first step. A later step was the determination of the non-plastic inclusions, both mineral and organic. The investigation of both aspects can be achieved within reasonable time and does not demand costly laboratory research equipment. Only precise identification of the non-plastics, necessary in provenance studies, requires analysis of thin sections under a polarising microscope.

The main research methods of the Institute of Pottery Technology described above can be used by archaeologists with simple technical devices. However, analyses executed with costly laboratory research equipment also form an integrated part of the technological research program to solve archaeological problems. These analyses take place in specialized laboratories outside the

Institute of Pottery Technology, when needed.

## The Laboratory

It is not the place here to present a complete survey of the various modern advanced laboratory analysis techniques that can be applied to archaeological ceramics. Most of them are used for the mineralogical and chemical characterisation of pottery: X-Ray Diffraction, the various thermal analysis methods, Optical Emission Spectroscopy, Neutron Activation Analysis, X-Ray Milliprobe, Electron Microprobe and so on (Rice 1987: 375-405). There are additional analyses to determine the physical, mechanical and thermal properties of pottery (Rice 1987: 347-370). Xeroradiography is a powerful method of establishing the manufacturing technique (Rye 1977).

The above-mentioned laboratory analysis methods are an important help within archaeological-ceramological research. But in the research concept of the Institute of Pottery Technology they are no more than an aid. Laboratory analyses alone, unless integrated into the technological research, do not give any explanation for understanding the pottery product. The results of the analyses give precise data (quantitatively or qualitatively) on separate pottery characteristics. A few specific points are worth making in that regard.

1. The precise results of modern laboratory analyses are not always relevant to the potter. Dilatometer measurements are often too precise.
2. Chemical analyses of potsherds, when done with a very small sample are often insignificant, archaeologically speaking. The results are, except in provenance studies, of no archaeological/technological importance.
3. Different methods of characterisation result in different classifications of potsherds. In her study of African Terra Sigillata from the San Sisto Vecchio in Rome, J. M. Schuring could find support for the division based on optical characteristics in the porosimetrical data, but the groups based on chemical composition were problematic (Schuring 1988: 26).
4. Xeroradiography is a useful test for the reconstruction of the manufacturing techniques made on various significant features. But unlike the interpretation of the relevant characteristics, Xeroradiography does not explain the manufacturing technique.

## Conclusions

In archaeology, describing the material remains is not sufficient. Only by explaining them does a vivid picture of life in antiquity arise (although this picture may sometimes remain vague). The study of pottery technology in the broadest sense of the word – meaning all possible aspects of pottery – is an explanatory archaeological study. Modern laboratory research forms part of it, but it is relevant only in the light of the above-mentioned understanding of archaeology. If not, one runs the risk of having modern laboratory analyses of pottery yield only footnotes in archaeological publications. Pottery technology is the bridge between archaeology and the laboratory. It is a *conditio sine qua non*. The results of the technological analysis of pottery form the basis for the selection of laboratory samples.

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# Decorative Elements on the Excavated Neolithic Pottery at 'Ayn Ghazāl

Around 5500 BC, the people of Jordan started to manufacture and use vessels made of clay for their daily life. However, as has already been reported, pottery sherds or clay pots were excavated in the earlier Aceramic levels at two major Pre-Pottery Neolithic sites in Jordan: 'Ayn Ghazāl (Rollefson and Simmons 1986: 148) and Baṣṭa (Nissen *et al.* 1987: 109).

As in other countries in the Near East, archaeological excavations at Neolithic Pottery sites in Jordan have yielded two major types of decorative elements on the pottery of that period: the painted and the incised, but the chronological sequence of these two traditions remains uncertain. At Munḥaṭa in Palestine, incised Yarmoukian pottery sherds were found in Stratum 2B2, considered to be earlier than Stratum 2B1, which yielded red painted sherds (Perrot 1968). During the Late Neolithic Culture (c. 5500-4000/3750 BC) several traditions have been identified: the Yarmoukian, Pottery Neolithic A, Ghrubba, Wādī Rabāḥ, and the Pottery Neolithic B (Kafafi 1987: 34-38; 1990: 149-163 Arabic). In addition, based on the excavations at the site of 'Ayn Ghazāl, subdivision within the Yarmoukian Culture is possible (Kafafi *et al.* 1990: 14). These facts should be discussed after the decorative elements visible on the excavated pottery sherds from the site of 'Ayn Ghazāl have been studied, because this site, added to the site of Wādī Shu'ayb, produced well stratified pottery sherds representing most, if not all, of the above mentioned cultural traditions. Although a parallel study of the pottery excavated in 1984 and 1989 at 'Ayn Ghazāl has already been published (Kafafi 1990), a comprehensive analytical study of the decorative elements combined with stratigraphic sequence is still badly needed, especially since the 1988 and 1989 seasons produced variants and a large quantity of several types of decorations. Other Pottery Neolithic sites in Jordan, e.g. 'Ayn ar-Rāḥūb (Kafafi 1989), Abū Thawwāb (Kafafi 1988), Dhrā' (Bennett 1980) and Khirbat adh-Dharīḥ (Bossut *et al.* 1988) yielded either a single or two occupational phases.

In 1984, during the third season of excavations at 'Ayn Ghazāl, an assemblage of pottery sherds was encountered that was confined to undisturbed contexts in the South and Central Fields (Rollefson and Simmons 1985: 12, 18 -19). The same kind of pottery continued to be excavated during the following seasons and was assigned to the so-called Yarmoukian Culture. In addition to the Neolithic pottery, Early Bronze Age, Roman, Byzantine, and Umayyad pottery collections were retrieved either at the site itself or in the vicinity (Simmons and Kafafi 1988).

Three stratigraphic architectural subphases were recognized within the Yarmoukian levels at 'Ayn Ghazāl. The first, which may represent the latest phase of the Yarmoukian Culture, is represented by what could be a large dwelling-pit dug into the earliest Yarmoukian levels in the South Field (Rollefson and Simmons 1985). The second phase is represented by a rectangular house consisting of either two rooms or a room and a courtyard. The house was built of boulders directly over the PPNC buildings. An apsidal structure excavated in the Central Field may be contemporary with this building. The reuse of the large wall and pits dug into the floor of a ramada-like structure (Sq. 3677) may represent the third and earliest phase of the Yarmoukian Culture at 'Ayn Ghazāl. The pottery sherds excavated in the earliest phase are somehow different from those of the other two phases. Below we present a discussion of all the decorative elements recognized on the pottery assemblages uncovered in strata belonging to those three phases.

## Decorative Elements

Three decorative elements – incised, punctated, and painted motives – were identifiable on the pottery assemblages excavated in 1984 and 1985 at 'Ayn Ghazāl, as has already been reported (Kafafi 1990: 15-19). However, as mentioned above, more decorative elements were recognized when the pottery assemblages excavated in 1988 and 1989 were studied (Kafafi *et al.* 1990: 16). This presentation aims at discussing in more detail the previously studied collections and adding more in-

formation derived from the unpublished assemblages. Also included is a study of the decorated pottery sherds in combination with their stratigraphic sequence.

**Painted Decoration**

Based on J. Perrot's study of the Munḥaṭa Neolithic pottery, it was thought that the incised ware recovered from Stratum 2B2 is earlier than the painted ware encountered in Stratum 2B1 (Perrot 1968: col. 415). This view should be restricted to Munḥaṭa only and not other Pottery Neolithic sites in Bilād ash-Shām, based on the results of the recent excavations at the sites of 'Ayn Ghazāl and Wādī Shu'ayb in Jordan, where well-stratified pottery assemblages were found. However, we agree with Perrot that two decorative traditions should be separated. This is because incised pottery collections not accompanied by the so-called Pottery Neolithic A or B traditions were found at several sites in Jordan, among them 'Ayn ar-Rāḥūb (Kafafi 1989: 5) and Abū Thawwāb (Kafafi 1988: 455). Other sites such as Dhrā' (Bennett 1980) and Khirbat adh-Dharīḥ (Bossut *et al.* 1988) produced painted pottery without having any incised ware.

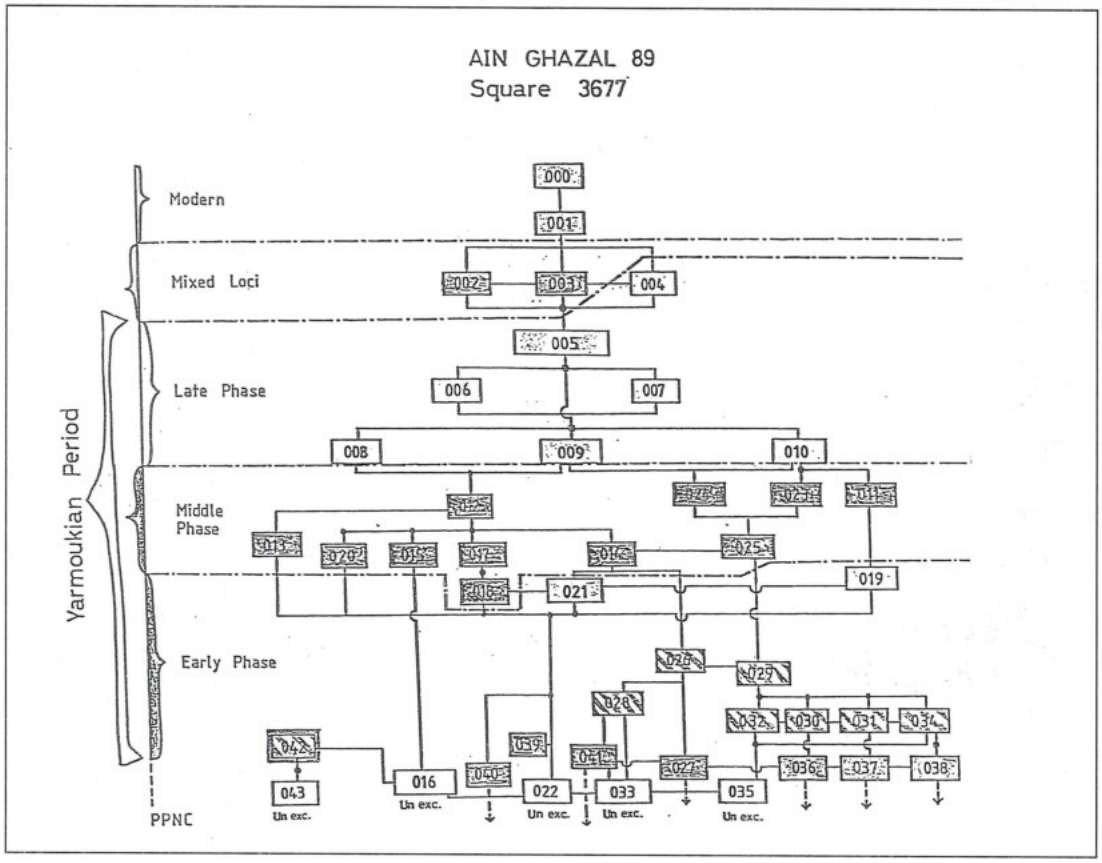
During the excavations of 'Ayn Ghazāl, it was noticed that the painted pottery came from levels earlier than the levels that produced incised decorations. This was recognized in both the Central and the South Fields.

Square 3677 in the Central Field yielded the best stratified pottery collection in the area (FIG. 1). Locus 42, a pit fill, produced dark red pottery sherds. The pit (locus 43) in which the pottery was found is dug into PPNC levels. In the same square, however, red painted pottery was encountered in the upper levels.

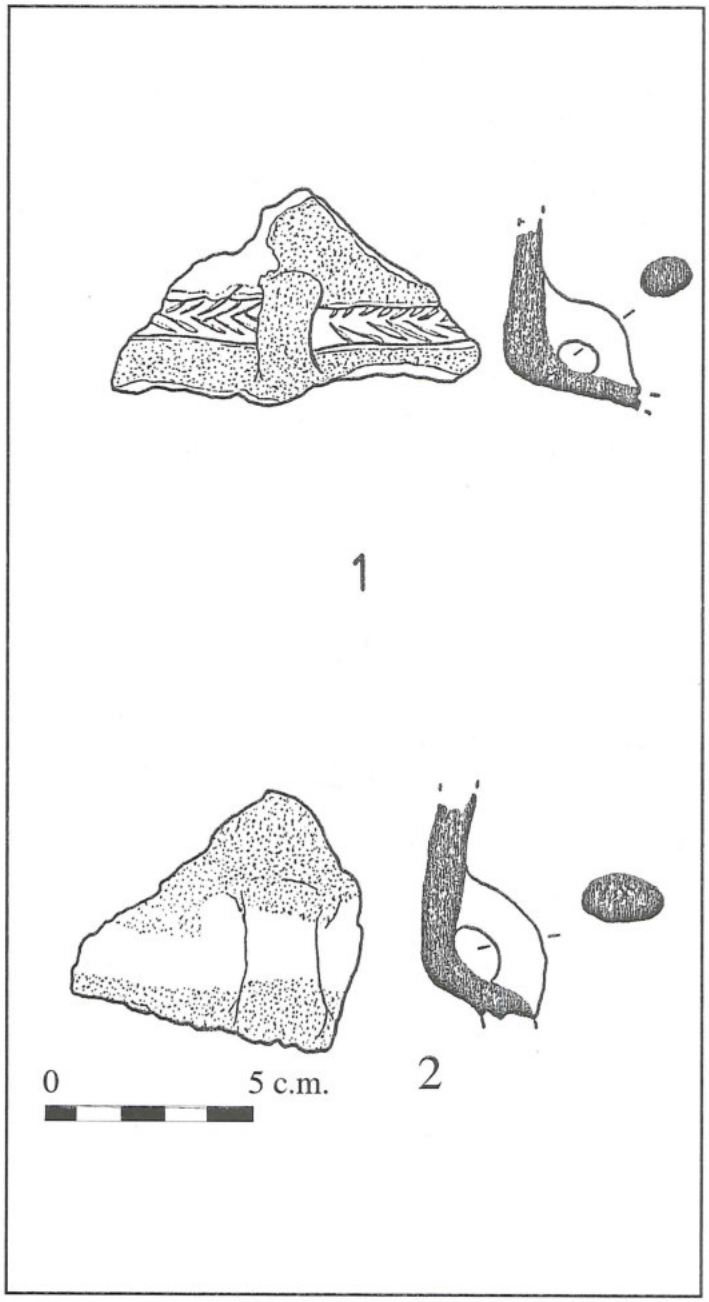
In the South Field, Square 4554, very crude red painted sherds were excavated in Locus 18, a floor of a house. Moreover, red painted pottery was also found in the same field in levels considered to represent the earliest phase of the Pottery Neolithic Culture at 'Ayn Ghazāl. This does not mean that no painted pottery was found in levels that produced incised ware.

Generally speaking, three major types of painted decorations are attested on the Neolithic pottery at 'Ayn Ghazāl. The earliest (FIG. 2:2) is represented by dark red painted bands on a creamy slip. This type was excavated at the sites of Jericho PNA (Ben-Dor 1936: PL. 31; Kenyon and Holland 1982: FIGS. 1-2; 1983: FIGS. 2,4; 5,8) and Tall Abū Zuraiq Hazorea (Anati *et al.* 1973: PLS. 28-29) in Palestine, and Wādī Shu'ayb (Simmons *et al.* 1989: 33, FIG. 3), Dhrā' (Bennett 1980: FIGS. 7-8), and Khirbet adh-Dharīḥ (Bossut *et al.* 1988: FIG. 3) in Jordan. Red painted sherds on a red slip were also excavated. In both cases, the ware is very crude and coarse.

The second type is formed with red painted fields having zigzags, triangles, and bands delineated with either herring bone incisions or only parallel incised lines (FIG. 3). Similar painted sherds accompanied with incisions were excavated at Sha'ar HaGolan (Stekelis




1. Stratigraphic analysis of Square 3677 at 'Ayn Ghazāl.




2. 1. Incized and red painted decoration; 2. red paint on a creamy slip.

1950-1951: PL. 1:9), Munḥaṭa 2B2 and 2B1 (Perrot 1968: FIG. 845), Abū Thawwāb (Kafafi 1988: FIGS. 2-4), 'Ayn Ghazāl (Rollefson and Simmons 1986: FIG. 3), Jericho VIII (Ben-Dor 1936; Droop 1935), Teleilat Batashi IVa-III (Kaplan 1958), and Wādī Rabāḥ/Neolithic Levels (Kaplan 1958b: FIG. 4:3).

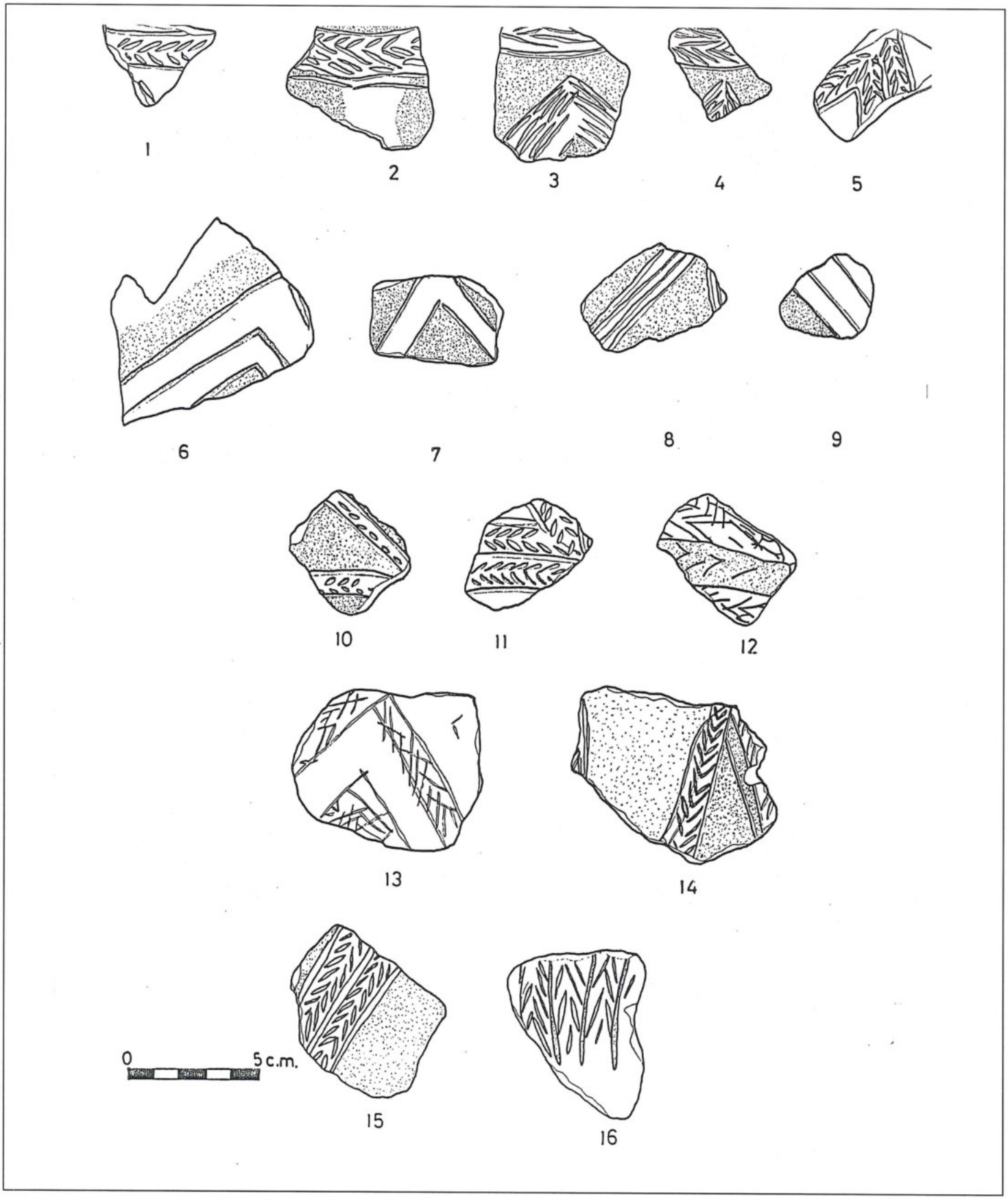
The third type consists of red painted parallel lines on a very highly burnished fine ware (FIG. 4: 5-8). Only very few sherds of this type were found in the upper stratigraphic levels and ought to be dated to a later period than the first type. No parallels for the very highly burnished fire ware are known in Jordan, thus, they may be imports.

**Incised Decoration**

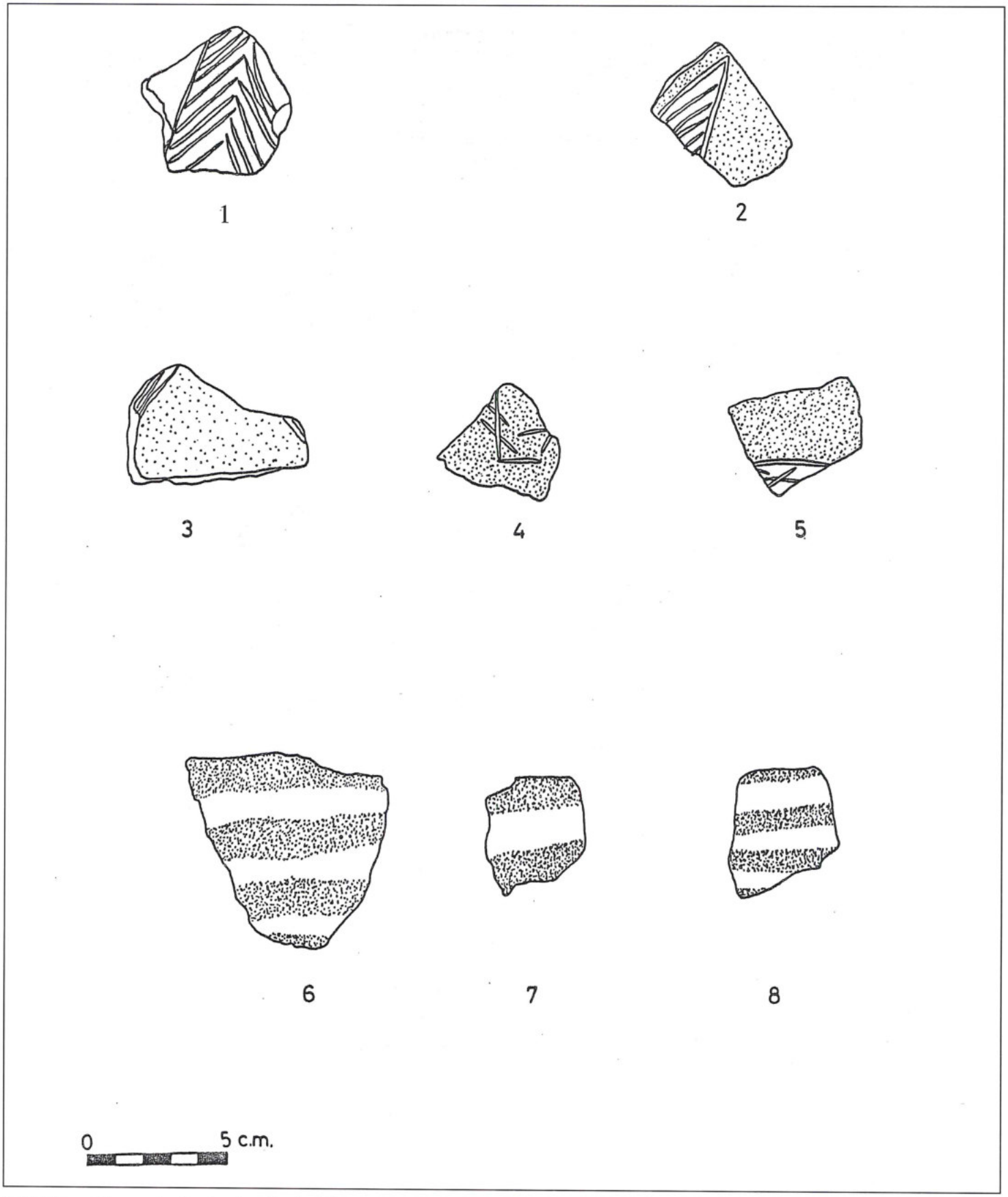
The incised decorations were probably made with a sharp instrument while the clay was leather hard. Some of the incised motives were irregular while others were very regular and neat. This suggests that the former were hand-made and the latter were perhaps rolled.

The incised motives recorded from 'Ayn Ghazāl are typical of the so-called Yarmoukian Culture and can be dated to a period ranging between c. 5500 and 4500 BC. After studying the published incised collections from Bilād ash-Shām and Mesopotamia, we may suggest that in general six types of incised decoration are present (FIG. 5):

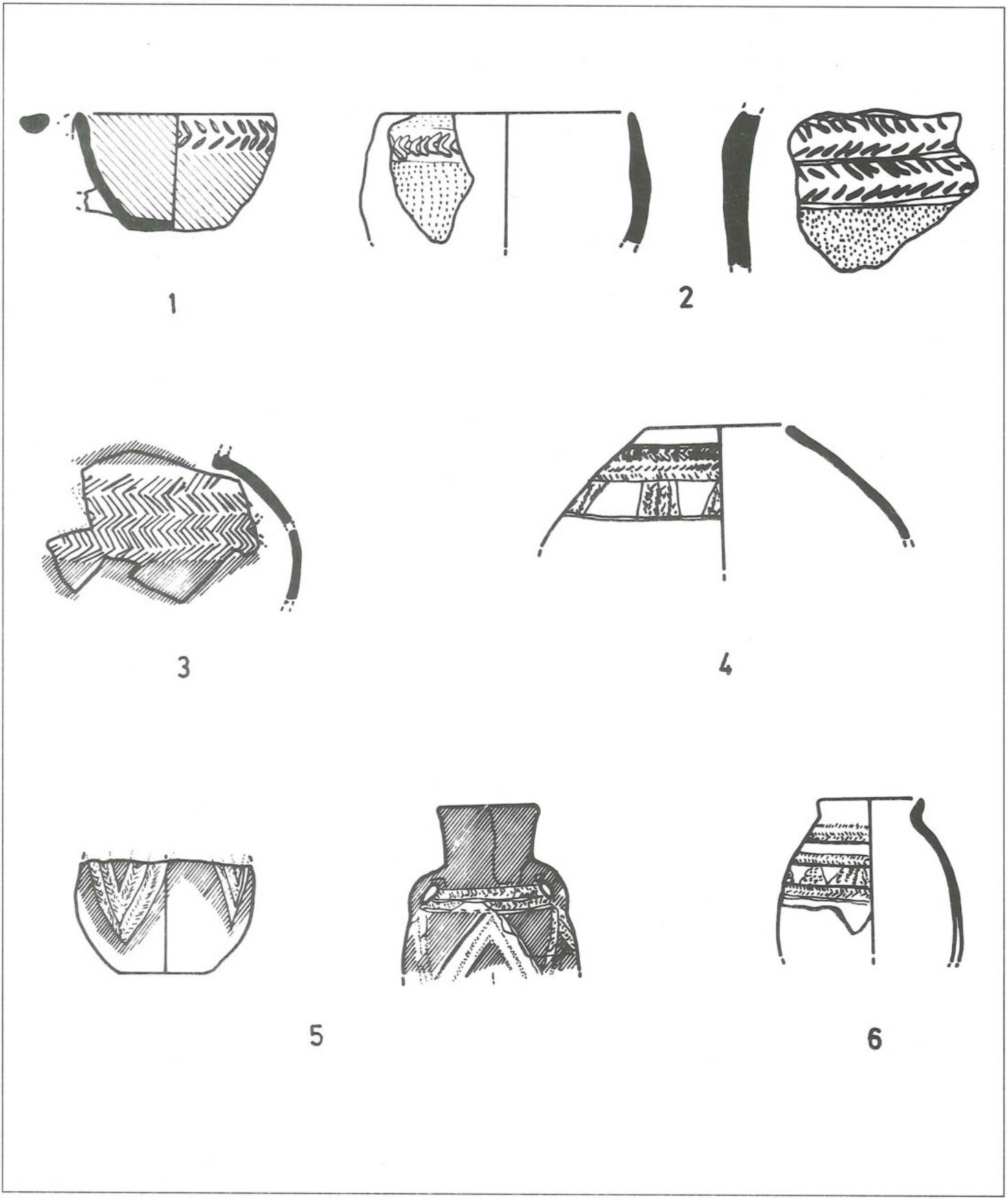
1. A horizontal line of incised chevrons just under the rims of cups, jars, and bowls (FIG. 5:1). This type may be assigned to the latest phase of the Neolithic Pottery period. It has the characteristic that the herring-bone incisions are not delineated by two parallel lines. This kind of decoration was attested at Jericho PNB (Kenyon and Holland 1982: FIG. 33:7), Teleilat Batashi III (Kaplan 1958: PL. 10: 11, 14), 'Ayn Al-Jarba (Kaplan 1969: FIG. 8: 2), and was dominant at Byblos E. N. R. (Dunand 1973: FIGS. 156-158). A similar type was also noticed at Hassuna II-VI in Mesopotamia (Lloyd and Safar 1945: FIGS. 4:7; 10).
2. Horizontal incised chevrons between two parallel lines (FIG. 5:2). This is the most dominant decorative element related to the Yarmoukian Culture. Located just below the rim of the vessel, it was used to decorate cups and bowls. It was also dominant at the sites of Sha'ar HaGolan (Stekelis 1972: PLS. 40-44), Munḥaṭa 2B2 (Perrot 1968: FIG. 845), Abū Thawwāb (Kafafi 1988: FIG. 2); and existed at Munḥaṭa 2B1 (Perrot 1968: FIG. 845), 'Ayn Ghazāl (Rollefson and Simmons 1986: FIGS. 3-4; Rollefson *et al.* 1990: 6-4), 'Ayn ar-Rāḥūb (Kafafi 1989: FIG. 5), Jericho PNA (Kenyon and Holland 1982: FIG. 25), Jericho PNB /VIII (Kenyon and Holland 1982: FIGS. 25, 32; Ben-Dor 1936: PL. 33; Droop 1935: PL. 44: 1-3), Megiddo XX (Loud 1948: PL. 2. 40-42), Teleilat Batashi IVa-III (Kaplan 1958a: PL. 9. 13), Wādī Rabāḥ/Neolithic (Kaplan 1958b: FIG. 4.3), Byblos/Néolithique Ancien (Dunand 1973: FIGS. 17, 18) and at Ṭabbat al-Ḥammām (Hole 1959: FIG. 2: 27-29).
3. This type is represented by many lines of incised chevrons in a wavy pattern with no parallel incised lines (FIG. 5:3). This decorative element was found on pottery vessels excavated at Munḥaṭa 2A (Perrot 1968: FIG. 846), Jericho VIII (Ben-Dor 1936: PL. 33), Teleilat Batashi III (Kaplan 1958a: PLS. 10. 17. 11. 12), Wādī Rabāḥ Phase (Kaplan 1958b: FIG. 6:2), 'Ayn al-Jarba (Kaplan 1969: FIG. 8:3), Hassuna II-VI (Lloyd and Safar 1945: FIG. 13), and it was dom-




3. Several types of incised and painted decorations.




4. 1-5. Several types of red painted and incised decorations; 6-8. red painted decorations.




5. Types of incised decorations from the Levant (after H. Wada).

inant at Byblos/E. N. R. (Dunand 1973: FIG. 158).

4. Type four (FIG. 5:4) is characterized by having several incised horizontal lines connected with other vertical ones, leaving undecorated spaces on the shoulders of the vessels, which are usually jars. This kind of decoration was attested only at Byblos/ Néolithique Ancien (Dunand 1973: 56 FIG. 25. 26954).
5. This type is made of either triangular or zig-zag shaped incised fields covering most of the body of the vessel (FIG. 5:5). This element was found on the decorated small jars at Sha'ar HaGolan (Stekelis 1972: PLS. 41-43), Munḥaṭa 2B2 (Perrot 1968: FIG. 845), Munḥaṭa 2B1 (Perrot 1966: FIG. 6.2), Abū Thawwāb (Kafafi 1988: FIG. 3.4), 'Ayn Ghazāl (Rollefson *et al.* 1990: FIG. 6.5), Jericho VIII (Ben-Dor 1936: PL. 33:15), Megiddo XX (Loud 1948: PL. 2.42), Teleilat Batashi IVa-III (Kaplan 1958a: PL. 9.12), and Wādī Rabāḥ/Neolithic Phase (Kaplan 1958b).
6. The last type (FIG. 5:6) is a combination of types 2 and 5. This decorative element was used to decorate jars. Similar types were excavated at Jericho PNA (Kenyon and Holland 1982:) and at Byblos Néolithique Ancien (Dunand 1973: 50,h FIG. 18. 26274).

Because those six decorative styles belong to a long time span (c. 5500-4000/3750 BC) the possibility of arranging the styles in a chronological order will be based on three factors:

1. A detailed study of the incised decorations from well stratified contexts, e.g. 'Ayn Ghazāl. This is presented below.
2. Clusters of C14 dates, which are still mostly lacking from sites that produced incised wares. They should be obtained for the well stratified incised ware collections, such as those from 'Ayn Ghazāl and Wādī Shu'ayb, in addition to the collections from single occupation sites, e.g. 'Ayn ar-Rāḥūb (Muheisen *et al.* 1988: 498).
3. A parallel study between all the excavated and well stratified incised ware assemblages. This is yet to be done.

To answer the first condition, a detailed study of the incised decorations from the site of 'Ayn Ghazāl was done. The incised patterns recorded are as follows (FIGS. 2:1; 3:1-16; 4:1-2, 4-5):

1. One line of incised chevrons delineated by two parallel lines. This kind of decorations is mostly used to decorate small vessels, especially cups, bowls, and small jars.
2. Irregular incisions between two parallel lines.
3. Two rows of incised patterns on decorated necks of jars. One row is situated just below the rim and the other on the attachment area connecting the neck with the body. The lowest line usually goes through the opening of the handle(s).
4. Two or more rows of incised chevrons between two parallel lines.
5. Triangular-shaped decorative motives made of incised lines of herring-bone incisions.
6. Irregular and regular incised patterns or only lines without the herring-bone incisions accompanied with red painted decorations.

In order to arrange those incised decorative elements, we tried to correlate them with stratigraphic contexts. The best examples were taken from the Central Field, Square 3677 and the South Field Squares 4654 and 4655 at 'Ayn Ghazāl. Based on the study of the stratigraphy of Square 3677, we recognized three different Yarmoukian Phases: Early, Middle, and Late (FIG. 1). The excavated loci in Square 3677 that belong to the Early Phase are 019, 021, 026, and 027-045; to the Middle Phase are 011, 012, 013, 014, 015, 017, 020, 023, 024 and 025; and those belonging to the Late Phase are 004-010. In addition, Loci 002-003 are mixed and 000-001 are modern.

Locus 043 is a pit and 042 is the excavated fill of the pit. They represent the earliest Neolithic Pottery loci from the Square. Only red or dark red painted pottery sherds were encountered in this fill and no incised ware was recovered. The first appearance of the incised decorations in the square was in Locus 035. The incised motives on the sherds from this locus consisted either of incised chevrons or more than one incised panel of a zig-zag shape. In both cases the incisions were accompanied by red painted decorations. However, the excavated incised sherds from the Early Phase were few in number compared with those from the other two phases.

The decorative incised elements of the Middle Phase were more developed than those from the Early Phase. A large quantity of incised sherds were excavated in the loci belonging to this phase in Square 3677, but they were mostly concentrated in Loci 01, a pit fill, 012, a pebbly layer, 014, a mudfloor, and 015, a pitfill.

The incised decorative elements belonging to the Middle Phase are very regular and variant. They consist, sometimes, of one row of a herring-bone incised pattern on the rim of a jar accompanied with red painted fields on the shoulder. In a few cases, the triangular painted fields are delineated by a row of irregular incised patterns. Thus, we may conclude that the incised decorative elements of the Middle Phase are mostly accompanied with red or brown painted designs, which are either parallel or have triangular and zig-zag shapes.

The Late Phase is represented by the pottery excavated either in pit fills (Loci 006, 008, and 010) or pebbly layers (Loci 004, 005, and 009). New decorative elements are recognizable in this phase. These are very high red burnishing on very fine ware, criss-cross or hatched

incisions, and several types of incisions accompanied with red painted motives thought to have developed from the Middle Phase. Among these incised forms are zig-zag patterns made of two parallel lines with no incisions in between and accompanied by red painted motives. Also horizontal incised panels over a triangle formed by incised lines separating triangular red painted fields are found.

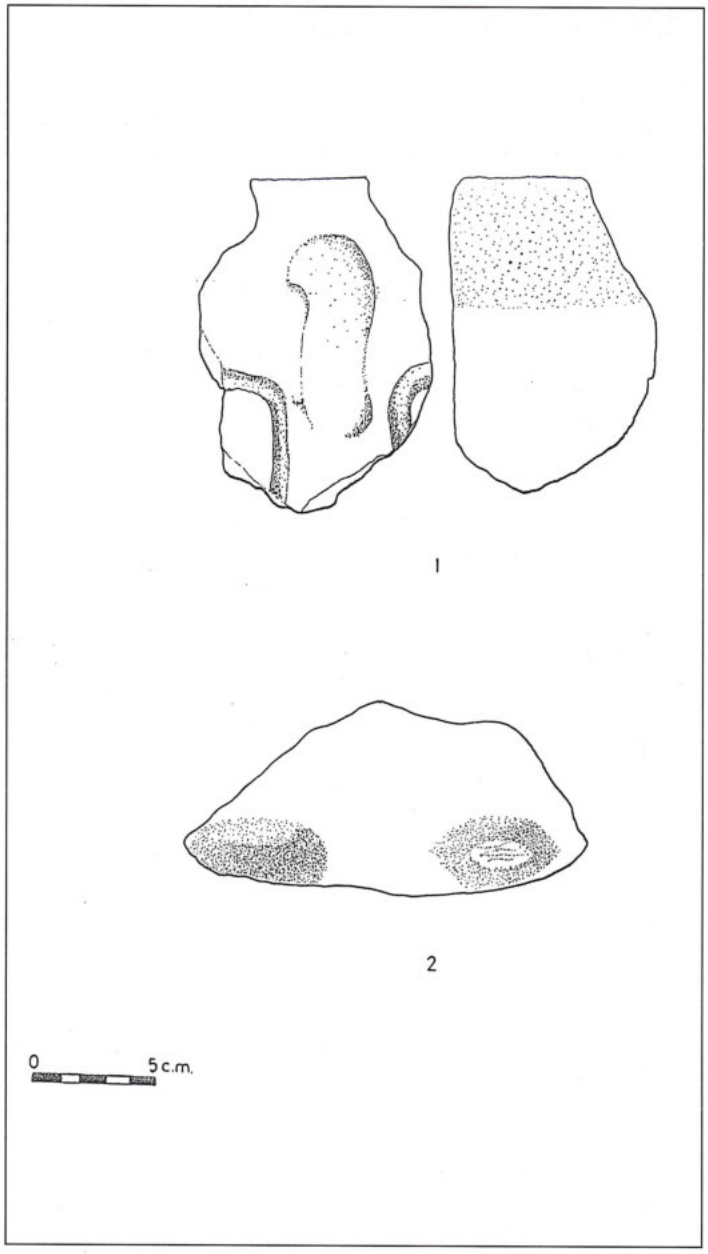
To conclude, several types of incised patterns are recognizable on the excavated Neolithic pottery assemblages at 'Ayn Ghazāl. The patterns can be arranged in a chronological order based on the stratigraphic sequence, although local development is noticed from one phase to another.

**Applied Decoration**

This kind of decoration was first noticed in knob handles (FIG. 6:2). Such a decorative element, if it is so, is common at most of the Pottery Neolithic sites. Nevertheless, new styles of applications were noted from the Late Yarmoukian Phase at 'Ayn Ghazāl. One style consists of two elongated knob handles with a space in between, attached to the middle of the body of a large jar. This could be functional, meaning that the space was left for holding a piece of rope to help in carrying the jar.

The other style consists of two applied curved motives that were added near the lower attachment of the loop-handle on the neck of a jar (FIG. 6:1). This style, to our knowledge, is recorded for the first time from the Neolithic Culture in Jordan, though it was found before at 'Ayn al-Jarba in Palestine (Kaplan 1969: FIG. 7). Parallels were also excavated at the site of Sotto in Iraq (Badr 1989: 176 - 177, FIGS. 62 - 63).

Such applied decorative elements, based on the stratigraphic sequence of the site of 'Ayn Ghazāl, most probably belong to the latest phase of the Yarmoukian Culture.




6. Applied decorations.

**Punctate Decoration**

Punctuate designs were found on a few sherds belonging either to jars or to a spoon. In the first case, the punctate decoration was made in rows on the body of the jar, while in the second, two punctations were made near the handle of the spoon and the saucer. The punctations were created by a very pointed tool while the clay was leather hard. This rare decorative element was also recognized at the site of Jabal Abū Thawwāb (Kafafi 1986: 62).

**Burnishing**

As a result of the study of the excavated pottery assemblages at 'Ayn Ghazāl, it was noticed that burnished ware made its first appearance during the Middle Phase, and became dominant during the Late Phase. A small collection of very highly burnished red ware was excavated in Loci 009 and 005 in Square 3677 in the Central Field. The burnished sherds were thin, hard, and well fired. Due to the small quantity of sherds in this collection, they may have been imported. The burnished sherds were decorated by a very glossy red paint and several styles of incisions, such as herring-bone, zig-zags, and criss-crosses.

To sum up, based on the results from the excavated areas at 'Ayn Ghazāl and their stratigraphy, the painted decorations represent the earliest decorative motives at the site. It is probable that future excavations will change this conclusion. Also, it is very clear now that the incised decorations accompanied by red paint were the most common decorative style during the Middle and Late

Phase of the Yarmoukian Culture at the site.

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# Pottery Marks from the Expedition to the Dead Sea Plain

## Pottery Marks

The principle kinds of incised and impressed marks which form individual designs on pottery excavated by the Expedition to the Dead Sea Plain fall into three groups. They may be identified as punctate, split reed, and incised. All three kinds were found on the tomb pottery; the first two groups are principally from tombs, while as usual at Early Bronze sites, incised sherds were found at the town sites as well. The tomb pottery presents the opportunity to look at whole vessel types from closely dated tombs.

This study will look at these three types of pottery marks – their date, when they appear, and their patterns of use. This leads to consideration, however inconclusive, of their purpose.

## Punctate

Punctate designs,[1] probably made by a round pointed instrument such as a reed, appeared on 29 vessels from the 1965 and 1967 Lapp campaigns as published in the first volume of the Expedition to the Dead Sea Plain (Schaub and Rast 1989: FIG. 152). They were all from EB IA tombs, on all types of vessels, and principally from four tombs. From the Rast-Schaub excavations, 24 vessels and two sherds with punctate designs came from EB IA tombs (FIGS. 1-2). In addition seven vessels came from EB IB tombs (FIG. 3). There were a few sherds with what may be punctate marks found at the town sites, but they have yet to be studied.

Several contrasts may be made between the two series of EB IA punctate vessels, those published and those from the later excavations. The "designs"from the latter are simple horizontal, slanted or vertical punctate lines, or combinations of them, and sometimes grouped. In general they are not as interesting as those found in 1965-67.[2] The designs from the later excavations are found on a variety of jars (medium-large, medium-small, and small)[3] on large, medium, and small bowls, and two juglets. They occur frequently on jar handles (eight examples) and twice on bowl handles. In two instances these are ledge handles, in other cases, strap. On four other vessels they are placed in relation to the handles, above, below, or around. The designs on and around handles form horizontal rows. Those on the walls or shoulders of vessels tend to be more vertical. From the Lapp excavations in only two cases is the design on or in relation to the handles.[4]

Several of the EB IB vessels which have punctate designs exhibit distinct EB IB characteristics.[5] A spouted large deep bowl has punctate marks on the plain ledge handles and on top of the spout as well as around the rim (FIG. 3:2; Schaub 1981: FIG. 16:22), and a small jar, which has a punctate pattern on its high neck, has two handles which reach above the rim (FIG. 3:1; Schaub 1981: FIG. 11:3). Finally, there are elaborate designs on the handle as well as the cup of two beak-handled spoons (FIG. 3:3,4; Schaub 1981: 71-72, FIG. 6:12-13).

Of the 29 vessels from the Lapp excavations, 20 were from four tombs (A 3, A 47, A 71W, and A 72NW); three of these tombs are of the later group of EB IA tombs and six pots with punctate designs were from other late EB IA tombs.[6]

The 26 EB IA punctate designs from the Rast–Schaub excavations, represent 17 different tombs. Only A 89SE

[1] Punctate *designs* do not include the very common punctate marks below rims, usually completely around the vessel, on large bowls and many juglets in EB IA tombs.

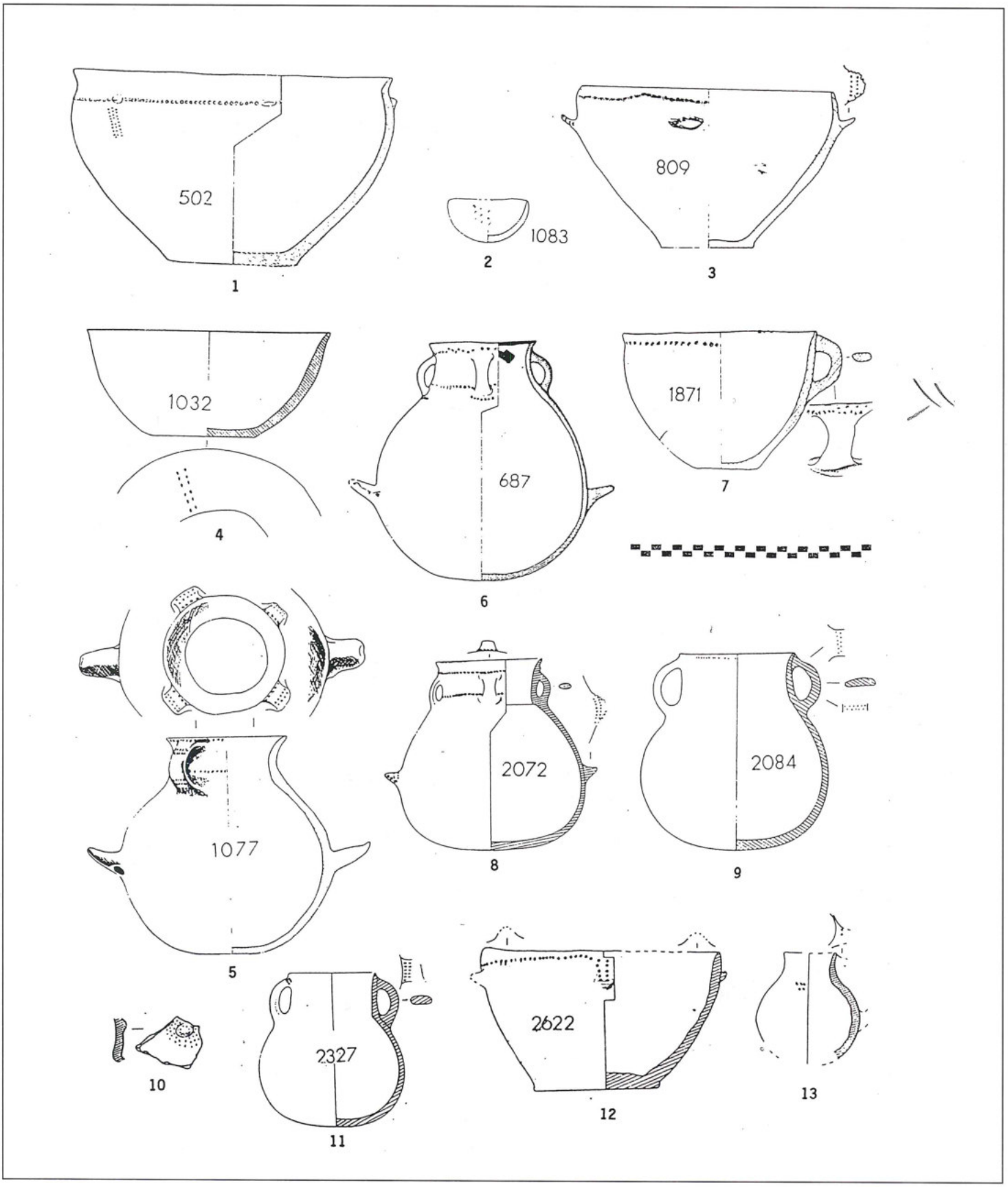
[2] Cf. Schaub and Rast 1989: FIG. 152, especially the long-necked animal, no. 28.

[3] From the early excavations the marks were only on medium-large jars.

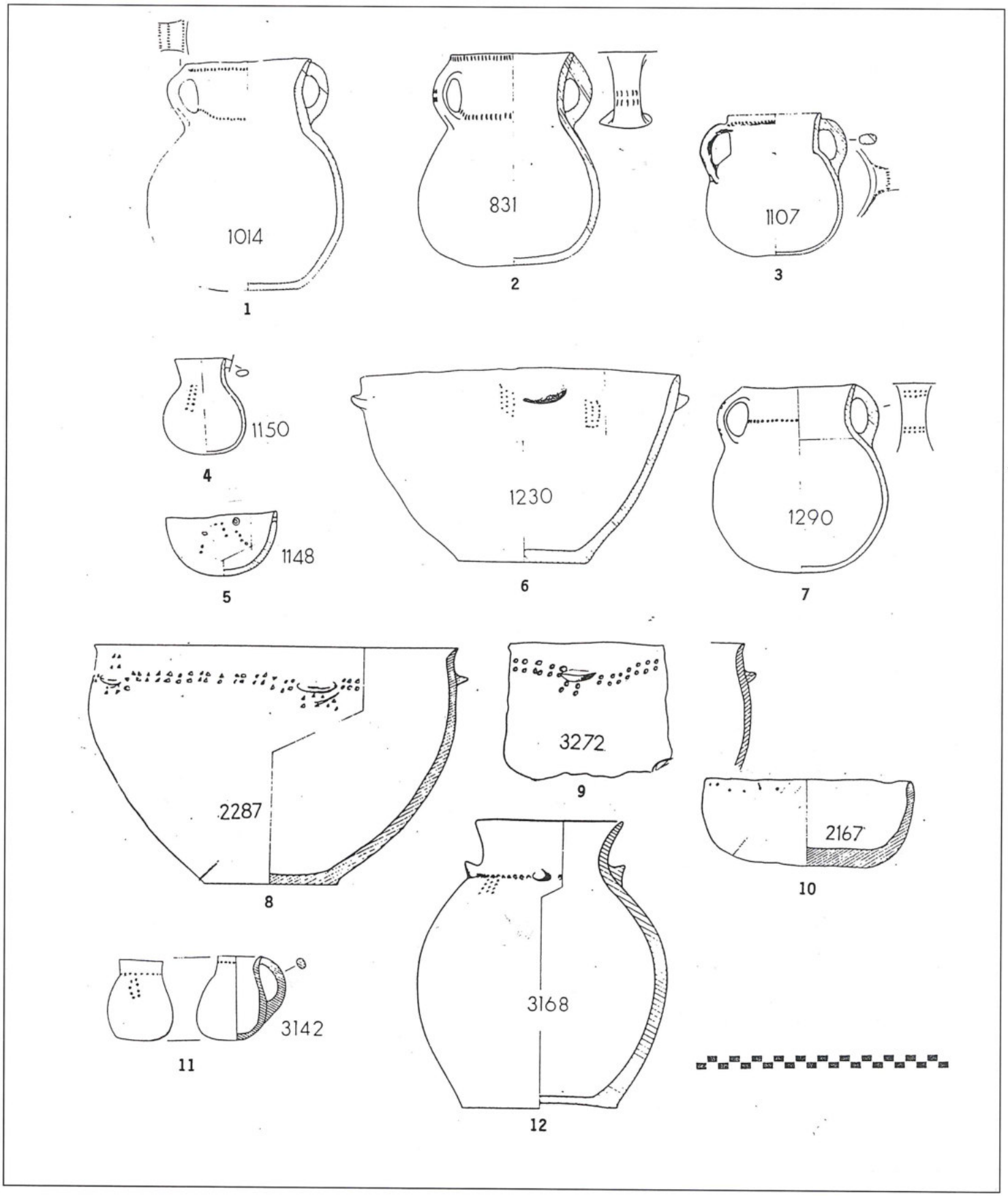
[4] Schaub and Rast 1989: 263, no. 15 is on a jug handle, and no. 29 also has punctate decorations on the ledge handles as well as the punctate design on the neck (microfiche [mf.] FIG. 368:1). Not included are juglets from any of the excavations which have a line of punctate marks on their handles which seem to serve a functional purpose (pp. 260-261). However, it might be worth noting the two lines of punctate lines vertically on the edges of juglet #91213 from A 68SE, (mf. FIG. 335:9), the punctate lines on the handles of jar #90200 and bowl #90145 from A 6N (mf. FIG. 315:7, 317:6), the punctate lines above and below the handle of jar #91692 from A 81E (mf. FIG. 356:5) and below the handle of jar #91735 from A 82SE (mf. FIG. 364:3).

[5] For a summary of the EB IB characteristics at Bāb adh-Dhrā', see Schaub and Rast 1989: 73-74.

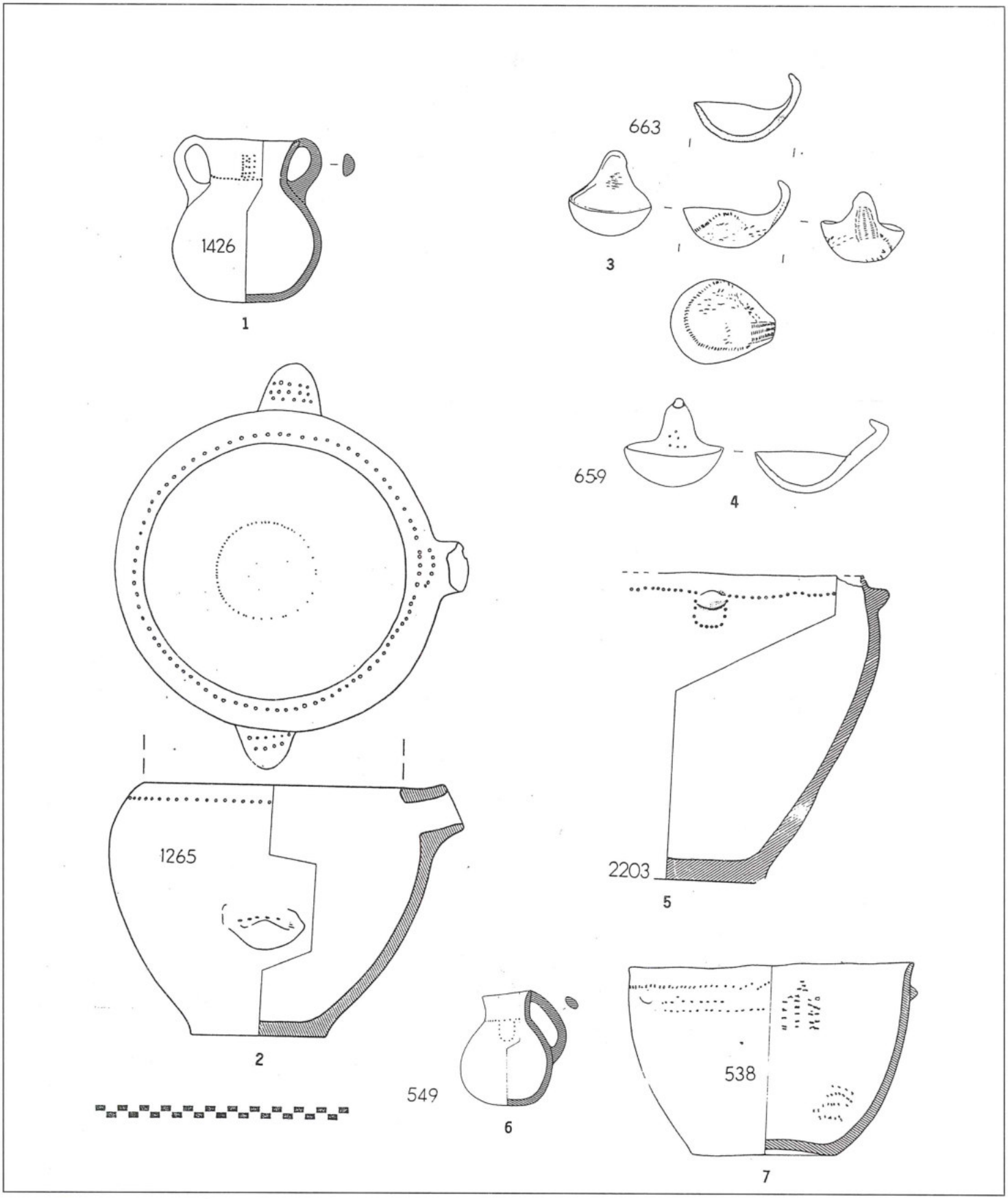
[6] The tombs are grouped chronologically, Schaub and Rast 1989: 29.



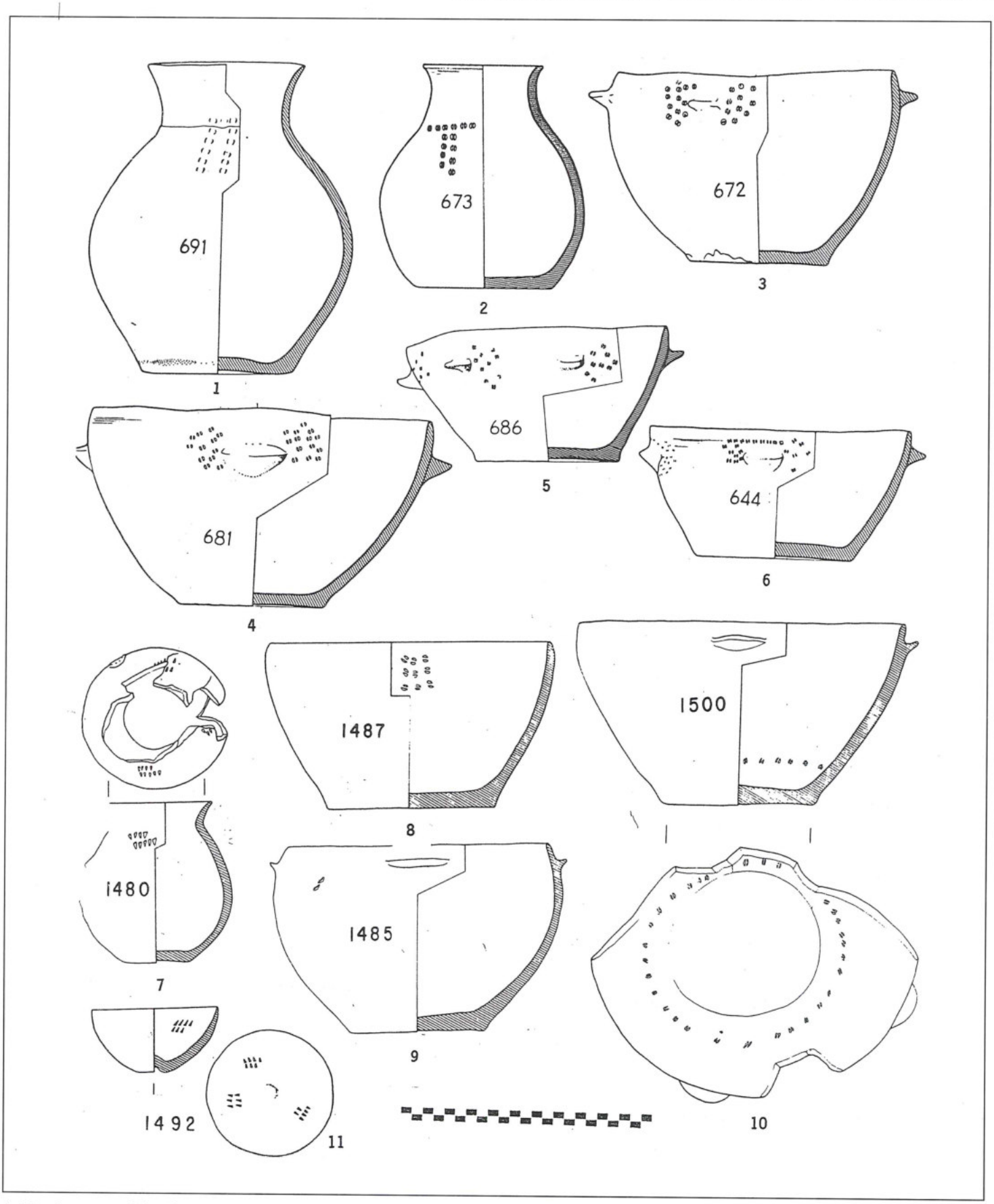

1. EB IA tomb pottery with punctate designs from the excavations of the Expedition to the Dead Sea Plain (Rast-Schaub excavations).




2. EB IA tomb pottery with punctate designs from the excavations of the Expedition to the Dead Sea Plain.




3. EB IB tomb pottery with punctate designs from the excavations of the Expedition to the Dead Sea Plain.




4. Tomb pottery with split reed designs from the excavations of the Expedition to the Dead Sea Plain.

had as many as four pots with punctate marks; chambers 89NW and A 107W had three, 89NE and A 111N, two.

The seven EB IB designs came from four different tombs, two each from A 88L, A 100N, and G2. The single pot came from A 104. These tombs will be noted again when we consider the other decoration types.

Parallels to these punctate designs from other sites of the Early Bronze Age are not plentiful. There are punctate designs at Jericho on small bowls[7] and juglets[8] from Tomb A 94, which dates close to but preceding the EB IB tombs at Bāb adh-Dhrā' (Schaub 1981: 76). Most of the designs at Jericho are on the inside of small bowls, as are some on the similar bowls at Bāb adh-Dhrā' (Schaub and Rast 1989: FIG. 152: 5, 6,16, 25). The Jericho designs are also varied, sometimes hardly more than a row of a few shallow holes.

The punctate decoration above a ledge handle at Tall Umm Ḥammād should be noted (Helms 1986: FIG. 12:12).[9] At least three ledge handles from the Bāb adh-Dhrā' cemetery have punctate designs on them (A 83 #91785, A 80W #809, A 105NW #2072). The Tall Umm Ḥammād vessel is from "Stage 2" which Helms dates to EB IA, Jericho Proto-Urban A (Helms 1986: 37, 44).

Markings on EB holemouth pots from Megiddo (Guy and Engberg 1938: FIG. 7: P4524 and P4526) may be punctate marks (EB IB?), but there are no vessels of this type with the punctate designs in the Bāb adh-Dhrā' repertory.

A fragment of a narrow-necked jug from Tall al-Fār'ah (North) Tomb 6 has what appears to be punctate lines on its shoulder (de Vaux 1951: FIG. 1:7).[10]

Very interesting are three quadrupeds (animals) in punctate on sherds published from Ghassūl as well as an elaborate design on the neck of a large jar (Mallon 1931: FIG. 61: 1-3, 7). This recalls the animal on the wall of a jug from Tomb A 82E (Schaub and Rast 1989: FIG. 152: 28). The Ghassūl sherds are from the Ghassulian culture, predating the Dead Sea Plain material.

The few parallels to the punctate design is probably due to the small amount of material contemporary with the early tombs of the Bāb adh-Dhrā' cemetery which have been published. The uniqueness of the Bāb adh-Dhrā' tombs is once again apparent.[11]

## Split Reed

The second type of decoration appears on pots in only three EB IB tombs from the Bāb adh-Dhrā' cemetery, and comparative material is lacking. The design is also impressed by a pointed instrument. It is characterized by marks always appearing in pairs as if made by a split reed, and has thus been designated the "split reed" type (FIG. 4).

The three tombs were all excavated by Rast and Schaub and include twelve vessels with the split reed design. Six are from Tomb A 100N, five from G 1, and one from G 2. It should be noted that Tombs 100N and G 2 also had vessels with punctate designs.

Three of the designs are on the shoulders of handleless jars and the rest are on bowls. From A 100N two split reed patterns are on jar shoulders (FIG. 4:1,2; Schaub 1981: FIG. 5:2, 3), and the other four are around the handles of bowls (FIG. 4:3-6; Schaub 1981: FIG. 7:1-4). The third split reed pattern on a jar shoulder came from Tomb G 1 (FIG. 4:7); the other bowl designs were on the walls of large or medium large deep types except for one small bowl from Tomb G 1 (FIGS. 3:7, 4:8-11).

The various groupings of split reed marks usually form vertical rows. Five times the pattern is repeated on more than one place on the vessel. This occurs in each vessel type: the handleless jars, the deep bowls, and the interior of the small bowl.

## Incised Marks

*Tomb Pottery*

From the Lapp excavations, five pots from EB IA tombs had incised marks on them. Three of the four tombs represented belonged with the latest EB IA tombs. The fourth, Tomb A 72NW was classed with the middle-range group (Schaub and Rast 1989: 29). Two small bowls from Tomb A 47 had incised circles in the interior on their bases.

All three EB IB tombs excavated by Lapp, A 13, A 43, and A 53, had pots with incised marks; 12 were from A 43. Schaub and Rast excavated four EB IB tombs in 1977 (A 100N, A 88L, G 1 and G 2), and Tomb A 104 in 1979 (FIG. 5).[12] All of these had at least one pot with an incised mark, with A 88L having 14. The two tombs with the most incised pots were A 43 with 12 out of 74 pots with incised markings (16%) and Tomb A 88L with 14 incised out of 95 pots (15%). This is approximately 10% of the EB IB pottery found in the tombs. Half the pots in Tomb A 43 were medium-large jars, while all the 14 incised A 88L pots were bowls, 12 of them large to medium-large deep types. The A 43 designs were varied, but many of them were modifications of a "U" design. All the marks on the A 88L vessels were 1, 2, or 3 crossing or touching lines. They were on the walls or in-

[7] Kenyon 1960: FIGS. 9:16; 10: 3-5, 7, 10; 11:5, 14, 25.

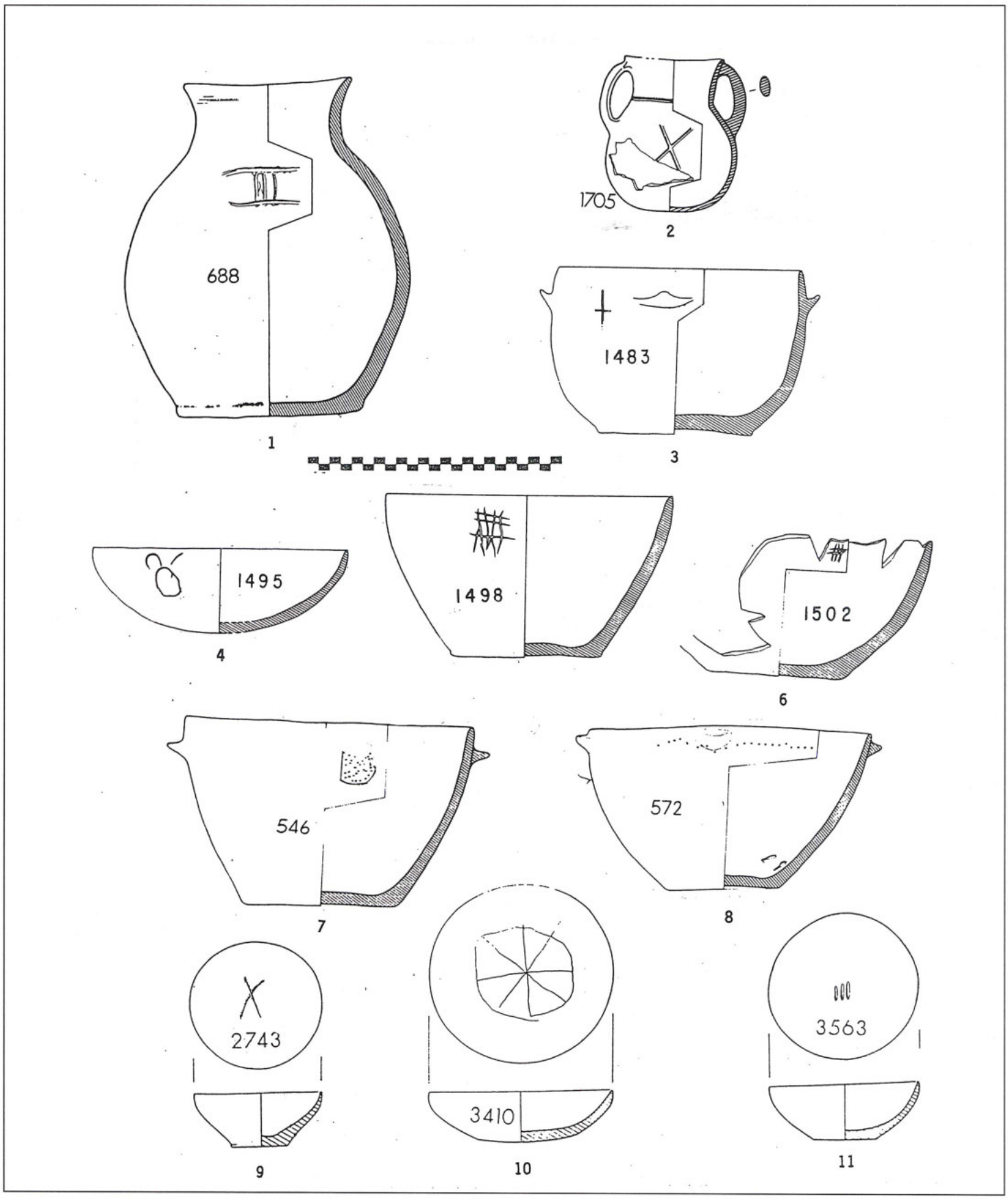
[8] Kenyon 1960: FIGS: 12:14, 27, 28; 13:7.

[9] Helms (p. 38) relates this vessel to Bāb adh-Dhrā' types: "... a generic relationship prevails which might indicate parallel development from a common source."

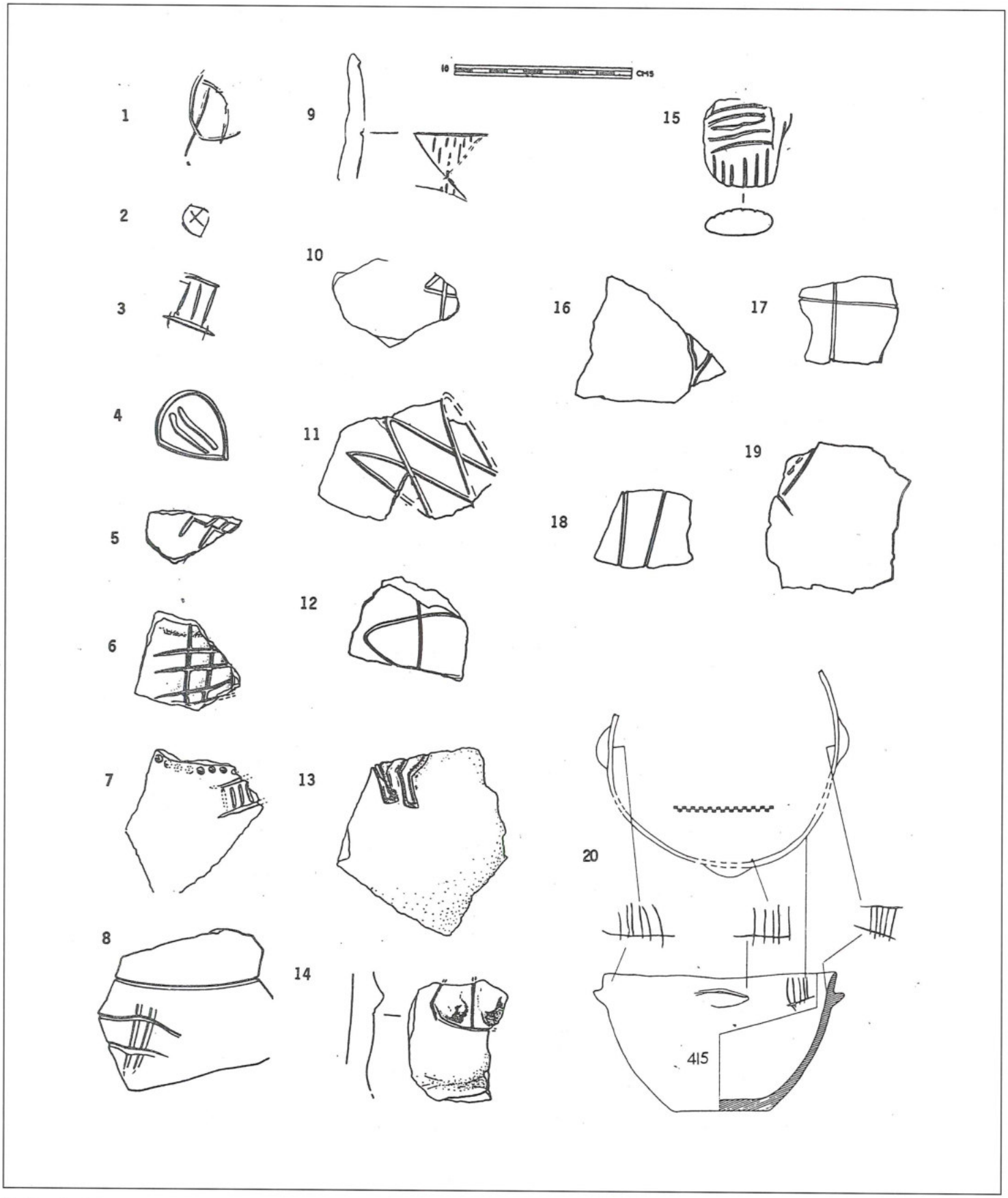
[10] See Shaub 1981:75-76 for the dating of the Tall al-Fār'ah tombs and narrow-necked jugs.

[11] Cf. Schaub 1981: 69, 71.

[12] See the catalogue for figure references for the tomb pottery published in Schaub and Rast 1989 and Schaub 1981.




5. EB IB and EB II-III tomb pottery with incised marks from the excavations of the Expedition to the Dead Sea Plain.




6. Sherds with incised marks from the excavations of the Expedition to the Dead Sea Plain.

terior bases of the bowls.

All the pots with incised marks from Tombs G 1 and G 2 were on the walls of deep medium-large to large bowls. The pots from A 13, A 53, A 100N and A 104 included two jars, two juglets, and a small bowl. Their designs were linear and circular variations.

The three small bowls from EB II-III Charnel House A 22 had incised markings on their interior bases. Their designs varied.

The cemetery sherds were from a juglet and a large vessel. At least the first was probably a common cemetery type.

*Town Site Pottery*

Incised marks on pottery from the town sites, Bāb adh-Dhrā‘ and Numayra (FIG. 6), have been found infrequently; only 30 from all seasons of excavation have been recorded. Most belong to the EB II-III occupation, and the majority probably appear on large jars. It is estimated that 17,000 diagnostic sherds have been registered from the town site excavations, so those with incised designs are a very small percentage.

It is possible to determine that four sherds are from large necked jars, two are from holemouths, and one each from a small jar, a jug, a juglet, and a medium-small bowl.[13] A very large deep bowl or basin with four sets of incised marks was partially reconstructed (FIG. 6:20). One incised mark is on a ledge handle. Twelve sherds must be from large vessels, probably jars with necks such as the two complete vessels with incised marks from Numayra.[14] Two sherds are too small to determine the kind of vessel from which they came or much about their incisions.

Of the sherds only five contain the complete incised mark (FIG. 6:1-4)[15]. There are enough of 17 other designs to be significant (FIG. 6:5-15). The remaining seven are incised lines too incomplete to determine if they are merely strokes or are designs (such as FIG. 6:16-19).

The marks made include X's, ovals with lines in them, occasional triangles, cross line patterns, and various other crossing or touching lines usually at right angles. One sherd has what appear to be the fore and hind legs of an animal, and two sherds have a pair of knobs with incised marks around and between them.

To consider comparable incised markings to the Bāb adh-Dhrā‘ tomb pottery, we must once again look at Jericho. The small EB IA bowls from the Bāb adh-Dhrā‘ cemetery have a variety of markings on their interior bases: principally circle designs, linear variations, and X's.[16] Jericho Tomb A 94, dated between the Bāb adh-Dhrā‘ EB IA and EB IB tombs, also has all three types on small bowls.[17]

The Bāb adh-Dhrā‘ juglets had an assortment of marks on their shoulders and bodies, from short dashes, U shape, and a linear pattern, to an elaborate circle and line design.[18] Some juglet handles had incised horizontal lines on them. Jericho Tomb A 94 has typical EB IB juglets (whose handles reach above the rim) with crosses and linear designs on their walls and other designs on and below their handles (Kenyon 1960: FIGS. 12 and 13). It should also be noted that a Bāb adh-Dhrā‘ juglet handle from the town site has an incised X near its top (BD 81 19.2.37 .7349).

The Bāb adh-Dhrā‘ large bowls found in the EB I tombs are generally unparalleled in other cemeteries, but there is a large bowl from Jericho Tomb A 13 which has incised crossing lines on its interior wall, the exact pattern on two Bāb adh-Dhrā‘ Tomb 88L bowls (Kenyon 1960: FIG. 22:1; Schaub 1981: FIGS. 12:2, 13:5). The Jericho and Bāb adh-Dhrā‘ tombs are contemporary (Schaub 1981: 76).

Except for Jericho, incised marks are lacking or rare in other published EB I tomb pottery.[19]

When we turn to pottery excavated from *talls* or town sites, the variety and frequency of incised marks on Early Bronze Age pottery has long been noted. Petrie, Bliss and Macalister all published many "pottery marks" from their early explorations and excavations, often without distinction as to site or period.[20] At some Palestinian sites incised marks have appeared very frequently on Early Bronze Age pottery: Tall al-Ḥiṣi, ‘Arād, Yarmouth and Tall Ḥalaf.[21] When Early Bronze Age pottery is published from almost any site, some pot marks are shown on sherds. Incised marks which are similar to almost any of the marks we have cataloged from the Expedition to the Dead Sea Plain can be found on other Early Bronze

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13 See catalogue where the vessel type is indicated and full descriptions of the vessels and marks are given as far as it is possible.

14 Since these are domestic vessels and not found in the tombs, their use and purpose probably should be separated from the tomb pottery incised marks. See below.

15 Also # .7349, see catalogue.

16 Circle designs: A 43, Schaub and Rast 1989: FIG. 40:5,8, EB IA; also on interior wall (A 43, FIG. 183:13) and exterior wall (G 1, #1495, EB IB); linear variations: A 188L, Schaub 1981: FIG. 15:3, 7, EB I B; and X's: in EB II-III tomb A 22, #2734, and #3410 (within a circle).

17 Note especially Kenyon 1960: FIG. 9: 24, 15, 17.

18 Short dashes: EB IA, A 72 NW, Schaub 1981: FIG. 84:3; U shape: EB IB, A 13, Schaub and Rast 1989: FIG. 129:6; linear pattern: EB IB, A 53, Schaub and Rast 1989: FIG. 145:16, and also a juglet sherd from the cemetery, BD 77 ATT9.6 #754; elaborate circle and line design: EB IB, A 43, Schaub and Rast 1989: FIG. 134:9.

19 Azor (Ben Tor 1975: FIG. 6:3) has a cup with incised decoration on its rim and han dle.

20 Petrie 1891: PL. V:48-50; Bliss 1898: 21, 23, 25; Bliss and Macalister 1902: PL. 29; Macalister 1912: PL. 190.

21 Ḥiṣi: beginning with Petrie and Bliss' and Macalister's publications of pot marks, most of which come from Ḥiṣi (see n. 20), more recently, Fargo 1979: 27, 38, FIGS. 4, 5; ‘Arād: Amiran 1978: PL. 112 *et passim*; Yarmouth: de Miroschedji 1988; Tall Ḥalaf: verbal communication from Joseph Seger.

Age sites. Except for the patterns we will note below concerning all the tomb pottery marks, no particular conclusions can be drawn. However, a few incised marks which appear with particular regularity on some types of vessels and some that are particularly interesting will be discussed.

It has often been noted that the marks occur frequently near the rim on holemouth jars (Fargo 1979: 27). Often the mark is a simple X as on a sherd from Bāb adh-Dhrā' (cat. no. .7089) and possibly on another fragmentary holemouth rim with a partial stroke (cat. no. .6077). These occur at Ḥiṣi, Yarmouth, 'Arād, Wādī al-Yābis and Tall Umm Ḥammād ash-Sharqiya,[22] but it should be noted that holemouths with a variety of other designs are probably more frequent.

Particularly interesting is the X on the ledge handle of a sherd from Bāb adh-Dhrā' (cat. no. .5491).[23] Punctate designs on ledge handles occurred on some of the Bāb adh-Dhrā' tomb pottery (see above). The X alone or sometimes within a circle or with other strokes is also fairly common on the interior bases of bowls in the tomb pottery at Bāb adh-Dhrā' and Jericho.[24]

There are several trident designs on EB IB tomb pots from Bāb adh-Dhrā' (Schaub and Rast 1989: FIG. 153: 32, 33, 38). Variations of the trident occur at 'Arād near the rim of two holemouth jars and on the bottom of a bowl, and on a Ḥiṣi sherd.[25] This symbol was found on Chalcolithic vessels at Ghassūl and Nahal Mishmar.[26] Petrie has many examples of tridents among the incised pottery marks he published from Egypt (Petrie 1901; 1902). In the First and Second Dynasties he considers them the *ka* hieroglyph when it consists of two raised hands (tridents) sometimes with other symbols.[27] When the single tridents are cruder signs and not linked to hieroglyph, he relates these "signatory" to later numeral systems.[28] Emery also shows a number of trident marks which he considers entirely disconnected from the hieroglyph of the First and Second Dynasties (Emery 1961: 201, FIG. 121).

Handles are a common place for pottery marks to appear.[29] An X appears near the top of a juglet handle from the Bāb adh-Dhrā' town site (cat. no. .7349). More interesting is a jug handle from the surface of the town site (FIG. 6:15) which has five horizontal lines between two vertical lines. Helms found a variety of "symbols" on jar and jug handles from the Umm al-Bighāl EB IV cemetery and he was able to rank them by volume, and further, hypothesize that such series may exist for northern Palestine/Transjordan and southern Lebanon.[30]

One incised design from Bāb adh-Dhrā' (FIG. 6:13) almost certainly depicts the fore and hind legs of an animal although the sherd is broken off above them. Incised animals are found on Jericho Tomb A94 small bowls,[31] but the stick figures are a totally different style and the Bāb adh-Dhrā' sherd is probably from a large vessel. From Megiddo animals are said to be scratched on pottery after firing.[32] Animals do not seem to be commonly incised marks during the Early Bronze Age.

Finally attention should be directed to two sherds from the town site (FIG. 6:14 and cat. no. .0059) with two knobs encircled, one with a vertical line between the knobs, the other with short dashes between them. They probably come from large vessels. FIG. 6:14 is broken (intentionally?) to look exceptionally like a woman's breasts. Knobs, singly or in pairs, are not unusual on Early Bronze Age pottery.[33] Several knobs from Bāb adh-Dhrā' tomb pottery had punctate designs around them,[34] and a complete pithoi from Shaykh Muḥsin in the Southern Sinai had two pairs of incised knobs one of them decorated with incised lines (cross lines between knobs) on its shoulders (Beit-Arieh 1986: 34, FIG. 9:5). Finally, from Ghassūl (Chalcolithic) came a round-based jar with two projecting knobs (or nipples?) with incised lines between them which may represent an incised garment or necklace.[35]

**Summary**

The pattern of designs on the tomb pottery is most revealing. The punctate designed pottery appeared mainly in EB IA tombs with only seven vessels of a total of 63 coming from EB IB tombs. On the other hand the split reed design appeared only on 12 EB IB vessels. Incised marks also appeared mainly on EB IB vessels, appearing on 37 EB IB pots out of a total of 45 incised marks from the tombs. Five of the remainder were on EB IA pots and three were from an EB II-III Charnel House.

Eight EB IB tombs from the Bāb adh-Dhrā' cemetery have been excavated and approximately 370 pots have

[22] Ḥiṣī (Fargo 1979: FIG. 4:4), Yarmouth (de Miroschedji 1988: PL. 39: 9, 10), Wādī al-Yābis (Mabry and Palumbo 1988: FIG. 8:37), Umm Ḥammād (Helms 1984: FIG. 16:1), and 'Arād (Amiran 1978: PL. 112: 7-10, FIGS. 8:24, 19:12, 45:17, 51:8, 54:31).

[23] A plain ledge handle from Megiddo has two short incised dashes (Guy and Engberg 1938: PL. 6:12).

[24] See above and n. 17; also Calloway 1980: FIG. 61:28.

[25] Amiran 1978: PLS. 46:6, 19:6; 23:7; Fargo 1979: FIG. 5:d.

[26] Mallon 1931: PLS. 3:4, 1:4; Mallon *et al.* 1934: PL. 37:4, 6; Bar-Adon 1971: 57, no. 27.

[27] Petrie 1901:47, PL. LV C: 27-48; 1902: 30, PLS. XLVII-XLVIII.

[28] Petrie 1901: PL. LVI: 330-346; 1902: 31, 32, PLS. LIV-LV.

[29] Punctate marks on handles are considered functional by Schaub (see above and Schaub 1981: 261).

[30] Helms 1987a: 46-48; Helms and McCreery 1988: FIGS. 8-12.

[31] Kenyon 1960: FIGS. 9:1, 10:6, 11:4; also juglet FIG. 13:12.

[32] Engberg and Shipton 1934: FIG. 10:K-S, Stage VI.

[33] For example, Kenyon 1960: FIG. 14:10; Ben Tor 1975: PLS. 14;4-5, 20:3, FIG. 37:9-10; Amiran 1978: FIG. 41:18; de Vaux 1951: FIGS. 4:7, 6:11, 12:6.

[34] Schaub and Rast 1989: FIG. 152: 11, 14, and a sherd from Tomb A 107S.

[35] Mallon *et al.* 1934: PL. 53; Elliot 1977: FIG. 5:4.

been recovered from them (TABLE 1). Fifty-four vessels or about 15% of them had punctate, split reed, or incised marks. All eight tombs have some pots with designs. Tomb 100N had all three types and the biggest percentage of decorated pots, nine out of 40 or approximately 22%. This tomb and G 1 had most of the split reed designs; most of the incised designs came from A 43 and A 88L. Pottery marks are characteristic of the EB IB tombs although in some tombs as few as 5% of the vessels had them. Most chambers favored a particular type of mark, but the variety is significant.

**Table 1.** "Decorated" vessels of EB IB tombs.

| | | | |
|---|---|---|---|
| *A 13* | 20 vessels | 5% | with marks: |
| | 1 incised | | |
| *A 43* | 74 vessels | 16% | |
| | 12 incised | | |
| *A 53* | 29 vessels | 7% | |
| | 2 incised | | |
| *A 100 N* | 40 vessels | 22% | |
| | 2 punctate | | |
| | 6 split reed | | |
| | 1 incised | | |
| *A 88L* | 95 vessels | 15% | |
| | 2 punctate | | |
| | 14 incised | | |
| *A 104* | 40 vessels | 5% | |
| | 1 punctate | | |
| | 1 incised | | |
| *G 1* | 40 vessels | 20% | |
| | 5 split reed | | |
| | 3 incised | | |
| *G 2* | 30 vessels | 13% | |
| | 1 punctate | | |
| | 1 split reed with punctate also | | |
| | 2 incised, 1 with punctate also | | |

## Significance or the Meaning of the Pottery Marks

Finally it is necessary to consider the significance or the meaning of the pottery marks. This has long been considered by archaeologists, and various suggestions will be briefly reviewed.

The marks occur on all parts of both large and small vessels: the handles, below rims, on shoulders and midbody, and bases, and on the interior as well as exterior walls and bases of bowls. They are incised both before and after firing, but our concern has mainly been with the former. Those made after firing are less durable, could be made on broken potsherds, and their use much more widespread. Those incised before firing are much more likely to be intentional.

Petrie publishes hundreds of marks made on Egyptian pottery (1901; 1902). He considers some "unquestionably hieroglyphs; others are probably connected with the signs used by the earlier prehistoric people; and many can scarcely be determined" (Petrie 1902: 29). The hieroglyphic signs[36] belong to the First and Second Egyptian dynasties, and are crude arms *(ka)*, birds, serpents, fishes, and such. The linear signs[37] according to Petrie certainly go back to early prehistoric times and "continued to be used until the alphabets of the Mediterranean were selected from them" (Petrie 1901: 47) and he relates these "signatory" to the "system of geometrical signs used from prehistoric to Roman times in Egypt, and also in other countries around the Mediterranean" (1902: 31). Of their alphabetic use in later stages the Phoenicians only selected a few for numerical purposes according to Petrie (1902: 32).

Emery also distinguishes between the Egyptian "incised texts on pottery vessels executed before firing," which, he says, "should not be confused with pot marks" (Emery 1961: 199, FIG. 119) and the pot marks or "signary" which are "entirely disconnected with known hieroglyphs" (p. 201, FIG. 121). The latter's purpose he still considered a matter of debate, although not haphazard marks. He did not think they could have been owners' marks or potters' signature because the same groups of signs were used over more than a hundred years. He thought they could possibly indicate the workshop in which the pots were made, but different groups of signs on pots made from the same clay source did not make this likely. The system of marking was not confined to one locality, but all over Egypt ( Emery 1961: 201).

Commenting on the marks from Ghassūl, Mallon suggested that the Ghassulians were on the verge of the development of writing, and compared some of the motifs to the Minoan script of the second millennium B.C. (1931: 267-270).

Bliss and Macalister note that some of the marks they publish from Ḥiṣi bear a certain resemblance to the old Hebrew letters of *tau, shin*, and *resh*, but "the rest of the signs are purely arbitrary", and antedate the "earliest known forms of Phoenician writing" (1902: 82-83). However, it should be noted that the proto-Sinatic inscriptions, date nearly a millennium later than many of the signs we are dealing with.

More recently other suggestions have been made as to their use. In their publication of the Megiddo tombs, Guy and Engberg suggested that short strokes or impressions might indicate the number of measures of grain contained in holemouth vessels (1938: 12). Holland, commenting on those found in his excavations at Tall as-Swayḥāt in Syria (1977: 54-55), notes that they might in-

[36] Petrie 1901: PLS. LV, A-C; 1902: PLS. XLIV-LI.

[37] Petrie 1901: PLS. LV C, D; 1902: PLS. LII-LVIII.

dicate measures of grain on large jars, but this could not hold true for similar marks on small bowls and cups unless they were used for measures. He compares the Swayḥāt marks with others, such as those from Ḥiṣi (Bliss 1894: 21, 23, 25), and thinks they possibly may indicate some numbering system generally accepted by pot manufacturers. Matthers has argued similarly as Schmandt-Besserat demonstrated that geometric symbols were an early form of account keeping in Mesopotamia (Fargo 1979: 38).

Helms argues for a system of marks on jug handles in relation to vessel volume throughout the northern and central areas of Palestine/Transjordan and Southern Lebanon during the latter part of the third millennium B.C., based on his finds in an EB IV cemetery at Umm al-Bighāl, near 'Ammān (1987a: 46-48). He limited his analysis to repeated symbols. He does not consider this a totally new invention but adapted from more sophisticated practices which existed at that time (1987a: 48).

The report from the first three campaigns of the French excavations at Yarmouth indicates that about 10% of the holemouth jars had pottery marks (de Miroschedji 1988: 76; Nodet 1988: 125, n. 2). Nodet then suggests that the marks may have been made before firing in order to keep account of their serial production. Every tenth jar would have been marked.

## The Marks on the Pots of the Expedition to the Dead Sea Plain

All of the above suggestions have merit in their own context, and it is possible that several are correct. However, it should be noted that in each case, evidence is based on specific sites or circumstances in date or area, often on a limited number of vessel types, and almost always on specific types of signs. It is therefore unlikely that any of the above suggestions are helpful in reference to the Expedition to the Dead Sea Plain.

Most of our marks are on tomb pottery. Specifically, most of the tombs with these vessels can be dated toward the end of EB IA or to EB IB. Among these tombs, it is difficult to establish a pattern of particular marks or even a constant percentage of vessels that are marked. Rather, it can be said, that characteristic of some EB I tomb groups and all EB IB tombs are decorations on vessels, and preference is shown within a chamber for a particular type of decoration (EB IA tombs: punctate; EB IB, split reed: Tomb 100N; incisions of particular types: Tomb 43 – U variations, Tomb 88L – crossing lines), or a combination of the various types (Tomb G 2). In other words, for the tomb pottery, it can probably be said that the pottery marks were for decorative purposes, perhaps a preference of a family or clan.

The marks on the Expedition to the Dead Sea town site pottery are not numerous or consistent enough to make any firm hypothesis. Most of the marks seem to be on large necked jars,[38] such as the two complete vessels from Numayra, but there are a number on other vessel types. Different designs are represented, but only the X appears more than once. Given the limited evidence, the purpose for the pottery marks from the town sites of the Dead Sea Plain can scarcely be determined.

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[38] Except in the two cases, the ware is not typical of holemouth ware (coarse, and usually dark, brown or reddish-brown, with brown or gray surfaces [cf. Nodet 1988: 125]).

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## Catalogue

### PUNCTATE

*Lapp Excavations*

| | | | | | | Schaub/Rast 1989: fig. |
|---|---|---|---|---|---|---|
| Tomb A 3 | 90038 | jar | 0161.13.62.11[1] | on shoulder | 2 horiz. rows with vert. crossing | 12:1, 152:1 |
| | 90026 | bowl | 0526.53.10.15 | ext. wall | horiz. row with 2 vert. below | 13:2, 152:2 |
| | 90057 | bowl | 0532.00.10.16 | ext. wall | vertical row | 13:8, 152:3 |
| | 90062 | bowl | 0547.53.12.16 | ext. wall | 2 vert. rows, diagonal crossing | 13:5, 152:4 |
| | 90047 | bowl | 0773.00.12.20 | int. wall | 2 vertical rows | 14:13, 152:5 |
| | 90027 | bowl | 0772.00.11.20 | int. wall | 2 groups of 3 short vert. rows | 14:9, 152:6 |
| Tomb A 6E | 90191 | bowl | 0772.00.11.20 | ext. wall | 2 uneven groups of two vert. rows | 316:13, 152:7 |
| | 90145 | bowl | 058 .53.12.12 | ca. handle | ca. knob of 3 | 315:7 |
| Tomb A 9 | 90362 | jar | 0161.00.41.14 | shoulder | 3 rounded vertical rows | 29:3, 152:8 |
| Tomb A 47 | 91530 | jar | 0161.00.42.12 | shoulder | small circle enclosing marks | 38:1, 152:9 |
| | 91548 | jar | 0161.54.61.16 | neck | short vert. rows between raised dots | 38:2, 152:10 |
| | 91513 | bowl | 0521.52.12.16 | ext. wall | circles around & beside knob | 39:3, 152:11 |
| | 91534 | bowl | 0516.52.12.16 | int. wall | small circle | 39:4, 152:12 |
| | 91550 | bowl | 0572.00.12.20 | int. wall | small pointed oval | 40:1, 152:13 |
| | 91549 | bowl | 0706.51.12.30 | ext. wall | around knobs | 40:2, 152:14 |
| Tomb A 65E | 91040 | jug | 0454.21.62.20 | handle | 2 horizontal rows | 329:3, 152:15 |
| Tomb A 65W | 91044 | bowl | 0772.00.12.20 | int. wall | 2 diagonal rows | 330:16, 152:16 |
| Tomb A 65S | 91028 | bowl | 0581..00.12.15 | ext. wall | short horizontal row | 45:4, 151:17 |
| Tomb A 71W | 91246 | jar | 0161.00.61.12 | upper wall | cross | 70:3, 151:18 |
| | 91278 | juglet | 0454.21.62.20 | below rim | short slanting rows | 71:9, 151:19 |
| | 91294 | bowl | 0572.00.12.20 | int. base | 2 rows | 75:4, 151:20 |
| Tomb A 72NW | 91469 | juglet | 0474.21.42.20 | shoulder | V shape on raised band | 84:5, 151:21 |
| | 91478 | juglet | 0494.24.62.20 | shoulder | oval with flat top, line inside | 84:12, 151:22 |
| | 91431 | bowl | 0502.55.11.12 | ext. wall | 3 vertical rows | 85:1, 151:23 |
| | 91489 | bowl | 0728.53.11.32 | ext. wall | loops from rim | 87:4, 151:24 |
| | 91441 | bowl | 0772.00.12.20 | int. base | group and row | 87:14, 152:25 |
| Tomb A 75 | 91576 | bowl | 0742.00.12.20 | ext. wall | 2 vertical rows | 352:7, 151:26 |
| Tomb A 81S | 91670 | jar | 0161.11.12.16 | upper wall | 3 horizontal rows | 360:1, 151:27 |
| Tomb A 82E | 91724 | jug | 0444.22.62.20 | wall | quadruped | 363:3, 151:28 |
| Tomb A 83 | 91785 | jar | 0161.13.62.16 | neck<br>ledge handles | 3 rows<br>4 rows | 368:1, 151:29 |

[1] See Schaub and Rast 1989: 5-8 for the explanation of these pot descriptions.

***Excavations of the Expedition to the Dead Sea Plain***

| | | | | | | fig. | Schaub 1981: fig. |
|---|---|---|---|---|---|---|---|
| Tomb A 78SW | 502 | bowl | 0502.54.62.15 | ext. wall | 3 vert. rows below rim | 1:1 | 2:3 |
| Tomb A 79W | 1083 | bowl | 0772.00.12.20 | ext. wall | 3 vertical row | 1:2 | |
| Tomb A 80W | 809 | bowl | 0512.11.52.15 | on handles | 2 horizontal rows | 1:3 | |
| Tomb A 89NE | 1032 | bowl | 0533.00.12.13 | int. wall | 2 vertical rows | 1:4 | |
| | 1077 | jar | 0164.31.62.30 | on 4 handles | 2 horiz. rows top & bottom | 1:5 | |
| Tomb A 89NW | 1014 | jar | 0164.21.62.30 | on handle | 3 horiz. rows on top | 2:1 | |
| | 831 | jar | 0235.21.62.30 | on 2 handles | 2 horiz. rows on bottom | 2:2 | |
| | 1107 | jar | 0264.22.61.31 | on handle | horizontal row on top | 2:3 | |
| Tomb A 89SE | 1150 | juglet | 0485.21.62.20 | shoulder | 2 vertically slanting rows | 2:4 | |
| | 1148 | bowl | 0772.00.12.20 | ext. wall | 3 varied vertical rows | 2:5 | |
| | 1230 | bowl | 0522.51.12.15 | ext. wall | 2 sets of 3 vert. rows near handle | 2:6 | |
| | 1290 | jar | 0234.21.62.20 | 2 handles | 2 horiz. rows on top & bottom | 2:7 | |
| Tomb A 100W | 687 | jar | 0164.32.62.20 | 4 handles | row below handles | 1:6 | |
| Tomb A 102S | 1871 | bowl | 0577.21.12.13 | on handle | row top handle | 1:7 | |
| Tomb A 103 | 1714 | bowl | small | ext. wall | 3 rows | | |
| Tomb A 105NW | 2072 | jar | 0144.33.62.20 | ledge handles | 2 horiz. rows top handle | 1:8 | |
| Tomb A 105SE | 2084 | jar | 0164.21.62.20 | on handle | 2 horiz. rows top & bottom | 1:9 | |
| Tomb A 107W | 3272 | bowl | straight-sided | rim & handle | 2 irreg. rows below rim & handle | 2:9 | |
| | 2287 | bowl | 0526.51.62.16 | rim & handle | 2 irreg. rows below rim & handle | 2:8 | |
| | 2167 | bowl | 0573.00.12.30 | below rim | 2 short vertical row crossing irregular row | 2:10 | |
| Tomb A 107S | | | sherd | knob | on and around knob | 1:10 | |
| Tomb A 108NE | 2327 | jar | 0224.21.12.20 | on handle | 2 horiz. rows top | 1:11 | |
| Tomb A 108SW | 2622 | bowl | 0580.51.12.15 | below rim | around and loop to knob handle | 1:12 | |
| Tomb A 111N | 3142 | juglet | 0495.21.62.20 | shoulder | loop below row below rim | 2:11 | |
| | 3168 | jar | 0161.54.62.16 | shoulder | 3 vert. slanting rows from neck | 2:12 | |
| Tomb G 4 | | juglet | rim & wall sherd | shoulder | 2 short rows | 1:13 | |
| *EB IB Tombs* | | | | | | | |
| Tomb A 88L | 1426 | jar | small, 2 handles | neck | 4 vert. rows | 3:1 | 11:3 |
| | 1265 | bowl | large deep | handles,spout | 1 to 3 hor. rows on spout, 2 handles | 3:2 | 16:22 |
| Tomb A 100N | 633 | spoon | | ext., handle | "feather" incisions, all ext., some int. | 3:3 | 6:12 |
| | 659 | spoon | | int. handle | 6 grouped | 3:4 | 6:13 |
| Tomb A 104 | 2203 | bowl | large deep | rim & handle | irreg. row below rim, loop below handle | 3:5 | |
| Tomb G 2 | 549 | juglet | | shoulder | loop before neck row | 3:6 | |
| | 546 | bowl | large deep | ext. wall | with incised loop | | |
| | 538 | bowl | large deep | int. wall | 4 irregular horiz. rows, lower int. wall<br>3 irregular vertical split reed rows near rim<br>also punctate rows below rim | 3:7 | |

SPLIT REED

| | | | | | fig. | Schaub 1981: fig. |
|---|---|---|---|---|---|---|
| Tomb A 100N | | | | | | |
| 691 | handleless jar | | on shoulder | 2 vertical rows | 4:1 | 5:2 |
| 673 | handleless jar | | on shoulder | 2 vertical rows below one horizontal | 4:2 | 5:3 |
| 672 | deep bowl | ca. | knob-ledge handle | 3 vertical rowls each side | 4:3 | 7:2 |
| 681 | deep bowl | ca. | knob-ledge handle | scattered group each side | 4:4 | 7:1 |
| 686 | deep bowl | ca. | knob-ledge handle | scattered group beside at least 3 handles | 4:5 | 7:4 |
| 644 | deep bowl | ca. | knob-ledge handle | 2 scattered groups beneath horizontal row | 4:6 | 7:3 |
| Tomb G 1 | | | | | | |
| 1480 | handless jar | | on shoulder | 2 short rows 3 times on shoulder | 4:7 | |
| 1487 | deep bowl | | interior wall | 3 vertical rows of 3 | 4:8 | |
| 1485 | deep bowl | | exterior wall | 1 set near rim | 4:9 | |
| 1500 | deep bowl | | interior around base | single row all around | 4:10 | |
| 1492 | small bowl | | interior wall | 3 groups of two rows | 4:11 | |
| Tomb G 2 | | | | | | |
| 538 | deep bowl | | interior wall | 3 irregular vertical rows near rim<br>4 horizontal punctate rows lower wall<br>also punctate rows below rim | 3:7 | |

## INCISED

| | | | | | | Schaub/Rast 1989: fig. |
|---|---|---|---|---|---|---|
| *EB IA* | | | | | | |
| Tomb A 9 | 90346 | jar | 0161.32.62.16 | mid-body | short vertical line | 29:4 |
| Tomb A 47 | 91539 | bowl | 0771.00.12.20 | interior base | circle | 40:5 |
| | 91543 | bowl | 0771.00.12.20 | interior base | circle | 40:8 |
| Tomb A 72NW | 91475 | juglet | 0484.21.62.20 | mid-body | 3 short vertical lines | 84:3 |
| Tomb A 65W | 91888 | jug | top missing | ext. base | X | 330:14 |
| *EB IB* | | | | | | |
| Tomb A 13 | 91931 | juglet | 1495.24.61.20 | on shoulder | U | 129:6, 152:30 |
| Tomb A 43 | 90897 | jar | 1141.24.62.14 | upper body | upside down U with 5 strokes inside | 134:1, 152:41 |
| | 90826 | jar | 1161.00.62.15 | above mid-body | U | 133:4, 152:31 |
| | 90863 | jar | 1161.00.62.16 | above mid-body | two U's with line through | 133:3, 152:38 |
| | 90841 | jar | 1161.12.61.16 | above mid-body | Y with stroke, or U with line through | 133:2, 152:33 |
| | 90894 | jar | 1161.12.62.16 | shoulder | U | 133:1 |
| | 90881 | jar | 1164.21.62.20 | shoulder | squared U | 133:6, 152:40 |
| | 90866 | juglet | 1275.00.61.20 | body | vert. line, loop & 2 lines top,1 bot. | 134:9, 152:39 |
| | 90830 | bowl | 1533.51.11.16 | exterior wall | upside down U, middle line & 3 lines | 136:2, 152:32 |
| | 90846 | bowl | 1535.00.11.16 | exterior wall | large U | 137:4, 152:36 |
| | 90845 | bowl | 1537.53.11.16 | exterior wall | half circle with lines | 136:4, 152:35 |
| | 90844 | bowl | 1547.53.11.16 | exterior wall | slanting line with 5 lines crossing | 137:3, 152:34 |
| | 90856 | bowl | 1775.00.12.15 | interior wall | circle with short line from | 138:13, 152:37 |
| Tomb A 53 | 91926 | juglet | 1484.24.61.20 | mid-body | 2 horiz. lines with 3 vert. between | 145:16 |
| | 91914 | bowl | 1742.00.11.20 | interior base | circle with line within | 146:8 |

| | | | | | | fig. | Schaub 1981: fig. |
|---|---|---|---|---|---|---|---|
| *EB IB* | | | | | | | |
| Tomb A 88L | 1174 | bowl | large deep | int. below rim | 2 horiz. lines with 4 vert. between | | 13:6 |
| | 1198 | bowl | med-large deep | ext. below rim | 1 horiz. with 3 vert. lines below | | 12:3 |
| | 1209 | bowl | large deep | int. base | 1 line with 3 crossing lines | | 14:2 |
| | 1285 | bowl | medium deep | ext. wall | 2 horiz. with 2 crossing vert. lines | | 12:2 |
| | 1286 | bowl | med-large deep | ext. wall | 2 horiz. with 2 crossing vert. lines | | 13:5 |
| | 1308 | bowl | large deep | int. wall | 2 horiz. lines with 4 vert. between | | 13:4 |
| | 1310 | bowl | large deep | int. base | 1 line with 2 crossing lines | | 15:1 |
| | 1314 | bowl | large deep | ext. wall | 2 horiz. lines with 3 vert. between | | 14:3 |
| | 1328 | bowl | med-small deep | int. base | 2 lines with 5 crossing lines | | 15:3 |
| | 1329 | bowl | large deep | int. base | 1 line with 4 crossing lines | | 14:1 |
| | 1387 | bowl | large deep | int. base | 2 crossed lines at right angles | | 13:2 |
| | 1407 | bowl | small deep | int. base | 3 wavy lines | | 15:7 |
| | 1441 | bowl | large deep | int. base | 1 line with 3 crossing lines | | 15:2 |
| | 1443 | bowl | large deep | int. base | 2 lines with 4 crossing lines | | 13:1 |
| Tomb A 100N | 688 | jar | medium | shoulder | 2 horiz. lines with 3 vert. between | 5:1 | 5:1 |
| Tomb A 104 | 1705 | jar | small | mid-body | X | 5:2 | |
| Tomb G 1 | 1483 | bowl | med-large deep | ext. wall | 2 lines crossing at right angles | 5:3 | |
| | 1495 | bowl | medium shallow | ext. wall | some circle with 2 short curves lines above | 5:4 | |
| | 1498 | bowl | med-large deep | ext. wall | 3 horiz. lines crossed by 4 irreg. vert. | 5:5 | |
| | 1502 | bowl | large deep (?) | ext. wall | 2 horiz. lines crossed by 3 vert. | 5:6 | |
| Tomb G 2 | 546 | bowl | large deep | ext. wall | U with punctate within | 5:7 | |
| | 572 | bowl | med-large deep | int. wall | 2 short dashes | 5:8 | |
| *EB II-III* | | | | | | | |
| Tomb A 22 | 2743 | bowl | small | int. base | X | 5:9 | |
| | 3410 | bowl | small | int. base | circle with 4 crossed lines within | 5:10 | |
| | 3563 | bowl | small | int. base | 3 dashes | 5:11 | |

| | | | | | fig. |
|---|---|---|---|---|---|
| *Sherds from Cemeteries (EB I)* | | | | | |
| 754 | BD 77 ATT9 2 .6 | juglet shoulder | | horizontal line crossing 3 vertical | |
| 755 | BD 77 ATT9 .2.4 | large vessel | ext. wall | oval with line crossing - **complete** | 6:1 |
| *Vessels from Town Site, Numayra (EB III)* | | | | | |
| 2866 | NU 81 NE 3-1.147 | large jar | ext. wall | wavy diagonal line & short vertical - **complete** | |
| 3721 | NU 83 | large jar | shoulder | 4 vert. lines crossing 2(?) horiz. lines - **complete** | |
| *Sherds from Town Site, Bāb adh-Dhrā' (mainly EB II-III)* | | | | | |
| | BD 75 F2.7* | small jar? | ext. wall | wide double line crossing narrower double line | |
| 415 | BD 75 F1* | very large deep bowl | below rim, by 3 handles | 5 lines crossed near end by 1 line twice, 6 by 1 once, & 5 by 2 at ends once - reconstructed | 6:20 |
| 770 | BD 77 III.2.47 | small jar | shoulder | oval with X through - **complete** | 6:2 |
| 778 | BD 77 F4 .7* | large vessel | ext. wall | 2 triangles in X shappe with short lines within | 6:9 |
| 1709 | BD 79 IV.1.20 | large vessel | ext. wall | X with line across top | 6:10 |
| 1849 | BD 79 XII.11.5 | large vessel | neck | 2 knobs encircled with line between | 6:14 |
| 1850 | BD 79 IV.1.49 | large vessel | ext. wall | legs of animal? | 6:13 |
| 1937 | BD 79 XII.11.15 | large jar | shoulder | at least 3 horiz. & 3 vert. crossing lines | 6:6 |
| 1939 | BD 79 XII.11.18 | large jar | shoulder | partial ladder beneath punctated row | 6:7 |
| 1941 | BD 79 XIII.2A.64 | large vessel | ext. wall | short lines either side horizontal line | 6:5 |
| 2096 | BD 79 XIV.4.165 | large vessel | ext. wall | two zigzag lines crossing | 6:11 |
| 2177 | BD 79 XIV.3.112 | large vessel | ext. wall | two partial lines | 6:18 |
| 2317 | BD 79 XIV.4.178 | large vessel | ext. wall | partial oval(?) with line through | 6:12 |
| .0059 | BD 79 XIV.3.32 | large vessel | shoulder | 2 knobs encircled and short lines within | |
| .5907 | BD 79 XIII.2A.96 | small sherd | | partial line | |
| .8786 | BD 79 XII.11.33 | large vessel | ext. wall (?) | two partial lines crossed at right angles | 6:17 |
| 2837 | BD 81 surface | jug | handle | 5 horiz. and 5 (partial) vert. lines | 6:15 |
| 2846 | BD 81 IV.3.56 | large vessel | ext. wall | two fragmentary lines with short lines | 6:19 |
| 3007 | BD 81 IV.5.50 | large jar | shoulder | 2 vert. lines with 2 lines crossing | 6:8 |
| .4757 | BD 81 XVI.4.104 | bowl | ext. below rim | partial horz. lines and 1 vert. | |
| .5344 | BD 81 XVII.1.276 | small sherd | | partial line with short bend | |
| .5491 | BD 81 XVII.1.88 | ledge handle | on handle | X | |
| .6077 | BD 81 XVII.2.309 | holemouth | below rim | partial vertical line | |
| .7089 | BD 81 XIX.2.47 | holemouth | below rim | X - **complete** | |
| .7349 | BD 81 XIX.2.37 | juglet | top handle | partial X | |
| *Sherds from Town site, Numayra (EB III)* | | | | | |
| 1944 | NU 79 SE 4-1 .81 | large vessel | ext. wall | two partial lines forming one | 6:16 |
| 2178 | NU 79 SE 4-2.31 | large jar | ext. wall | 4 lines forming rectangle with center line, **complete** | 6:3 |
| 3004 | NU 81 NE 5-2.24 | large vessel | ext. wall | pointed oval with 2 lines within - **complete** | 6:4 |

*Area F vessels are EB I.

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# Neutron Activation Analysis of Clay and Late Third Millennium Pottery from Iktanu, Jericho and Jerusalem: First Results

## History

The project was initiated in discussions between Newton and Prag in 1985, and a pilot project with 32 samples was undertaken as part of a third-year student project in 1987/88 by Gavin Elley in the Chemistry Department, University of Manchester. The first samples (Nos. 1-32, TABLE 1) included material excavated by Prag in 1966 from Tall Iktanu (Jordan), including two lots of cooking pot ware and a more heterogeneous set. These three sample sets were compared with two sets of approximately the same late third millennium date from the Kenyon excavations at Jericho (1952-58) and at Jerusalem (1965), which were available in Manchester. The questions addressed in particular were:

1) intra-site: whether the clay used for the cooking pots in Phases 1 and 2 on the site could be differentiated;
2) inter-site: did similarities exist between clays used at different sites, in particular in the clays containing a large amount of fine calcite grains to which attention has been drawn by Dr. H. J. Franken (Leiden University).

It was evident that much of the Iktanu pottery contains grog temper. To avoid problems in analysis, and to follow up the preliminary results, a second student project analysing a further 34 samples of cooking pot ware which does not contain grog (18 fragments from Phase 1 and 16 fragments from Phase 2 contexts) was undertaken by Stephen Booker in 1988/9 (Nos. 50-67, TABLE 1).

**Table 1.** Sample list.

| Number | Provenance | Description |
|---|---|---|
| *Iktanu: Intermediate Early Bronze-Middle Bronze Age: tall* | | |
| 1 | IK.140.10.11 | Phase 1 (1A) cooking pot |
| 2 | IK.170.7.2 | Phase 1 (1A) cooking pot |
| 3 | IK.170.7.3 | Phase 1 (1A) cooking pot |
| 4 | IK.170.5.64 | Phase 1 (1A) cooking pot |
| 5 | IK.170.5.69 | Phase 1 (2A) cooking pot |
| 6 | IK.170.5.72 | Phase 1 (1C) cooking pot |
| 7 | IK.100.7.1 | Phase 2 (1D) cooking pot |
| 8 | IK.110.6a.1 | Phase 2 (1D) cooking pot |
| 9 | IK.130.2.5 | Phase 2 (1D) cooking pot |
| 10 | IK.180.1 | Phase 2 (1D) cooking pot |
| 11 | IK.190.2.8 | Phase 2 (?1A) cooking pot |
| 12 | IK.502.2.9 | Phase 2 (2D) cooking pot |
| 13 | IK.190.2.11 | Phase 2 Jug |
| 14 | IK.190.2.9 | Phase 2 cup/small bowl |
| 15 | IK.190.2 | Phase 2 Jar |
| 16 | IK.+.12 | Phase 2 Jar |
| 17 | IK.+.15 | Phase 2 Jar |
| 18 | IK.190.8.9 | Phase 1 holemouth jar |
| *Jericho: Intermediate Early Bronze-Middle Bronze Age: tall.* | | |
| 19 | JpT3.4 | ?Phase 1 holemouth jar |
| 20 | JpT3.4 | Holemouth jar/'teapot' |
| 21 | JpN2.11 | Cooking pot (1D) |
| 22 | JpJ3.14b | Jar |
| 23 | JpJ2.40 | Band-combed cup |
| 24 | JpJ3.127 | Holemouth jar |
| 25 | JpJ2.36/4 | Small bowl |
| 26 | SNJ.2 | Jar |
| 27 | JpJ2.35 | Jar |
| *Jerusalem: Intermediate Early Bronze-Middle Bronze Age: cemetery* | | |
| 28 | Jm Tomb C1.5 | Jar |
| 29 | Jm Tomb C1.6 | Jar |
| 30 | Jm Tomb C2.9 | Jar |
| 31 | Jm Tomb C2.10 | Jar |
| 32 | Jm Tomb B2.3 | Jar |
| *Iktanu: Intermediate Early Bronze-Middle Bronze Age: tall* | | |
| 50 | IK.160.6 | Phase 1 cooking pot |
| 51 | IK.160.6.2 | Phase 1 cooking pot |
| 52 | IK.160.6.3 | Phase 1 cooking pot |
| 53 | IK.160.6.4 | Phase 1 cooking pot |
| 54 | IK.170.4 | Phase 1 (1A) cooking pot |
| 55 | IK.170.5.61 | Phase 1 cooking pot |
| 56 | IK.170.5.66 | Phase 1 cooking pot |
| 57 | IK.170.5.65 | Phase 1 cooking pot |
| 58 | IK.170.5.70 | Phase 1 cooking pot |

| | | |
|---|---|---|
| 59 | IK.170.7.5 | Phase 1 cooking pot |
| 60 | IK.170.7.6 | Phase 1 cooking pot |
| 61 | IK.180.4 | Phase 1 (2A) cooking pot |
| 62 | IK.140.9.9 | Phase 1 cooking pot |
| 63 | IK.160.6.1 | Phase 1 cooking pot |
| 64 | IK.170.5.A | Phase 1 cooking pot |
| 65 | IK.170.5.62 | Phase 1 cooking pot |
| 66 | IK.190.9.A | Phase 1 cooking pot |
| 67 | IK.190.9.B | Phase 1 cooking pot |
| 68 | IK.160.1.1 | Phase 2 cooking pot |
| 69 | IK.180.1.C | Phase 2 (1D) cooking pot |
| 70 | IK.190.3.1 | Phase 2 (1D) cooking pot |
| 71 | IK.190.3.2 | Phase 2 (1D) cooking pot |
| 72 | IK.190.3.3 | Phase 2 (1D) cooking pot |
| 73 | IK.190.3.4 | Phase 2 (1D) cooking pot |
| 74 | IK.190.3.5 | Phase 2 (1A) cooking pot |
| 75 | IK.190.3.6 | Phase 2 (1A) cooking pot |
| 76 | IK.190.3.7 | Phase 2 (1A) cooking pot |
| 77 | IK.190.3.8 | Phase 2 cooking pot |
| 78 | IK.502.1.A | Phase 2 (2D) cooking pot |
| 79 | IK.502.1.B | Phase 2 cooking pot |
| 80 | IK.502.2.8 | Phase 2 cooking pot |
| 81 | IK.130.2.4 | Phase 2 cooking pot |
| 82 | IK.180.1.B | Phase 2 (2A) cooking pot |
| 83 | IK.190.2.A | Phase 2 (1A) cooking pot |

*Iktanu: Intermediate Early Bronze-Middle Bronze Age: kilns*

| | | |
|---|---|---|
| IK100 | Area C2 | Clay lining of Kiln 1 (Phase 1) |
| IK101 | Area C2 | Clay lining of Kiln 1 (Phase 1) |
| IK102 | Area C2 | Clay disk 51 (Phase 1) |
| IK103 | Area C2 | Clay disk 31 (Phase 1) |
| IK104 | Area C2 | Clay disk 9 (Phase 1) |
| IK109 | IK.302.35 | Black ash from Kiln IV (Phase 1) |
| IK110 | Area C2 | Decayed mud brick near Kiln IV (EB1) |
| IK111 | IK.302.30 | Clay lining of Kiln III (Phase 1) |
| IK112 | Area C2 | Marl lump in disk 28 (Phase 1) |
| IK113 | Area A10 | Clay sample from gravel soils |
| IK114 | | Clay sample from gravel soils |
| IK115 | Main tell | Marl sample from highway cutting |

*Pottery from Phase 1 kilns*

| | | |
|---|---|---|
| IK121 | IK.301.+.(a) | pink sherd |
| IK122 | IK.301.+.(a) | pink sherd |
| IK123 | IK.301.+.(b) | pink sherd |
| IK124 | IK.301.+.(c) | pink sherd |
| IK125 | IK.301.+.(c) | pink sherd |
| IK126 | IK.301.+.(d) | very hard red sherd |
| IK127 | IK.301.+.(e) | pink storage bowl |
| IK128 | IK.301.+.(f) | pink sherd |
| IK129 | IK.301.+.(g) | pink sherd |
| IK130 | IK.301.+.(h) | pink sherd |
| IK131 | IK.301.+.(a) | gy/gn misfired sherd |
| IK132 | IK.301.+.(b) | gy/gn misfired jar base |
| IK133 | IK.301.+.(c) | gy/gn misfired jar |
| IK134 | IK.301.+.(d) | gy/gn misfired jar |
| IK135 | IK.301.+.(e) | gy/gn misfired jar |
| IK136 | IK.301.+.(e) | gy/gn misfired jar |
| IK137 | IK.301.+.(f) | gy/gn misfired jar |

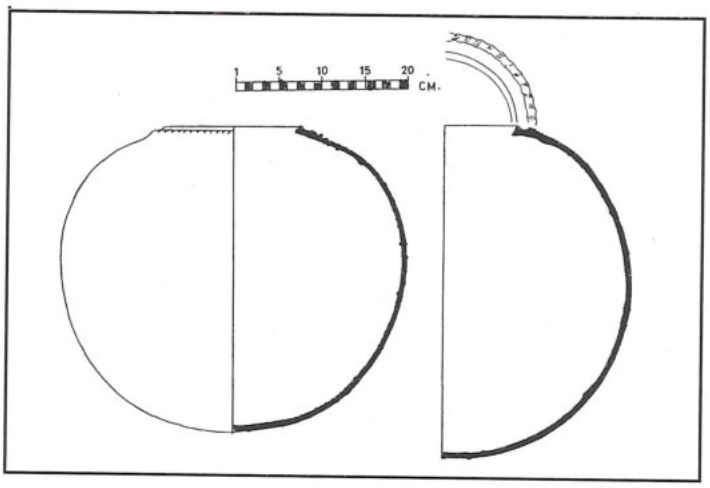
(gy = grey; gn = green)
(IK.132 - IK.137 may be part of the same jar)

In the meantime a series of kilns had been excavated at Iktanu in December, 1987 and Newton began a project to analyse the clays used in the kilns, in pottery made in the kiln area, and in samples collected in 1987/1989 from local clay beds. A third sample of 34 analyses has been completed, and all the results are in TABLE 2. The interpretation is not complete, but the following preliminary remarks may be of interest to colleagues.

The cooking pots used in the late third millennium village at Tall Iktanu are round-based, globular holemouth jars. The holemouth rim and the calcite temper are made in the classic Early Bronze Age tradition, used by potters throughout Palestine for the previous millennium. They are characterised by crushed quartz and calcite temper. The walls are surprisingly thin, at Iktanu usually 5-6 mm thick, for vessels which are usually large, like the intact examples found at Wādī ad-Dāliyah on the West Bank which are respectively 40 and 50 cm in diameter (Lapp 1974: 40-42, PL. I:5, 7; see FIG. 1). They are well made, and coil-built, perhaps with the help of moulds. There are, however, changes in manufacture and typology between Early Bronze 3 and the Intermediate Early Bronze-Middle Bronze Age (=EB 4) and it is usually possible to distinguish sherds of the two periods, as Lapp also pointed out. In the Iktanu area also, EB 3 cooking pots seem to have flat bases, which are never found in the EB.MB period cooking pots at Iktanu. This seems to mark a social change between the two periods.

The EB.MB village at Iktanu had two structural phases with a brief period of abandonment between them; both phases were relatively short. Although there is clear continuity between the phases, there are also numerous changes. The ceramic repertoire, although consisting of basically the same range of equipment in both phases, is also distinguishable. Holemouth cooking pots are in use in both phases, but a higher proportion of undecorated pots with concave rims (Type 1A) seems to occur in Phase 1, and cooking pots with a flat or convex rim and a band of impressed decoration below the rim (Type 2D, see FIG. 1) seem to be more popular in Phase 2 (Prag 1974: 83, FIGS. 3:17, 18; 6:5, 6; Prag 1988: 69, FIG. 6:7, 8).

Apart from 'fingerprinting' the local ceramic production, it was thought that the investigation of the cooking pots might help to resolve the question of whether the changes are due simply to passage of time between




1. Two EB.MB cooking pots from Wādī ad-Dāliyah (from Lapp 1974).

Phase 1 and 2 at the site, or whether some change of population is represented between the two settlements. If the Phase 2 population exploited a different clay bed we might assume discontinuity in local traditions (forgotten local resources, or different traditions); on the other hand exhaustion of a previous clay bed might be involved, or the discovery of a more workable or better clay.

**Chemical Analysis**

Chemical analysis using neutron activation has been used on the samples listed in TABLE 1. The purpose was to identify different groupings and see if this was related to vessel type or find location; in addition clay analyses were included in a preliminary attempt to relate the pottery to a clay source.

*Sample Preparation*

For the pottery the surface of sherds was cleaned with a flat diamond drill and a sample drilled with a pointed diamond drill from the cleaned surface. 200mg of this sample was weighed precisely.

For clay an attempt was made to follow the routine potters may have used. Large samples of several kilograms were taken from various positions in the clay bed; these were then slurried with water and after a few minutes poured off into clean vessels to separate the coarse material which was left behind. Each sample was allowed to settle for about 12 hours and then the very fine particles and organic matter decanted from the surface. The remaining sludge was allowed to dry in the sun until plastic. Several small tiles (about 5 x 5 x 0.5 cm) were made from each sample and the sample number drawn in the wet clay, these were then dried completely in the sun. 200mg samples were taken from each tile by grinding a portion to a fine powder in an agate mortar and pestle.

*Irradiation*

To optimise provenance it was necessary to measure as many elements as possible, in this case 22. This requires three separate irradiation steps:

a) 10 minutes irradiation, 10 minutes decay and 10 minutes counting; this measures Na, Al, Ca, Ti, V, Mn, Dy and U.
b) 10 minutes irradiation, 2 - 3 hours decay and 20 minutes counting; this measures Na, Mn, Dy and Sm.
c) 7 hours irradiation, 7 - 14 days decay and 2 hours counting; this measures Sc, Cr, Fe, Co, Rb, Sb, Cs, La, Ce, Eu, Sm, Yb, Lu, Hf, Ta and Pa.

All irradiations were at the Universities Reactor, Risley; the 10 minute irradiations in the fast rabbit and the 7 hour irradiations in the 4 x 4 inch hole.

*Analysis*

The Manchester standard (Podmore Red Clay, analysed by ten different laboratories around the world) was irradiated with every eight samples. Quantitative results were obtained using standard gamma ray spectroscopy and taking the ratio of peak areas between sample and standard for each element. Since the concentration of each element in the standard is well known, the concentration in the sample could be calculated. The results are in TABLE 2.

*Interpretation*

It is difficult, if not impossible, to identify groups by visual inspection of such a large dataset as TABLE 2. Various statistical techniques are available to facilitate group classification and Ward's method of clustering has been used here. This procedure has suggested eight groups:

Group 1. (40 samples) IK10, IK12, IK14, IK16-20, IK26, IK27, IK109-111, IK115, 4, 11, 14, 19-32, 51, 61-63, 66, 73, 80, 81, 83.
Group 2. (24 samples) 1-3, 5, 6, 8, 15, 18, 50, 52, 54-60, 64, 65, 67, 71, 72, 76, 82.
Group 3. (10 samples) 7, 8, 10, 12, 68-70, 77-79.
Group 4. (9 samples) IK4-9, IK11, IK13, IK15.
Group 5. (6 samples) 13, 16, 17, 53, 74, 75.
Group 6. (16 samples) IK1-3, IK12, IK20-30, IK115.
Group 7. (9 samples) IK100-104, IK112-114, IK130.
Group 8. (14 samples) IK121-127, IK129, IK132-137.

**Discussion** (which includes additional material submitted by H. J. Franken for analysis).

Group 1 is very heterogeneous and includes two groups of fine calcite wares from Jericho and Jerusalem, and five examples each of Iktanu Phase 1 and of Phase 2 cooking pots. The distinction between Groups 1 to 6 is not clear, and the possibility of three separate types of calcite clay in Groups 1, 4 and 6 needs confirmation.

Group 2 consists mainly of Phase 1 cooking pots, Group 3 is uniquely Iktanu Phase 2 cooking pots. Of the twenty-four Phase 1 cooking pots sampled, seventeen are in Group 2, the remainder are in the heterogeneous Group 1 except for one in Group 5. Of the twenty-two Phase 2 cooking pots, ten form a unique Group 3, with the remainder scattered in Groups 1, 2, and 5. There is no obvious archaeological solution to the variation; the sherds derive from a number of different contexts. However the site is shallow, and allowance should be made for some Phase 1 residuals in Phase 2, and for rodent activity. The student projects suggested that the majority of Phase 1 examples in Group 2 indicated a clay distinct from that used in Group 3. The second project included a correction program for dilution by calcium carbonate ($CaCO_3$) on all 66 samples and concluded that the groups were distinct, but more work is needed on interpreting these samples.

Groups 4 and 6 are uniquely fine calcite ware of various sites and periods, but the groups appear to be different; it remains to be seen if the only difference is one of dilution with varying amounts of calcite for example.

Groups 7 and 8 are discrete, and these should be separated from the dataset with the remainder being reinterpreted. Group 7 consists of two groups of samples, clays taken from the red gravels on the south hill at Iktanu, and clays used in the Phase 1 kilns on the south hill (linings and disks, see Prag 1988: FIGS. 2-4). This implies that the latter were made from the local clays on the South hill, which are certainly not the same as the geologically distinct deposit of marl clay from the north tell, only two samples of which have been analysed to date, and which appear in Groups 1 and 6. Much more work is planned on these clays.

Group 8 consists entirely of pottery from the Phase 1 kiln area for which there is no local clay identified as yet. The possibility that the analysis of the clay used in this group is affected by use of grog temper has also to be investigated.

**Table 2.** Neutron activation results (Elements: Na%, Al%, K%, Ca%, Sc, Ti%, V, Cr, Mn, Fe%, Co, Rb, Cs, La, Ce, Sm, Dy, Yb, Lu, Hf, Th, U). Results expressed in ppm unless shown otherwise.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 8265 | 5.4000 | 1.3400 | 14.9000 | 9.4970 | .4803 |
| | 91.0000 | 89.8022 | 156.6000 | 5.2277 | 9.4275 | 44.5958 |
| | 17.6602 | 23.7526 | 54.8644 | 7.1102 | 4.2600 | .6705 |
| | .3885 | 7.7005 | 5.6528 | 1.0146 | | |
| 2 | .5954 | 4.8900 | 1.7400 | 12.6000 | 11.0598 | .4467 |
| | 83.3000 | 100.6400 | 190.6000 | 4.7522 | 13.2330 | 59.5223 |
| | 14.8209 | 24.7415 | 53.4884 | 8.3531 | 3.0400 | .6740 |
| | .4083 | 8.0049 | 6.1870 | 2.2459 | | |
| 3 | .6139 | 5.3850 | 1.3120 | 10.7000 | 10.7303 | .5117 |
| | 106.3000 | 96.1807 | 144.0000 | 4.5556 | 12.2028 | 57.0763 |
| | 21.2385 | 23.8335 | 51.0724 | 6.0251 | 3.2600 | .5879 |
| | .3470 | 7.3398 | 5.7861 | 1.3600 | | |
| 4 | .5922 | 4.5000 | 1.5000 | 13.0000 | 8.4373 | .4435 |
| | 65.4000 | 81.0597 | 164.0000 | 3.1667 | 7.7965 | 38.8374 |
| | 14.9046 | 20.3435 | 44.6517 | 4.9143 | 2.8400 | .5571 |
| | .3352 | 6.6063 | 4.8945 | 10.1286 | | |
| 5 | .6711 | 5.6000 | 1.8500 | 10.2000 | 10.4016 | .4934 |
| | 87.6000 | 92.6936 | 150.0000 | 4.4757 | 10.0552 | 56.7770 |
| | 15.7644 | 22.2939 | 49.9562 | 5.9739 | 3.3600 | .6041 |
| | .3536 | 7.1478 | 5.7506 | 1.3873 | | |
| 6 | .6529 | 5.0000 | 1.5000 | 11.8000 | 10.5195 | .4911 |
| | 73.0000 | 94.5264 | 124.0000 | 4.3308 | 8.8812 | 60.6031 |
| | 17.9664 | 24.3180 | 49.1025 | 5.8235 | 2.8900 | .6023 |
| | .3295 | 8.2778 | 6.0168 | 1.3282 | | |
| 7 | .2570 | 4.0800 | 1.2500 | 16.9000 | 8.1707 | .2940 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 96.8000 | 67.6310 | 2054.000 | 2.8061 | 13.3779 | 27.9029 |
| | 2.7404 | 18.6563 | 37.6067 | 5.9833 | 1.8900 | .5023 |
| | .3422 | 5.8807 | 4.3709 | 2.1891 | | |
| 8 | .6655 | 5.5200 | 1.4400 | 15.3000 | 11.8218 | .3943 |
| | 82.7000 | 105.0241 | 252.0000 | 4.7826 | 15.6033 | 51.0385 |
| | 12.0065 | 27.2010 | 54.2715 | 8.7519 | 2.9600 | .6997 |
| | .4169 | 6.0958 | 5.9941 | 2.2339 | | |
| 9 | .3701 | 4.2000 | 1.0800 | 20.0000 | 8.1348 | .3281 |
| | 75.9000 | 75.2097 | 1267.0000 | 3.0455 | 12.2501 | 27.6911 |
| | 3.7783 | 18.6590 | 40.1831 | 4.9536 | 2.3000 | .3946 |
| | .3124 | 4.7468 | 4.2865 | 3.0987 | | |
| 10 | .5508 | 3.8900 | 2.1300 | 20.7000 | 7.5645 | .3049 |
| | 98.4000 | 57.7876 | 1772.0000 | 2.8793 | 10.8163 | 26.9602 |
| | 2.7396 | 17.8661 | 36.2271 | 5.7037 | 3.4900 | .4171 |
| | .2966 | 4.1480 | 3.9529 | 2.3425 | | |
| 11 | .4638 | 7.2500 | 1.7000 | 16.5000 | 10.6448 | .4507 |
| | 87.0000 | 92.8475 | 496.0000 | 3.1534 | 15.3393 | 25.8037 |
| | 1.7006 | 23.4176 | 47.9871 | 5.8790 | 2.8300 | .5762 |
| | .3402 | 6.2172 | 5.2798 | 2.0168 | | |
| 12 | .2473 | 4.2500 | 1.5100 | 19.6000 | 8.9008 | .3240 |
| | 75.9000 | 74.7637 | 1459.0000 | 2.9687 | 14.0794 | 31.7850 |
| | 3.0814 | 21.3669 | 41.3792 | 6.4106 | 2.2500 | .5357 |
| | .2918 | 5.7697 | 4.9010 | 2.4347 | | |
| 13 | .4698 | 8.5300 | 2.2700 | 7.6300 | 15.7496 | .6068 |
| | 93.3000 | 110.9699 | 384.0000 | 5.1350 | 24.3992 | 75.7487 |
| | 7.2331 | 44.1594 | 91.7088 | 12.1311 | 2.9400 | 1.1362 |
| | .5936 | 9.4916 | 9.6109 | 3.1170 | | |
| 14 | .4675 | 5.0300 | .6585 | 16.0000 | 9.5954 | .2944 |
| | 71.3000 | 63.1591 | 338.0000 | 2.8673 | 14.9144 | 18.8761 |
| | 3.8971 | 17.7358 | 37.2184 | 5.6903 | 2.2500 | .4513 |
| | .3147 | 5.5414 | 4.4531 | 3.0658 | | |
| 15 | .6874 | 7.6000 | 1.8200 | 8.2000 | 13.1923 | .4506 |
| | 94.0000 | 97.6751 | 183.0000 | 2.9296 | 12.1672 | 63.3657 |
| | 10.1389 | 26.3885 | 52.1566 | 4.9435 | 2.5000 | .4972 |
| | .3140 | 6.0320 | 7.3574 | 1.4856 | | |
| 16 | .8335 | 9.7100 | 2.7500 | 7.5400 | 15.8394 | .6002 |
| | 90.3000 | 142.7844 | 244.0000 | 5.1736 | 15.5636 | 80.2324 |
| | 7.5175 | 54.6461 | 110.9059 | 8.6905 | 5.0600 | 1.1046 |
| | .6412 | 10.5522 | 11.6272 | 2.9283 | | |
| 17 | .4677 | 8.1400 | 2.0900 | 8.9200 | 14.7981 | .5435 |
| | 95.4000 | 99.6157 | 334.0000 | 4.5994 | 17.8157 | .8887 |
| | 6.5253 | 40.6639 | 84.8641 | 12.0926 | 5.0800 | .9585 |
| | .5677 | 9.8141 | 9.2377 | 3.4484 | | |
| 18 | .6014 | 6.9100 | 2.1200 | 7.7300 | 13.2185 | .4373 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 88.7000 | 115.3853 | 182.0000 | 2.8241 | 15.8981 | 73.7298 |
| | 9.0728 | 29.1172 | 59.4609 | 7.7821 | 2.4100 | .6907 |
| | .4357 | 7.9656 | 8.0068 | 3.1399 | | |
| 19 | .6353 | 5.2000 | 2.2000 | 13.2000 | 10.5137 | .4819 |
| | 92.0000 | 113.7537 | 253.0000 | 2.9321 | 14.3215 | 36.0265 |
| | 3.3324 | 27.0150 | 55.4335 | 6.8442 | 3.5000 | .6385 |
| | .3981 | 6.2928 | 5.5009 | 2.3944 | | |
| 20 | .3460 | 3.8300 | 1.4500 | 22.9000 | 8.5579 | .2840 |
| | 76.3000 | 159.5052 | 275.0000 | 2.2903 | 9.2608 | 15.5199 |
| | 1.6097 | 30.0619 | 45.1107 | 7.0400 | 3.5700 | .7944 |
| | .6019 | 3.1529 | 3.5208 | 7.4103 | | |
| 21 | .4945 | 5.1200 | 2.4600 | 20.4000 | 9.6799 | .2192 |
| | 71.3000 | 65.6899 | 122.2000 | 2.3114 | 6.6942 | 42.5064 |
| | 3.3911 | 13.8901 | 26.0366 | 3.5999 | 2.0300 | .4225 |
| | .2238 | 2.4122 | 3.4865 | 1.1813 | | |
| 22 | .5681 | 4.3500 | 3.5700 | 14.7000 | 11.5752 | .2751 |
| | 82.6000 | 83.1511 | 229.0000 | 2.3357 | 13.0368 | 62.2855 |
| | 5.0529 | 18.3762 | 36.3986 | 6.2877 | 2.6000 | .4224 |
| | .3188 | 3.5222 | 4.5945 | 2.0622 | | |
| 23 | .2742 | 6.4800 | 3.3800 | 12.9000 | 13.8086 | .3028 |
| | 105.0000 | 92.1856 | 199.0000 | 3.2574 | 16.0433 | 71.5979 |
| | 8.0704 | 18.5049 | 39.1482 | 6.5247 | 2.2700 | .5478 |
| | .3518 | 3.5319 | 4.8489 | 2.6501 | | |
| 24 | .3902 | 6.8700 | 4.6400 | 13.0000 | 12.8561 | .2815 |
| | 98.0000 | 88.2194 | 256.0000 | 2.9482 | 17.2694 | 75.4582 |
| | 7.9178 | 15.7310 | 35.5006 | 4.5709 | 2.2900 | .3971 |
| | .2965 | 3.0315 | 4.3687 | 2.7056 | | |
| 25 | .4878 | 4.0300 | 1.8300 | 18.8000 | 8.2369 | .3361 |
| | 93.6000 | 115.5184 | 498.0000 | 2.5118 | 12.2874 | 29.1713 |
| | 2.9205 | 22.3670 | 45.8010 | 5.7241 | 3.0000 | .5651 |
| | .3989 | 5.5380 | 4.0846 | 3.9164 | | |
| 26 | .8112 | 4.2700 | 1.8600 | 17.0400 | 8.5301 | .3595 |
| | 88.8000 | 126.0335 | 488.0000 | 2.5199 | 11.4233 | 31.0569 |
| | 2.6833 | 23.6511 | 45.2731 | 5.9644 | 2.8200 | .5775 |
| | .4279 | 4.7113 | 4.3493 | 4.3145 | | |
| 27 | .6144 | 6.0600 | 1.0300 | 17.3000 | 14.2621 | .3352 |
| | 126.0000 | 95.6646 | 444.0000 | 3.0118 | 17.1551 | 36.4065 |
| | 4.7315 | 44.5549 | 61.0628 | 8.0353 | 5.4000 | 1.3299 |
| | .8944 | 5.0886 | 6.0542 | 6.2200 | | |
| 28 | .1956 | 9.5000 | 2.1400 | 7.0000 | 15.4038 | .4553 |
| | 68.3000 | 107.1398 | 206.0000 | 3.8366 | 14.2589 | 43.7378 |
| | 5.3149 | 16.9491 | 38.9136 | 5.2967 | 2.8300 | .5218 |
| | .3087 | 3.5729 | 5.8088 | 3.2179 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 29 | .1596 | 8.7400 | 2.8000 | 8.7700 | 17.8271 | .4652 |
| | 84.4000 | 117.3270 | 227.0000 | 3.9309 | 17.6863 | 37.8626 |
| | 1.2883 | 25.2116 | 54.8708 | 9.1069 | 3.4400 | .6589 |
| | .4231 | 5.2994 | 6.6811 | 3.6400 | | |
| 30 | .2525 | 5.9700 | 2.2300 | 16.0400 | 12.5636 | .3194 |
| | 76.3000 | 84.8466 | 208.0000 | 2.7425 | 11.4324 | 54.5573 |
| | 5.4467 | 20.0052 | 39.5302 | 6.7556 | 2.2600 | .4668 |
| | .3083 | 3.9582 | 4.8404 | 2.7911 | | |
| 31 | .9970 | 6.7300 | 2.0000 | 12.9000 | 13.3248 | .3301 |
| | 90.5000 | 85.5485 | 158.0000 | 3.4582 | 10.3656 | 49.6995 |
| | 6.3714 | 16.2765 | 34.9646 | 5.8226 | 2.1600 | .4456 |
| | .3044 | 3.4250 | 4.8700 | 2.4013 | | |
| 32 | .2915 | 5.9200 | 3.2300 | 14.4000 | 11.0962 | .2627 |
| | 85.5000 | 68.9296 | 174.0000 | 2.5635 | 10.4479 | 52.4604 |
| | 4.8919 | 14.3730 | 33.3917 | 4.0750 | 2.1800 | .4265 |
| | .2462 | 2.4304 | 3.8831 | 1.9167 | | |
| 50 | .7231 | 5.4600 | 1.0600 | 14.6000 | 10.4505 | .4513 |
| | 79.5000 | 88.8200 | 135.0000 | 4.0835 | 10.3225 | 50.7353 |
| | 16.1387 | 24.4807 | 62.7729 | 7.8851 | 4.4200 | .7429 |
| | .4214 | 6.7747 | 5.6483 | 1.4756 | | |
| 51 | .5736 | 5.9400 | 1.6200 | 19.6000 | 10.6092 | .2927 |
| | 83.2000 | 63.4942 | 167.0000 | 2.5589 | 8.7123 | 35.1200 |
| | 3.2218 | 13.2113 | 31.6427 | 3.8717 | 1.9100 | .3992 |
| | .2449 | 2.2590 | 4.0316 | 1.1679 | | |
| 52 | .5550 | 4.2000 | .7310 | 15.3000 | 9.8045 | .4031 |
| | 70.1000 | 90.7658 | 163.0000 | 5.4073 | 13.0584 | 70.0613 |
| | 21.6046 | 22.3932 | 52.0872 | 6.0227 | 2.5000 | .7080 |
| | .3796 | 7.6071 | 5.5844 | 1.3567 | | |
| 53 | .8196 | 7.7100 | 1.5600 | 12.3000 | 12.6160 | .4553 |
| | 78.5000 | 78.2004 | 277.0000 | 4.1421 | 12.5409 | 46.5973 |
| | 3.7645 | 37.8037 | 88.0448 | 88.5551 | 4.4500 | .9411 |
| | .5140 | 7.9533 | 8.8018 | 2.9185 | | |
| 54 | .7717 | 5.2200 | 1.1000 | 10.8000 | 11.7184 | .4797 |
| | 77.9000 | 99.1928 | 148.0000 | 5.4653 | 10.8363 | 50.4794 |
| | 14.4102 | 26.7187 | 71.6039 | 8.4920 | 4.2900 | .9499 |
| | .4754 | 8.9920 | 6.6202 | 1.5376 | | |
| 55 | .5943 | 4.9000 | 1.1600 | 11.8000 | 10.9150 | .4201 |
| | 77.0000 | 97.4134 | 127.0000 | 4.2943 | 9.1046 | 66.7658 |
| | 21.6278 | 23.2205 | 53.6194 | 5.8870 | 2.6700 | .6591 |
| | .3377 | 8.0735 | 6.1507 | 1.5170 | | |
| 56 | .6358 | 5.2300 | 1.4200 | 12.3000 | 10.5731 | .4331 |
| | 97.7000 | 88.7541 | 153.0000 | 3.9036 | 13.6330 | 52.5958 |
| | 14.6309 | 21.5986 | 51.9624 | 5.6018 | 2.6200 | .6708 |
| | .3618 | 6.5908 | 6.2347 | 1.9685 | | |

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|---|---|---|---|---|---|---|
| 57 | .6124 | 4.6800 | .7640 | 14.4000 | 9.6833 | .4332 |
| | 74.7000 | 92.1409 | 138.0000 | 3.2664 | 9.0684 | 51.0796 |
| | 13.7636 | 20.3141 | 50.0056 | 5.5308 | 2.6000 | .5941 |
| | .3334 | 6.5236 | 5.4323 | 1.8726 | | |
| 58 | .1560 | 6.3000 | 2.2300 | 19.9000 | 11.5250 | .6515 |
| | 107.0000 | 102.3740 | 307.0000 | 4.8513 | 10.9374 | 67.2640 |
| | 16.4775 | 24.2611 | 59.5177 | 6.6411 | 5.3000 | .7563 |
| | .4088 | 7.4502 | 5.9665 | 1.5464 | | |
| 59 | .6037 | 4.4000 | 1.2200 | 11.3000 | 9.9721 | .3840 |
| | 68.4000 | 91.6266 | 154.0000 | 4.2026 | 11.9122 | 51.8130 |
| | 11.8402 | 22.5789 | 55.6442 | 6.1924 | 2.4300 | .7128 |
| | .3961 | 9.1342 | 6.0570 | 1.3156 | | |
| 60 | .8131 | 5.1700 | .5100 | 9.6100 | 11.8698 | .4415 |
| | 77.2000 | 102.9170 | 140.0000 | 5.5031 | 10.9251 | 52.7242 |
| | 14.8396 | 26.2566 | 69.9220 | 8.3145 | 3.4200 | .8625 |
| | .4644 | 8.3668 | 6.8263 | 1.6164 | | |
| 61 | .4790 | 5.2000 | 1.7500 | 19.1000 | 8.5455 | .4193 |
| | 74.0000 | 78.9561 | 237.0000 | 2.4171 | 10.5079 | 38.2355 |
| | 9.8305 | 18.6479 | 44.7942 | 4.9412 | 2.3700 | .5864 |
| | .3175 | 6.1771 | 5.1850 | 1.8503 | | |
| 62 | .6329 | 5.8600 | 1.6700 | 19.1000 | 11.3550 | .3148 |
| | 77.8000 | 70.4383 | 162.0000 | 2.7042 | 8.6783 | 34.4628 |
| | 3.1201 | 15.3491 | 34.8515 | 4.4760 | 2.0900 | .4569 |
| | .2555 | 2.7533 | 4.3876 | 2.2885 | | |
| 63 | .5471 | 8.5000 | 1.0700 | 24.5000 | 11.4524 | .2990 |
| | 97.1000 | 76.6084 | 157.0000 | 2.6754 | 9.9472 | 35.3415 |
| | 3.9656 | 15.2475 | 35.4222 | 4.2949 | 1.5400 | .4548 |
| | .2457 | 2.4641 | 4.5609 | 1.3008 | | |
| 64 | .5590 | 1.6900 | .8510 | 12.1000 | 9.1750 | .2798 |
| | 38.0000 | 84.7107 | 171.0000 | 3.6172 | 11.1291 | 64.1068 |
| | 17.1303 | 21.4162 | 49.2889 | 5.5781 | 3.0700 | .6006 |
| | .3302 | 6.1984 | 5.2276 | 1.3745 | | |
| 65 | .6439 | 4.7900 | .7340 | 17.1000 | 9.7103 | .4116 |
| | 67.5000 | 91.0893 | 169.0000 | 3.7831 | 10.3653 | 56.7744 |
| | 18.5620 | 22.1796 | 50.6276 | 5.7320 | 2.8200 | .6579 |
| | .3573 | 6.3377 | 5.5273 | 1.6462 | | |
| 66 | .7864 | 5.6000 | 1.7200 | 16.4000 | 6.9096 | .5308 |
| | 90.0000 | 68.1689 | 225.0000 | 3.5561 | 9.9982 | 36.3605 |
| | 8.4635 | 16.9740 | 37.7916 | 4.5001 | 3.6500 | .4854 |
| | .3153 | 5.2971 | 4.2010 | 2.2844 | | |
| 67 | .5076 | 3.2800 | .7320 | 19.2600 | 9.6550 | .3039 |
| | 67.3000 | 90.9373 | 236.0000 | 3.8672 | 9.9063 | 51.4323 |
| | 14.4919 | 20.9301 | 49.4795 | 5.5756 | 2.1000 | .5862 |

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|---|---|---|---|---|---|---|
| | .3339 | 6.9601 | 5.4139 | 1.5921 | | |
| 68 | .3702 | 4.3500 | .9200 | 21.3000 | 8.5103 | .2994 |
| | 83.1000 | 73.8699 | 1389.0000 | 2.8699 | 12.2725 | 27.1305 |
| | 3.9770 | 20.6995 | 42.2967 | 5.1831 | 2.0700 | .5077 |
| | .3289 | 5.2075 | 4.8160 | 2.9110 | | |
| 69 | .1943 | 4.1300 | .8800 | 19.8000 | 8.0949 | .3083 |
| | 78.4000 | 65.4409 | 1571.0000 | 2.5125 | 11.1589 | 25.8219 |
| | 2.9617 | 18.5700 | 40.4555 | 4.7663 | 2.8000 | .4209 |
| | .2896 | 4.2120 | 4.2420 | 1.9630 | | |
| 70 | .2593 | 4.8400 | 1.4400 | 18.1000 | 9.8606 | .4208 |
| | 84.9000 | 88.0955 | 2056.0000 | 3.2290 | 14.4656 | 33.6365 |
| | 3.1663 | 24.8869 | 52.2304 | 6.0348 | 2.6100 | .5772 |
| | .3771 | 5.7236 | 5.1850 | 2.5120 | | |
| 71 | .5134 | 5.1600 | 1.5600 | 9.6300 | 10.9773 | .4826 |
| | 80.3000 | 92.8841 | 251.0000 | 4.4304 | 14.5341 | 51.6552 |
| | 14.1850 | 21.9165 | 52.1186 | 6.0263 | 3.2800 | .6180 |
| | .3904 | 9.6079 | 5.9290 | 1.4400 | | |
| 72 | .6167 | 4.4700 | 1.1400 | 10.3000 | 9.4306 | .4888 |
| | 67.0000 | 85.9350 | 161.0000 | 4.3415 | 11.3093 | 38.3466 |
| | 13.4309 | 18.1040 | 47.3492 | 5.2784 | 3.2200 | .5143 |
| | .3483 | 9.8631 | 6.0900 | 1.3970 | | |
| 73 | .6551 | 4.6400 | 1.5100 | 19.2000 | 9.1377 | .3550 |
| | 67.3000 | 72.4154 | 432.0000 | 2.5900 | 13.3316 | 32.3989 |
| | 3.8945 | 19.2965 | 42.9888 | 5.1475 | 2.8300 | .4534 |
| | .3085 | 6.1539 | 4.8750 | 2.1330 | | |
| 74 | .5288 | 6.8200 | 1.6600 | 14.7000 | 10.7437 | .3878 |
| | 56.9000 | 67.1549 | 368.0000 | 3.6432 | 14.7146 | 47.9021 |
| | 4.2203 | 36.7593 | 81.3771 | 8.5409 | 4.2700 | .8472 |
| | .5098 | 8.6033 | 8.3770 | 2.7210 | | |
| 75 | .5935 | 7.3500 | 1.5000 | 12.5000 | 11.9260 | .7433 |
| | 69.7000 | 73.8491 | 382.0000 | 4.1074 | 16.3823 | 44.2568 |
| | 5.0226 | 37.6591 | 85.8309 | 9.1592 | 4.6500 | .9308 |
| | .5089 | 9.1446 | 9.0180 | 2.4260 | | |
| 76 | .3552 | 4.6700 | 1.2900 | 13.1000 | 10.1391 | .6165 |
| | 73.9000 | 90.6176 | 224.0000 | 4.2646 | 12.5373 | 51.7363 |
| | 17.1283 | 23.9546 | 52.2972 | 6.1347 | 2.9500 | .6012 |
| | .3592 | 7.0689 | 5.6400 | 1.3450 | | |
| 77 | .9758 | 5.1700 | 1.4800 | 17.4000 | 10.6769 | .4087 |
| | 93.2000 | 91.7220 | 1551.0000 | 3.4737 | 16.2711 | 26.8242 |
| | 3.2408 | 24.8439 | 53.1774 | 6.3980 | 2.5300 | .5353 |
| | .3464 | 5.4295 | 5.6340 | 2.7310 | | |
| 78 | .2180 | 4.5600 | .9670 | 17.5000 | 9.3950 | .4432 |
| | 77.2000 | 76.8657 | 1641.0000 | 3.1497 | 13.4156 | 33.3079 |
| | 4.4196 | 21.3597 | 44.8446 | 5.4331 | 2.2000 | .4974 |

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|---|---|---|---|---|---|---|
| | .3065 | 5.0233 | 5.1400 | 2.1760 | | |
| 79 | .1961 | 4.6100 | .9130 | 16.0000 | 9.7095 | .5130 |
| | 87.6000 | 86.1916 | 1605.0000 | 3.3864 | 15.4534 | 34.3809 |
| | 4.6197 | 21.9628 | 47.8921 | 5.7504 | 2.4200 | .5272 |
| | .3613 | 5.7049 | 5.1470 | 2.8060 | | |
| 80 | .3308 | 6.9800 | 1.4700 | 12.3000 | 14.1345 | .7048 |
| | 102.0000 | 123.7357 | 556.0000 | 4.0905 | 19.3766 | 41.8411 |
| | 5.5094 | 26.0256 | 55.5135 | 6.8155 | 3.2400 | .6701 |
| | .3938 | 7.2857 | 6.2240 | 2.8930 | | |
| 81 | .5605 | 5.8000 | 1.1300 | 14.7000 | 12.2537 | .4317 |
| | 88.8000 | 100.5970 | 589.0000 | 3.6849 | 17.3489 | 36.0823 |
| | 5.2467 | 26.6659 | 58.6260 | 6.9933 | 3.1700 | .7056 |
| | .4426 | 7.6978 | 6.1880 | 2.1240 | | |
| 82 | .2546 | 5.2300 | 1.1600 | 12.8000 | 11.2351 | .4354 |
| | 76.7000 | 98.0902 | 178.0000 | 5.2807 | 10.8122 | 62.5925 |
| | 19.5689 | 24.8739 | 52.9088 | 6.3529 | 3.0000 | .6519 |
| | .3641 | 7.0029 | 5.9900 | 1.4960 | | |
| 83 | .2060 | 5.2600 | 1.1200 | 18.4000 | 8.3916 | .3140 |
| | 51.5000 | 58.4508 | 307.0000 | 2.5081 | 11.6084 | 31.8919 |
| | 3.3095 | 25.3450 | 54.0507 | 6.0071 | 3.1200 | .5509 |
| | .3501 | 5.5730 | 5.7160 | 2.0630 | | |
| IK100 | 0.9523 | 2.2500 | 1.4800 | 21.2000 | 4.2924 | .1193 |
| | 31.0000 | 119.7299 | 361.0000 | 1.3730 | 8.6788 | 7.6241 |
| | 0.3638 | 14.6088 | 28.4551 | 3.6109 | 1.6300 | 0.3092 |
| | 0.2215 | 6.1103 | 2.9394 | 1.7900 | | |
| IK100 | 0.9523 | 2.2500 | 1.4800 | 21.2000 | 4.4165 | .1193 |
| | 31.0000 | 46.0269 | 361.0000 | 1.4341 | 9.4235 | 8.9515 |
| | 0.7294 | 13.7194 | 29.3185 | 3.7993 | 1.6300 | 0.5213 |
| | 0.2604 | 6.4688 | 3.1444 | 1.7900 | | |
| IK101 | 0.5580 | 3.8900 | 1.5600 | 25.2000 | 4.6871 | .2220 |
| | 77.1000 | 46.4845 | 363.0000 | 1.5381 | 8.9562 | 22.6709 |
| | 1.9931 | 14.9408 | 29.0436 | 3.6954 | 2.8500 | 0.3376 |
| | 0.2387 | 5.6865 | 3.1459 | 3.0300 | | |
| IK101 | 0.5580 | 3.8900 | 1.5600 | 25.2000 | 5.3219 | .2220 |
| | 77.1000 | 49.9110 | 363.0000 | 1.7350 | 8.9154 | 27.1697 |
| | 2.4346 | 15.7870 | 31.7971 | 4.0862 | 2.8500 | 0.3215 |
| | 0.2549 | 6.5400 | 3.6445 | 3.0300 | | |
| IK102 | 0.6776 | 2.6300 | 1.7500 | 27.9000 | 4.7827 | .1166 |
| | 61.5000 | 41.1809 | 220.0000 | 1.4456 | 7.4511 | 22.3004 |
| | 2.2194 | 11.3629 | 25.1221 | 3.3749 | 1.2400 | 0.3415 |
| | 0.2016 | 3.0085 | 2.7508 | 2.0500 | | |
| IK102 | 0.7104 | 2.6000 | 1.5700 | 27.1900 | 4.8425 | .1245 |
| | 55.5000 | 43.1709 | 213.0000 | 1.4655 | 6.8051 | 19.9814 |
| | 2.1248 | 11.6287 | 25.7533 | 3.6008 | 1.6400 | 0.2315 |

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|---|---|---|---|---|---|---|
| | 0.2003 | 3.4552 | 2.7398 | 2.1400 | | |
| IK103 | 0.7378 | 3.0300 | 1.5300 | 28.6000 | 5.0542 | .1409 |
| | 59.9000 | 45.3534 | 217.0000 | 1.4743 | 8.0481 | 12.6089 |
| | 1.9547 | 14.6183 | 26.0747 | 3.5491 | 1.4900 | 0.2498 |
| | 0.2367 | 3.2973 | 2.7220 | 3.2900 | | |
| IK104 | 0.4926 | 2.7000 | 1.5400 | 27.9000 | 5.1174 | .1130 |
| | 44.9000 | 40.5192 | 214.0000 | 1.5062 | 7.5922 | 29.2790 |
| | 2.8618 | 13.4235 | 27.4084 | 3.6523 | 1.7200 | 0.2600 |
| | 0.2227 | 3.7304 | 2.7602 | 2.4700 | | |
| IK104 | 0.5000 | 2.8900 | 1.6100 | 28.6000 | 5.1371 | .1211 |
| | 51.0000 | 43.4630 | 219.0000 | 1.4618 | 7.5776 | 26.8352 |
| | 2.9637 | 12.3586 | 26.0022 | 3.7409 | 1.3600 | 0.3398 |
| | 0.2117 | 2.9721 | 2.8226 | 2.5100 | | |
| IK109 | 0.7342 | 2.6100 | 1.6600 | 16.8000 | 8.1729 | .1667 |
| | 42.0000 | 96.3541 | 366.0000 | 2.5888 | 15.6477 | 29.7448 |
| | 2.7383 | 26.2210 | 52.1706 | 11.9959 | 2.3000 | 0.7262 |
| | 0.4430 | 11.7139 | 6.7045 | 2.7600 | | |
| IK110 | 0.4619 | 3.3800 | 1.3400 | 18.5000 | 6.5834 | .1830 |
| | 63.0000 | 68.7120 | 372.0000 | 2.0521 | 10.8521 | 25.9373 |
| | 2.1095 | 19.0570 | 38.7822 | 8.8739 | 2.4000 | 0.4747 |
| | 0.3023 | 8.4475 | 4.6013 | 2.5300 | | |
| IK111 | 0.6794 | 2.3200 | 1.4600 | 18.9000 | 4.9572 | .1783 |
| | 51.4000 | 54.0722 | 281.0000 | 1.5929 | 9.0921 | 13.9886 |
| | 0.9886 | 14.8412 | 29.3937 | 7.0040 | 2.0100 | 0.3915 |
| | 0.2653 | 6.9801 | 3.6156 | 3.2200 | | |
| IK111 | 0.6509 | 2.4300 | 1.4200 | 19.5000 | 8.1387 | .1423 |
| | 53.1000 | 84.3178 | 286.0000 | 2.5656 | 14.9976 | 24.5250 |
| | 1.3013 | 25.0838 | 52.0774 | 11.5931 | 2.4900 | 0.5893 |
| | 0.4066 | 10.4330 | 5.7476 | 3.0300 | | |
| IK112 | 0.5586 | 2.8800 | 1.5200 | 26.0000 | 41.2208 | .1200 |
| | 49.0000 | 1.2875 | 201.0000 | 6.7566 | 22.2841 | 2.9837 |
| | 12.1524 | 25.7793 | 3.2010 | 0.8100 | 2.0500 | 0.2117 |
| | 3.0783 | 2.7507 | 1.9661 | 1.7000 | | |
| IK112 | 0.6098 | 3.6500 | 1.4200 | 24.9000 | 43.8738 | .1439 |
| | 52.0000 | 1.0904 | 184.0000 | 5.3462 | 27.8597 | 4.5944 |
| | 12.7196 | 25.3173 | 3.0003 | 0.8913 | 1.6700 | 0.2147 |
| | 2.6358 | 2.8864 | 1.8621 | 2.9500 | | |
| IK113 | 0.0353 | 1.3510 | 1.5300 | 75.9400 | 1.2702 | .0308 |
| | 35.2000 | 25.3442 | 196.0000 | 0.3243 | 1.7772 | 5.3925 |
| | 0.4807 | 7.8670 | 6.1661 | 1.8220 | 1.4970 | 0.1101 |
| | 0.0804 | 0.3351 | 0.4541 | 3.3520 | | |
| IK113 | 0.0353 | 1.3510 | 1.5300 | 75.9400 | 1.9177 | .0308 |
| | 35.2000 | 50.8928 | 196.0000 | 0.4871 | 3.8704 | 3.9808 |
| | 0.5975 | 8.0043 | 9.5519 | 2.1958 | 1.4970 | 0.2244 |

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|---|---|---|---|---|---|---|
| | 0.1145 | 0.5548 | 0.7204 | 3.3520 | | |
| IK113 | 0.0252 | 1.2840 | 1.4400 | 72.7000 | 1.9044 | .0340 |
| | 34.7000 | 35.2234 | 189.0000 | 0.5088 | 3.3743 | 5.2058 |
| | 0.5095 | 7.4891 | 10.1376 | 2.1049 | 0.9510 | 0.1514 |
| | 0.1249 | 0.5915 | 0.7344 | 2.1010 | | |
| IK114 | 0.0423 | 2.0350 | 1.3300 | 65.1900 | 2.2113 | .0874 |
| | 53.5000 | 38.8140 | 181.0000 | 0.7614 | 4.9027 | 5.5343 |
| | 0.1511 | 9.7147 | 12.9895 | 2.7589 | 0.6800 | 0.1742 |
| | 0.1541 | 1.8524 | 1.1152 | 3.3080 | | |
| IK114 | 0.0477 | 2.0320 | 1.3900 | 65.6000 | 2.2783 | .0786 |
| | 55.4000 | 40.4542 | 180.0000 | 0.8296 | 4.8005 | 5.1468 |
| | 0.4142 | 11.2123 | 13.1919 | 2.9697 | 1.3530 | 0.1749 |
| | 0.1796 | 2.2341 | 1.1770 | 2.9840 | | |
| IK115 | 0.8033 | 8.7400 | 1.7800 | 41.5800 | 8.2284 | .2220 |
| | 105.0000 | 78.7099 | 327.0000 | 2.3893 | 12.8699 | 41.5666 |
| | 2.5182 | 21.5706 | 37.8256 | 5.6811 | 1.3470 | 0.4566 |
| | 0.3132 | 4.0646 | 4.2416 | 4.8240 | | |
| IK115 | 0.0860 | 7.1870 | 0.6380 | 2.4960 | 9.0084 | .4617 |
| | 122.0000 | 77.6208 | 525.0000 | 2.5247 | 13.2302 | 30.6275 |
| | 1.2083 | 19.8443 | 41.9591 | 10.6192 | 6.4940 | 0.5197 |
| | 0.4298 | 4.4065 | 4.5225 | 4.3300 | | |
| IK121 | 0.7999 | 10.7000 | 1.4000 | 3.7600 | 112.8140 | .4536 |
| | 141.0000 | 4.4217 | 272.0000 | 16.2561 | 49.8133 | 6.7212 |
| | 54.9540 | 122.8088 | 12.0070 | 2.9864 | 6.0600 | 0.7044 |
| | 10.7269 | 12.5871 | 5.0859 | 5.2800 | | |
| IK122 | 0.7872 | 9.8640 | 1.5600 | 3.4230 | 153.4001 | .4473 |
| | 131.0000 | 4.6483 | 228.0000 | 14.9834 | 56.5244 | 5.6347 |
| | 64.4213 | 124.7854 | 13.0331 | 2.6846 | 7.2150 | 0.6813 |
| | 11.1044 | 13.3775 | 5.5267 | 5.8010 | | |
| IK123 | 0.8192 | 10.4000 | 1.8400 | 2.6300 | 110.1822 | .5014 |
| | 133.0000 | 4.2736 | 207.0000 | 14.1891 | 41.4481 | 3.5712 |
| | 52.3754 | 115.0142 | 11.6892 | 2.5397 | 7.0600 | 0.7023 |
| | 10.5236 | 12.5826 | 4.6732 | 4.9300 | | |
| IK124 | 0.8325 | 10.3000 | 1.7400 | 4.1400 | 111.2071 | .4699 |
| | 138.0000 | 4.1445 | 219.0000 | 13.3447 | 49.7191 | 4.2969 |
| | 55.4469 | 111.6415 | 11.6260 | 2.6331 | 6.1500 | 0.6614 |
| | 10.2919 | 12.3664 | 4.9804 | 4.6000 | | |
| IK126 | 1.5800 | 12.5000 | 3.0300 | 2.1000 | 124.6681 | .6514 |
| | 107.0000 | 6.8953 | 1192.0000 | 24.7517 | 78.0456 | 8.3986 |
| | 59.9388 | 132.8352 | 12.9948 | 2.9056 | 13.0000 | 0.7759 |
| | 13.0818 | 13.0139 | 3.0295 | 6.2900 | | |
| IK127 | 1.6700 | 8.9300 | 2.9500 | 12.3000 | 96.8913 | .5007 |
| | 112.0000 | 4.1835 | 901.0000 | 19.8128 | 51.2539 | 5.3521 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 40.9338 | 91.8114 | 9.4121 | 2.0800 | 10.0000 | 0.6188 |
| | 8.5499 | 9.5205 | 3.1173 | 7.8900 | | |
| IK125 | 0.6928 | 10.3000 | 1.7300 | 2.9800 | 113.0573 | .4887 |
| | 129.0000 | 4.3107 | 207.0000 | 12.0637 | 38.6360 | 4.4508 |
| | 53.2770 | 116.9757 | 11.7914 | 2.6703 | 5.4400 | 0.6995 |
| | 10.6734 | 12.2667 | 5.3059 | 3.9700 | | |
| IK129 | 0.7658 | 10.0000 | 1.6900 | 4.0500 | 128.2802 | .5008 |
| | 157.0000 | 4.2687 | 202.0000 | 12.9161 | 49.8964 | 4.3561 |
| | 46.6938 | 105.6789 | 10.5467 | 2.8419 | 4.8800 | 0.6460 |
| | 10.0189 | 11.9807 | 4.6290 | 5.1300 | | |
| IK130 | 1.0000 | 5.3400 | 2.2100 | 12.1000 | 85.6999 | .2024 |
| | 99.8000 | 2.8203 | 225.0000 | 10.9341 | 57.3285 | 4.2684 |
| | 19.3810 | 45.1035 | 4.5953 | 2.8857 | 2.7800 | 0.2503 |
| | 4.4017 | 4.8455 | 1.5781 | 3.6800 | | |
| IK132 | 0.6408 | 10.6000 | 1.4500 | 3.8900 | 136.9720 | .4945 |
| | 144.0000 | 4.8794 | 254.0000 | 14.3375 | 66.0225 | 8.9489 |
| | 61.2234 | 130.0962 | 13.5470 | 2.8101 | 6.9400 | 0.8533 |
| | 12.9151 | 13.8792 | 7.3768 | 7.8100 | | |
| IK133 | 0.4892 | 10.9000 | 1.2800 | 4.2900 | 127.7854 | .4834 |
| | 147.0000 | 4.3843 | 191.0000 | 10.8679 | 68.1514 | 8.4370 |
| | 62.0213 | 129.8006 | 12.5531 | 2.2880 | 5.6300 | 0.7765 |
| | 12.4608 | 13.9646 | 7.6968 | 7.5100 | | |
| IK134 | 0.7137 | 8.9640 | 1.4560 | 6.1930 | 111.8730 | .4017 |
| | 118.0000 | 4.3076 | 298.0000 | 14.5853 | 69.7726 | 7.1477 |
| | 48.2094 | 104.0424 | 11.3713 | 1.8239 | 5.8230 | 0.6672 |
| | 10.5516 | 11.2687 | 5.0417 | 5.8800 | | |
| IK135 | 0.6395 | 10.5700 | 1.3390 | 3.9730 | 3.9300 | .5376 |
| | 101.0000 | 6.0273 | 584.0000 | 22.9931 | 70.6427 | 7.6078 |
| | 54.3214 | 115.5282 | 11.7004 | 2.0131 | 6.8320 | 0.7221 |
| | 11.2178 | 12.2401 | 3.0996 | 3.9300 | | |
| IK136 | 0.7225 | 10.0200 | 1.4150 | 5.1120 | 104.3742 | .4585 |
| | 108.0000 | 5.6996 | 568.0000 | 23.6292 | 70.0229 | 5.7191 |
| | 50.5834 | 110.3026 | 11.0029 | 2.0449 | 6.4920 | 0.6947 |
| | 10.8459 | 11.7410 | 3.4104 | 3.3900 | | |
| IK137 | 0.3128 | 8.7111 | 0.8310 | 4.8620 | 94.3836 | .4143 |
| | 113.0000 | 4.1500 | 202.0000 | 10.4157 | 56.9501 | 6.1941 |
| | 54.7225 | 109.8337 | 6.8059 | 1.7571 | 4.8090 | 0.6466 |
| | 10.5714 | 11.9290 | 5.8123 | 4.9840 | | |

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# Metallic Burnished Early Bronze Age Ware from Tall Abū al-Kharaz

## Introduction

Tall Abū al-Kharaz is situated at a strategic point in the Jordan Valley north of Wādī al-Yābis (for further information see: Glueck 1951; de Contenson 1960; 1964; Mellaart 1962; Mittmann 1970, Ibrahim *et al.* 1976; Mabry and Palumbo 1988; Fischer 1991a). The summit of Tall Abū al-Kharaz is 142.70 m below mean sea level. According to the Palestine Grid Coordinate System, the coordinates of the summit are, to an accuracy of 50-100 m, 206.2 E and 200.6 N (FIG. 1).

In 1989 the Swedish Jordan Expedition *(SwedJordEx)* carried out excavations on the western slope of the *tall* about 80 m west of the summit. It was shown that pottery from the Early Bronze Age I and II was well represented at the site. The 1991 campaign confirmed these observations. During the second season of excavation an area was exposed which revealed remains belonging to an extensive Early Bronze Age settlement. The generosity of the Department of Antiquities of Jordan, and its Director General Prof. Safwan Tell, made it possible to fulfill the main objectives of the expedition. Thanks are due to Professor Alexander Lodding for his kindness in loaning the SIMS equipment for the necessary analyses.

This paper deals with an investigation of an Early Bronze Age ware excavated in the fall of 1991 at Tall Abū al-Kharaz. The ware is designated as Metallic Burnished because of its special surface treatment. The aim of the present study is to:

1. study the ware and shapes;
2. analyze the "metallic burnish" in order to increase our understanding of ceramic production techniques.

## Stratigraphy: A Brief Summing-up of the Early Bronze Age Strata in Trenches VII A-D, VIII and IX (FIG. 2)

The oldest phase in this area is represented by a destruction layer found directly on bedrock. It contains a series of rooms enclosed by walls of sun-dried mudbricks. Most of the walls are built on stone foundations of one or more courses.

None of the walls shows signs of dislocation caused by earthquakes. It seems rather that the cause of destruction was a conflagration. An ash layer intermingled with burnt mudbricks, charcoal and fallen superstructures covered a variety of vessels and tools. The tools were made of bone, bronze and stone. No human skeletons were found.

The pottery consists of large storage vessels of Grain-wash/Bandslip ware. A variety of holemouth and other large jars were found. Small vessels are represented by bowls, jugs and juglets, amphoriskoi and platters. Many of them are burnished either vertically or diagonally, thus showing different net patterns.

The next phase can be divided into different subphases. Within this phase a destruction layer was found which is clearly recognizable in almost all the trenches.

The pottery and other finds resemble the vessels from the previous phase, indicating continuity. Grain-wash/ Band-slip wares are frequent, together with platters and minor vessels, traditionally dated within the Early Bronze Age II period. Among the latter hard-fired, thin-walled vessels of a mainly fine fabric with a grey to brownish-grey "metallic burnish" and "metallic sound" were found. These vessels are partly manufactured or at least finished on a slow wheel. Their improved production technique and excellent finish reflect the high skill of the potters.

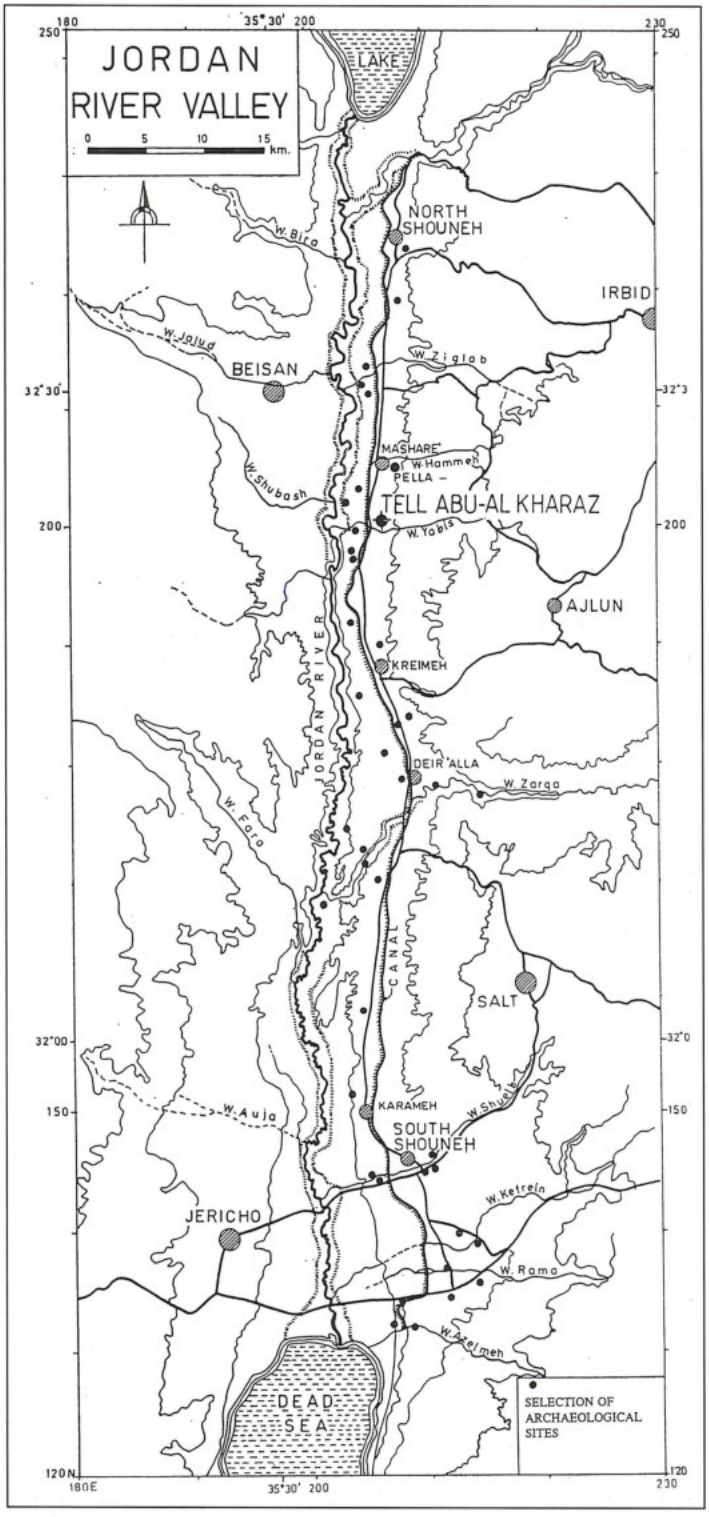
## THE METALLIC BURNISHED WARE

### 1. The Pottery

The 1991 excavations at Tall Abū al-Kharaz produced nine vessels which were classified as "Metallic Burnished" (FIGS. 3-6). The criteria listed below were common to this ware. Only ware which satisfied the following description was studied any further.

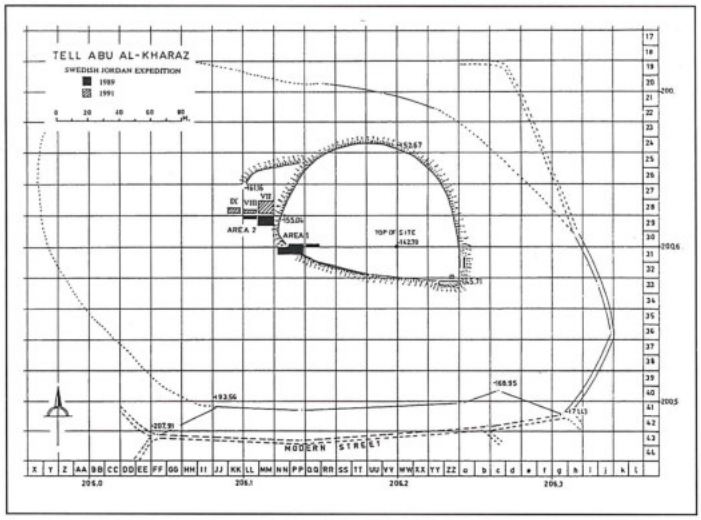
#### *1.1. Definition*

Ware: hard-fired; different shades of grey to brown clay, sometimes orange tan and pinkish-orange; grey cores oc-




1. Map of the Jordan Valley, showing Tall Abū al-Kharaz.

cur; the small vessels show mainly a range of very fine (<0.1 mm), fine (<0.25 mm) and medium (<0.5 mm) inclusions, the jugs medium (<0.5 mm) to coarse (c. 1 mm) inclusions (Wentworth 1922; 1933); the matt slip is applied in one or two layers with red, brown and grey shades; the outermost surface treatment is a vertical or,



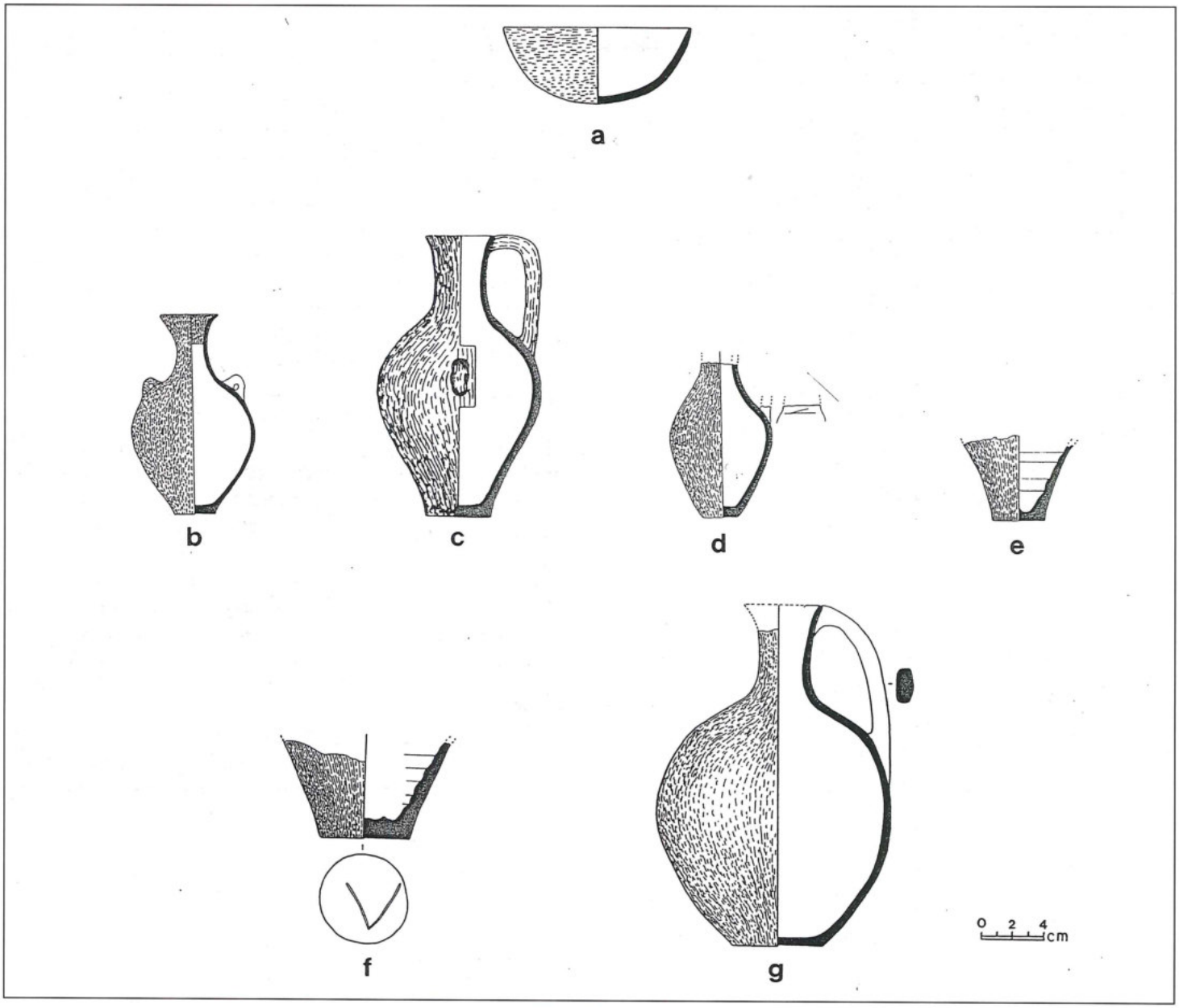

2. Sketch of the position of Trenches VII, VIII and IX.

in the case of the small bowl, horizontal high burnish with a grey to brownish-grey and occasionally fluorescent appearance, resulting in a metallic lustre.
Shapes: small bowl; amphoriskoi; juglets; and jugs.

*1.2. Pottery Descriptions and Parallels*

The identification number is the database code, which is a combination of site-year-trench-stratum-locus-find number (if classified as find; Fischer 1991a); HM/WM = hand/wheel made; H = hard fired; parallels refer to shapes.

1. K91VIIA12L246, small bowl, WM, H, dark grey, very fine inclusions, reddish-brown - greyish-brown slip, horizontally metallic burnished on outside (FIG. 3a). Parallel: Amiran 1978: PL. 13:20.
2. K91VIIC6L140N0271, amphoriskos with two vertical pierced lug handles, HM/WM, H, light brown to grey, fine inclusions, reddish brown - greyish-brown slip, vertically metallic burnished (FIG. 3b). Parallels: de Vaux and Steve 1948: FIGS. 8:9, 9:7; Tufnell 1958: PLS. 58:134, 61:266; Kenyon 1960: 104, FIG. 35:9; Kenyon and Holland 1982: 233, FIG. 87: 29; Schaub 1981: 114, FIG. 19:8.
3. K91VIII5L144N0343, amphoriskos with two vertical pierced lug handles and one vertical handle from body to rim, WM?, H, brownish-grey, medium dark grey and crushed pottery inclusions, reddish-brown slip, vertically metallic burnished (FIG. 3c). Parallels: Wright 1937: 58, FIG. B:IV:c (unpierced lugs?); Kenyon 1960: 173, FIG 64:4; Kenyon and Holland 1982: 229, FIG. 85:9 (jug with unpierced lugs); Amiran 1970: 59, PHOTO 56; Amiran 1978: PL. 25:3 (juglet with unpierced, degenerated handles).
4. K91V9L103, rim and neck of amphoriskos or juglet, WM, H, pinkish-orange, medium inclusions of mainly crushed pottery, light reddish-brown slip, vertically metallic burnished. D. of rim 4.3 cm, D. of neck 2.2




3. Metallic Burnished wares: a. small bowl (1.), b. amphoriskos (2.), c. amphoriskos (3.), d. juglet (5.), e. amphoriskos or juglet (6.), f. jug (7.), g. jug (8.); numbers within brackets refer to "1.2. Pottery Descriptions and Parallels".




4. Amphoriskos 2. K91VIIC6L140N0271 (26); juglet 5. K91VIII5L144N0295 (27); the other juglets (28-30; none is Metallic Burnished ware) were found in the same context as (27).



5. Amphoriskos 3. K91VIII5L144N0343 *in situ* in Early Bronze Age destruction layer.

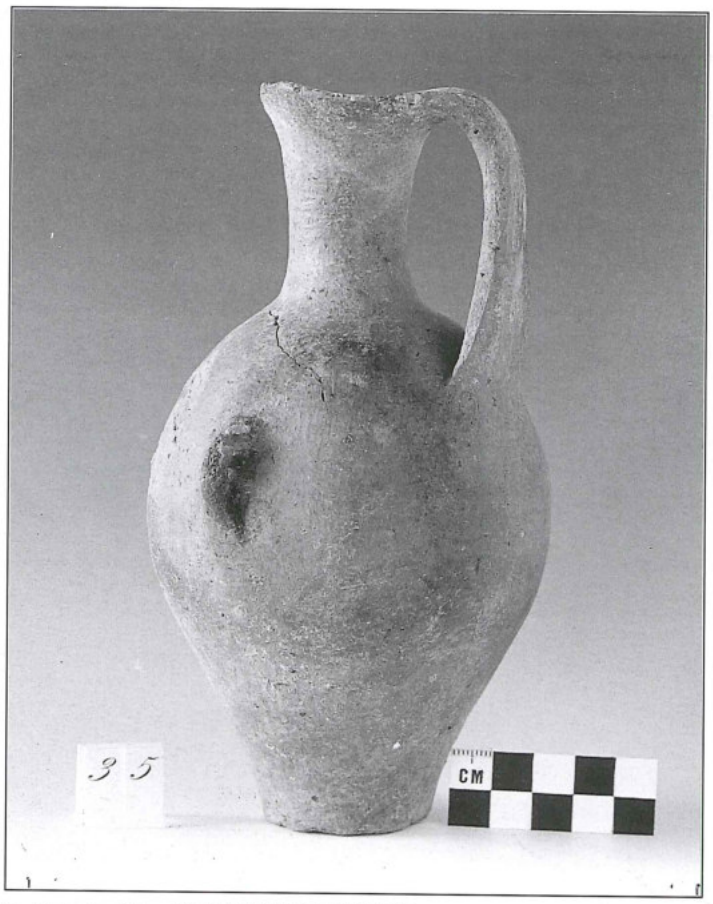
cm. For parallels see 2. and 3. above.

5. K91VIII5L144N0295, juglet with one vertical handle from body to rim, body and base HM (possibly in a mould), neck WM, H, light brown, grey core, medium-coarse inclusions of mainly crushed pottery, reddish grey slip, vertically metallic burnished with fluorescent appearance, pot mark on lower part of handle (FIG. 3d). Parallels: Wright 1937: 58, FIG. B:IV:d; Tufnell 1958: PL. 58:99; Kenyon and Holland 1982: 233, FIG. 87:1; Dorell 1991: 82-84, 85, FIG. 18:7.
6. K91VIID7L175N0287, amphoriskos or juglet, WM, H, grey, medium coarse dark grey to black inclusions, grey slip, vertically metallic burnished (FIG. 3e). For parallels see 2. and 3. above.
7. K91VIIB12L230N0408, jug, HM, H, light greyish-brown, coarse white and grey inclusions, reddish brown - matt brown slip, vertically metallic burnished (FIG. 3f). Parallels: Amiran 1970: 62, PHOTO 57; Schaub 1981: 77-78, 115, FIG. 19:3,5.
8. K91VIID7L0175N0292, jug, WM, H, orange tan, dark grey core, medium white and black inclusions, brown slip, vertically metallic burnished, base with potter's mark (FIG. 3g).
9. K91IX3L223, closed vessel (jug?), HM?, H, light grey, medium coarse crushed pottery inclusions, orange-brown slip, very thin vertically metallic burnished. Approximate D. of body >15 cm.

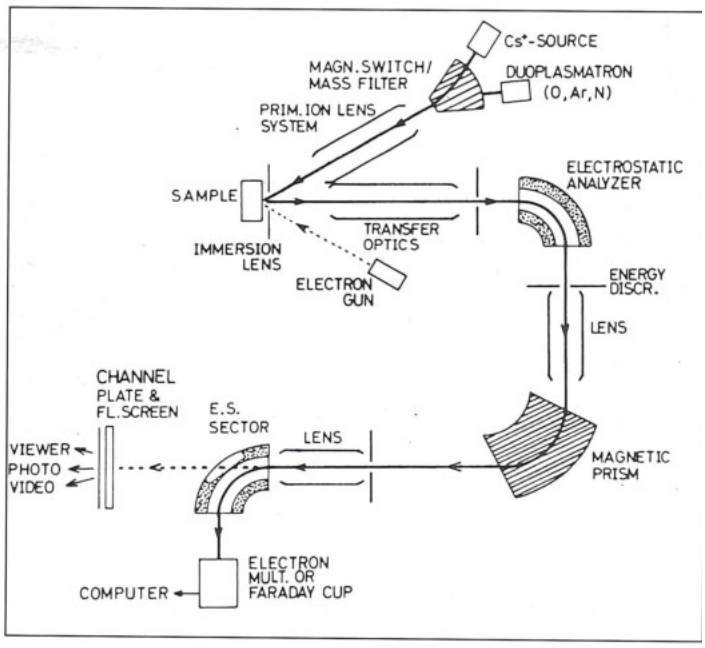
## 2. Analysis of the Surface Treatment by Secondary Ion Mass Spectrometry (SIMS)

SIMS was used for the analyses of the surfaces and the underlying slip and ware. SIMS is a surface analyzing method which makes it possible to define even very small portions of a sample, both in-depth and along-surface (step-scan). The high sensitivity of SIMS in chemical and isotopic detection (ppb-ppm), and the efficient topographical resolution (nm-micron both in depth and laterally) make it in many respects superior to other surface analytical techniques in interdisciplinary sciences (e.g. Fischer *et al.* 1985; 1989; Lodding 1988; Fischer 1991b).

The instrument at the SIMS laboratory of the Department of Physics at the Chalmers University of Technology in Gothenburg, which was used in the present




6. Amphoriskos 3. K91VIII5L144N0343.




7. Schematic drawing of a Cameca 3/4F ion probe.

study, is the only multi-purpose SIMS in Scandinavia. This equipment, a Cameca 3/4F ion probe, is therefore especially suitable for use in archaeometry. Archaeometric investigations have been performed at the laboratory since 1984.

*2.1. Principles and Features of SIMS*

Secondary ion mass spectrometry is based on the following functions (FIG. 7; Lodding 1988):

a. Bombardment of the sample surface with focused primary ions, with sputtering of the outermost atomic layers.
b. Mass-spectrometric separation of the ionized species (sputtered atoms, molecules and clusters) according to their mass-to-charge ratios.
c. Collection of the separated secondary ions as quantifiable mass spectra, as in-depth or along-surface (step-scan) profiles of elemental concentrations, or as element distribution images of the sputtered surface.

The primary ions (usually $O_2^+$, $O^-$ or $Cs^+$) are accelerated and focused at a selected impact area on the specimen. The focused beam can be narrow (micro-probe; 0.2-1.0 microns) or relatively wide (10-300 microns), permitting analysis of a smaller or larger area. The collision cascade following the incidence of a primary ion results in the reshuffling of some 50-500 matrix atoms, and emission of secondary particles either neutral or ionized. Secondary ions from the specimen are extracted into the mass spectrometer, the operation of which is based either on electric/magnetic deflection fields (e.g. the Cameca ion probes) or on the quadrupole/time-of-flight principle. Secondary ions with a given mass-to-charge ratio, and within a certain range (window) of kinetic energy, are collected for pulse or current measurements, ion-optic imaging, and data processing.

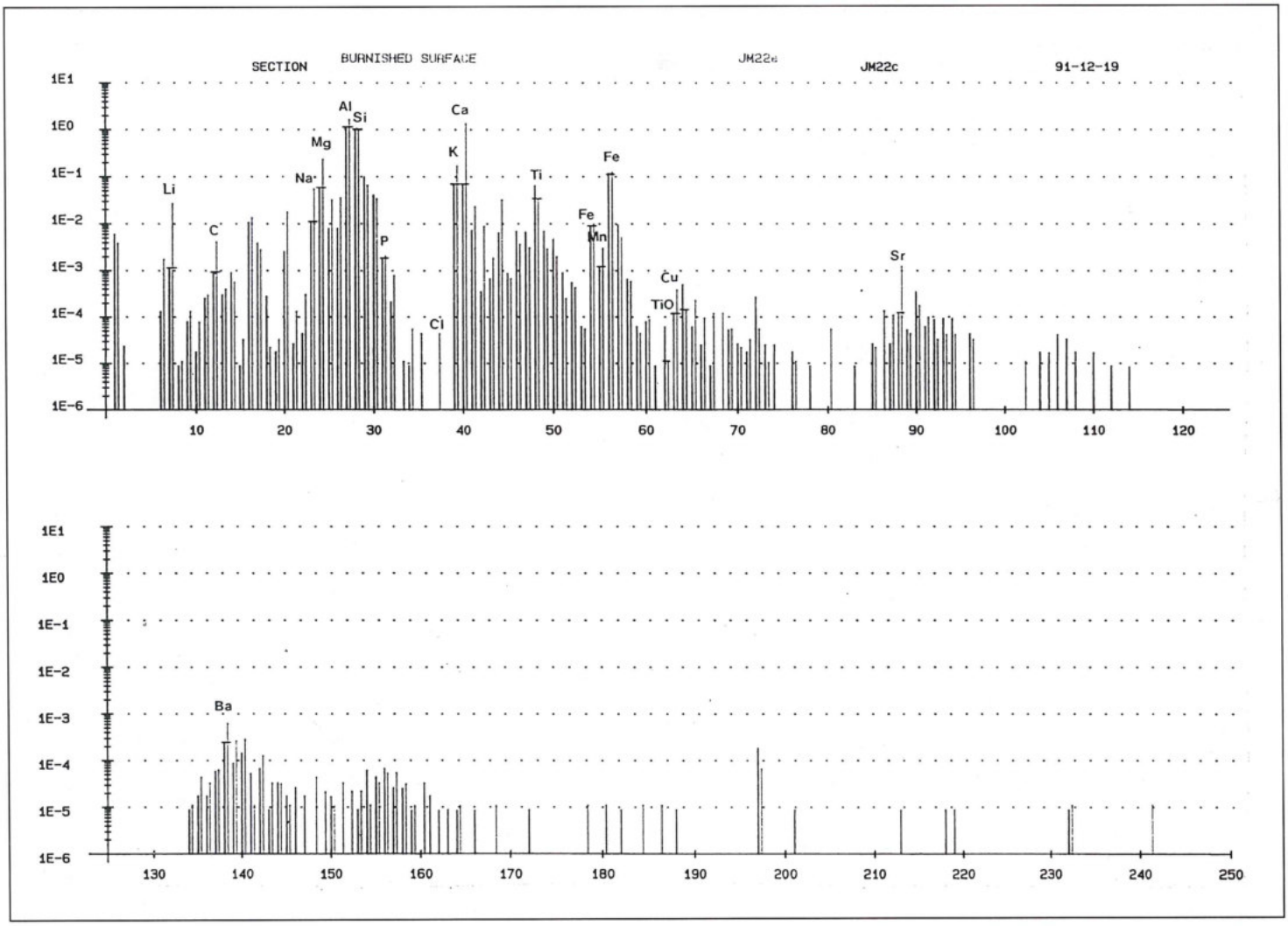
An advantage of SIMS which is especially important to archaeometry, is that the method may be considered virtually "nondestructive" apart from the fact that the sample size should not exceed 25mm by 12mm. A sample size of a few $mm^3$ is sufficient for a SIMS analysis. Analyzed samples can be returned.

*2.2. Sample Preparation*

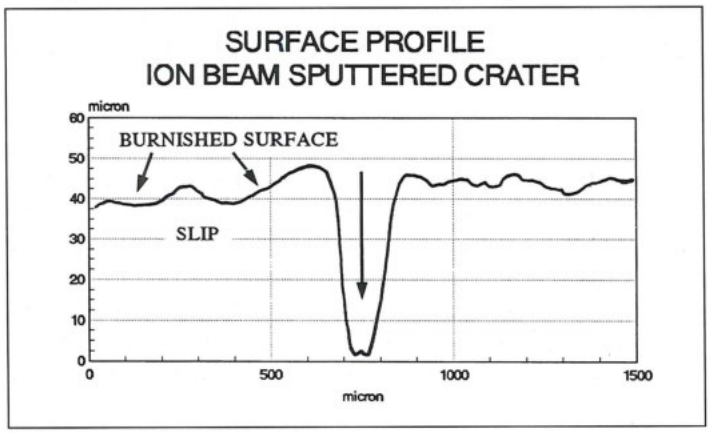
The samples were cleaned in water with a soft brush. No chemicals were used. The surface or the section of samples can be analyzed (either in an in-depth, or a step-scan mode which was not used in the current project). Sections of samples are polished with silicon carbide grinding paper, grit 600, and held in the SIMS sample holder (D. 25mm, max. height 12mm) with an embedding resin. The embedding procedure is the same as for surface analyses. Non-conducting samples (e.g. pottery) are also thinly gold-coated under vacuum, in order to provide a conducting surface layer – a precondition of all SIMS analyses.

*2.3. The Applied Analyzing Mode*

The gold-coated sample surfaces were bombarded with




8. Two spectra of the Metalic Burnished jug 9. K91IX3L223; arranged in pairs for mass number: clay matrix to the left, "burnished surface" to the right. Mass number on x-axis and intensity on y-axis.

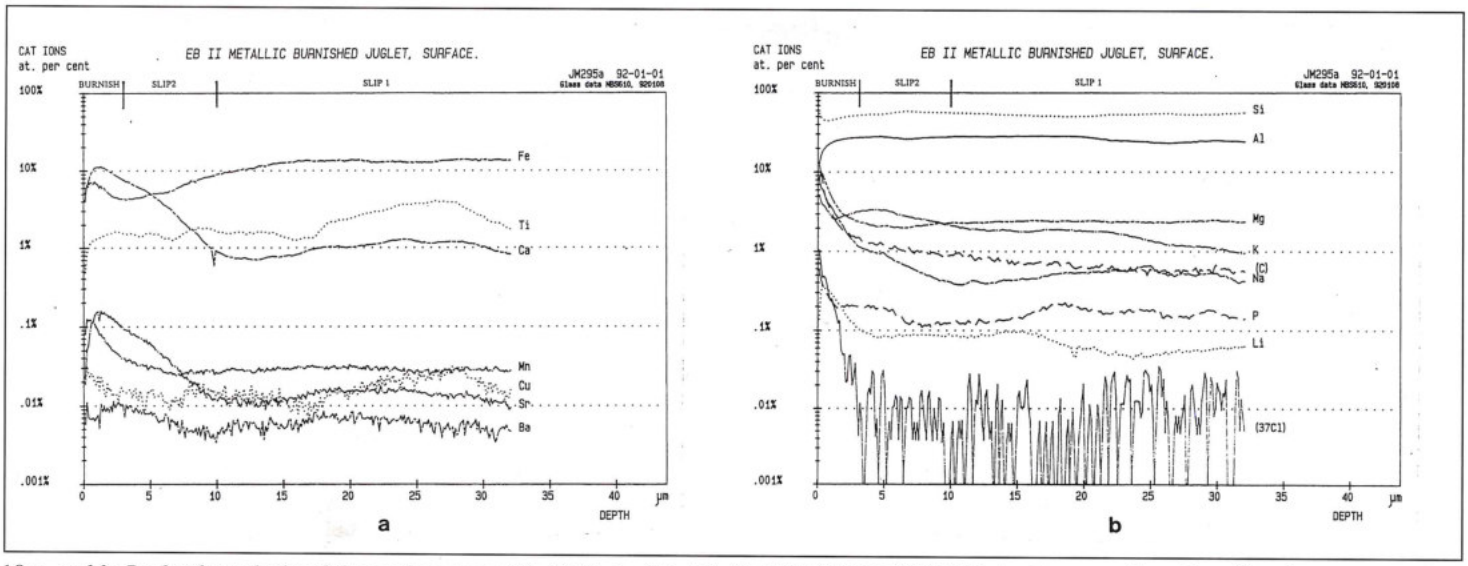



9. A crater in the surface of jug 7. K91VIIB12L230N0408 as the result of the primary ion beam sputtering (measured by the Talysurf).

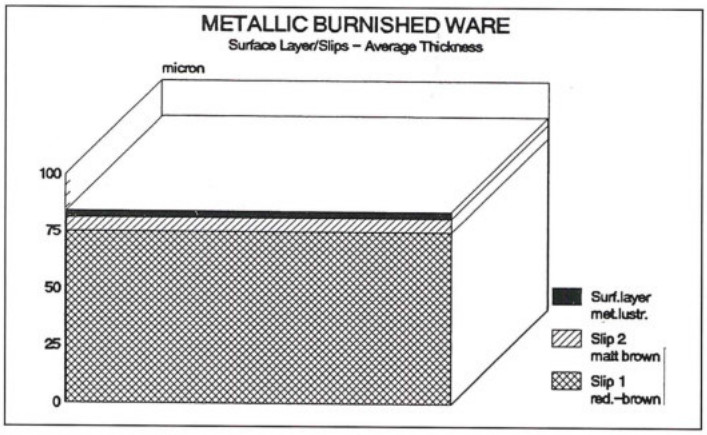
a beam of $O^-$ primary ions, c. 25 microns in diameter, accelerated through 12.7kV at a primary current of 175-200nA. The beam raster was 150x150 microns. The secondary positive ions were extracted and transmitted for mass separation from an analyzed area of 32x32 microns. Profiling of secondary negative ions was not performed since experimental problems due to charging of an insulating sample may arise. The kinetic energy window admitted only ions in the 75eV to 125eV range. The build-up of surface charge was countered by automatically adjusting the high voltage sample potential.

*2.3.1. Fast-Spectrum Mode*

Samples from all nine vessels were analyzed. The analyzing instrument was used initially in the fast-spectrum mode. Average sputtering time for each analysis was c. 450 seconds. All existing masses from 1 to 250 were exhibited in a single table for each sample analysis (see the spectra of the clay matrix compared with the surface of 9. K91IX3L223 in FIG. 8). For statistical reasons each sample was analyzed at three different points on the surface and likewise on the section of the same ware (clay




10 a. and b. In-depth analysis of the surface layer/slip 2/slip 1 of juglet 5. K91VIII5L144N0295; depth on x-axis and positive ion concentration on y-axis.




11. Average thickness of slips and surface layer of jug 7. K91VIIB12L230N0408 as measured by the Talysurf.

matrix). Care was taken to avoid analyses of areas not representative of the clay matrix, e.g. large inclusions. Each clay matrix spot to be analyzed was marked in a stereo microscope prior to the SIMS analysis. This offered a good topographical definition.

*2.3.2. In-Depth Analyses*

As implied from the study of the fast mass spectra, the following masses were chosen to study the changes and interpenetration between the surface layer, the underlying slip and the clay matrix by means of in-depth analyses: *7-Li, 12-C, 23-Na, 24-Mg, 27-Al, 28-Si, 31-P, 37-Cl, 39-K, 40-Ca, 48-Ti, 54-Fe, 55-Mn, 56-Fe, 63-Cu, 64-TiO, 65-Cu, 88-Sr, 138-Ba.*

Five samples were analyzed in-depth [numbers within brackets refer to "1.2. Pottery Descriptions and Parallels": small bowl (1. K91VIIA12L246), amphoriskos or juglet (4. K91V9L103), juglet (5. K91VIII5L144N0295), amphoriskos or juglet (6. K91VIID7L175N0287), and jug (7. K91VIIB12L230N0408)].

Three hundred in-depth analyses (i.e. 300 cycles) of the 19 chosen masses were performed, starting at the surface and sputtering through it, and into or through the underlying slip(s) (FIG. 9). Average sputtering time for the 300 cycles was 28 000 seconds and an average depth of c. 35 microns as measured from the surface was reached (i.e. within each cycle a layer c. 0.12 microns thick was analyzed with respect to the concentration of all the relevant elements).

## Results

FIG. 10 and TABLE 1 show the positive ion concentrations at increasing depth. The sample is the juglet 5. K91VIII5L144N0295. The figure and the table may serve as examples of the average elemental concentration of the Metallic Burnished ware. This analysis will be discussed below.

The thickness of the surface layer is approximately 3 microns, which corresponds to the depth of penetration after 25 cycles (FIG. 8). The elemental profiles of the following masses show clear differences in concentration as compared to the slips below:

*Lithium, calcium, manganese:* apart from a low concentration in the outermost layer (<1-2 microns) the concentration is much higher in the surface layer than in the slip.

*Carbon, sodium, magnesium, phosphorus, chlorine:* very much higher concentration in the surface layer.

*Potassium:* elevated concentration in the outermost layer of the surface layer.

*Iron:* a higher concentration in the surface layer than in the outermost slip, but lower than in the deeper portions of Slip 1.

**Table 1.** Metallic burnished juglet K91VIII5L144N0295. Mean values of element concentrations at different depths (Mol% of cations). Distance from surface in microns.

| Element | Surface Layer | | Slip 2 | Slip 1 |
|---|---|---|---|---|
| | 0 - 0.6 | 0 - 3 | 3.1 - 10.2 | 10.3 - 33 |
| *Li* | 0.29 | 0.22 | 871ppm | 672ppm |
| *C* | 6.0 | 3.4 | 1.1 | 0.66 |
| *Na* | 5.2 | 3.1 | 0.71 | 0.49 |
| *Mg* | 6.6 | 4.6 | 2.2 | 2.4 |
| *Al* | 13.5 | 21.8 | 27.1 | 26.1 |
| *Si* | 50.2 | 48.6 | 54.6 | 52.3 |
| *P* | 0.41 | 0.25 | 0.15 | 0.16 |
| *Cl* | 0.63 | 0.22 | 91ppm | 94ppm |
| *K* | 4.1 | 3.1 | 2.9 | 1.6 |
| *Ca* | 5.8 | 7.3 | 3.5 | 1.0 |
| *Ti* | 0.93 | 1.4 | 1.54 | 2.45 |
| *Mn* | 0.11 | 750ppm | 290ppm | 290ppm |
| *Fe* | 6.1 | 5.6 | 6.0 | 12.6 |
| *Cu* | 250ppm | 190ppm | 140ppm | 170ppm |
| *Sr* | 660ppm | 0.12 | 420ppm | 140ppm |
| *Ba* | 75ppm | 85ppm | 65ppm | 60ppm |
| Total | 99.97 | 99.81 | 99.98 | 99.90 |

*Aluminum:* appears to be substituted by silicon in the outermost layer.
*Titanium and titanium oxide:* show low concentration in the outermost surface layer.
*Copper:* is somewhat more concentrated in the outermost surface layer than in the outermost layers of the slip.

## Discussion

The examination of the samples with a stereo-microscope indicated a surface treatment which was applied on top of the slip. The surface-profiling instrument (Talysurf 10, manufactured by TaylorHobson) lent support to this assumption with measurements of the thickness of the outermost layer and the slip(s) (FIG. 11). It has been suggested that the burnish of a similar group of pottery, namely the Early Bronze Age burnished ware found at Bāb adh-Dhrā', is the result of polishing the leather-hard clay with a smooth tool, thus presenting a compacted surface with a micro layer of clay brought to the surface to give a dull sheen (Johnston and Schaub 1976). As regards the Early Bronze Age Metallic Burnished ware from Tall Abū al-Kharaz, it rather seems that the "burnish" is an additional substance applied as strokes of coating on top of the slip. This has also been demonstrated by SIMS-analyses. Furthermore it was shown that the elemental compositions of the two slips are more related to each other than to the surface layer. This kind of manufacturing technique is without doubt time consuming. It was obviously used for both fine and coarse wares to achieve a more appealing look and perhaps to imitate

bronze vessels. Such a surface treatment certainly delays the evaporation of the liquid contents. It appears therefore that these vessels were intended for a special purpose and to hold particularly valuable substances.

It is difficult at present to define accurately the nature of the applied surface layer. However, the high concentrations of carbon, sodium, magnesium, chlorine, potassium and phosphorus indicate a material in which an organic substance has the function of a binder. It seems therefore that the final result is likely to have been achieved either by "glazing" (see e.g. the almost fluorescent surface of juglet 5. K91VIII5L144N0295) or by a post-firing treatment.

Glaze is by definition a glass-coating melted onto the surface of a once fired ceramic (biscuit) during a secondary firing process (glost; Rice 1987). However, even an unfired vessel can be treated with a glaze and be completed in a single firing process. During the cooling process glaze does not form a crystalline structure and therefore keeps the properties of a glass-liquid (Rhodes 1973; Nelson 1984)). According to Rhodes (1973), three components characterize a glaze: network formers, network modifiers and intermediates.

Network formers mainly consolidate oxygen with cations (e.g. Si and P) resulting in $SiO_2$ and $P_2O_5$. Network modifiers act as fluxes by lowering the melting point of silica (c. 1710°C). Among the most common fluxes $Na_2O$, MgO, $K_2O$ and CaO may be mentioned. Intermediates either increase the viscosity (if this has been lowered too much by the fluxes) and/or increase the strength of the glaze in firing. A common intermediate is $Al_2O_3$. Among the oxides used to stain the glaze, those of iron, manganese and copper should be mentioned. Organic materials are commonly used to bind the raw glaze.

Generally glazes are divided into high-temperature, hard glazes, above 1200°C, or low-temperature, soft glazes, below 1200°C (cf. Brody 1979). Low-temperature glazes with firing temperatures of 800-1000°C from about 3500 BC. Egypt and Iran are reported (Vandiver 1990).

All the elements and oxides essential to produce a soft alkaline glaze are confirmed by SIMS analyses. However, some observations do not entirely support the "glaze-theory". Chief among these is the fact that the surface layer is applied in strokes. It is not found at spots difficult to reach with a brush or another tool, e.g. inside handles or on the body below a handle. One would rather expect the potter to use either dipping, splashing or pouring as a technique to apply the raw glaze liquid, which would result in a glaze at parts of a vessel tricky to reach with tools.

As suggested above, another possibility might be that a post-firing treatment was applied to the vessels. The most common way seems to be to apply different organic substances to the pot while it is still hot (Arnold 1985). This would possibly explain the very high carbon content of 6% "on surface" (0-0.6 microns), respectively the mean value of 3.4% carbon in the outermost layer (0-3 microns; see TABLE 1)). Resins, beeswax or various concoctions of plants, possibly intermingled with a "liquid slip" can be used to achieve a glaze-like surface (ref. to the relatively high aluminum and silicon contents of the surface layer in TABLE 1). The final treatment of the surface was most likely performed by burnishing with different tools or textiles, and solutions.

During the authors' study of the available relevant literature, the terms "Metallic ware", and "Abydos ware" and "Foreign ware" from Egypt, were found in a number of publications (Engberg and Shipton 1934: *passim;* de Vaux and Steve 1948: 556; Kantor 1965: 29, FIG. 5:AG; Hennessy 1967: *passim*; Amiran 1970: 59-66; Kühne 1976: 33-72; Dever and Richard 1977: 10; Amiran 1978: PL. 13:20, 23; Callaway 1980: 84, FIG. 62:11, 12, 18, 19; Cohen and Dever 1981: 63; Ben-Tor *et al.* 1981: 160, 162; Bar-Yosef *et al.* 1986: 148, FIG. 13:3; Dornemann 1988: 13-42; Gal 1988: FIG 3:7; Rast and Schaub 1989: 431, FIG. 256). Those wares are dated from Early Bronze Age IC (Callaway; see ref. above)/II-IV. It must be stressed that the designation "Metallic ware" in the above publications relates to the metallic-hard fired clay and not to the surface treatment. However, the ware in the current study designated as Metallic Burnished is related to "Metallic" and "Abydos/Foreign wares" as far as the hard-fired clay, the Early Bronze Age II date, and certain shapes are concerned. The search for the suggested, descriptive designation "metallic burnished" was unsuccessful. It is conceivable that other designations were used in earlier publications to describe the colour shades of comparable wares. The designation "metallic burnished" is intended to provide descriptive differentiation from other Early Bronze Age burnished wares. It is possible that this group of pottery constitutes a separate group among other burnished wares from the Early Bronze Age by virtue of a different production technique.

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# Some Technological Features of Tall as-Sa'īdiyya Cooking Pots

## Introduction[1]

This paper will attempt to describe and explain the production of cooking pots in the Jordan Valley between c. 1250-600 BC. For this purpose the Late Bronze and Iron Age cooking pots from Tall as-Sa'īdiyya were analysed technologically. The analysis was carried out in 1991, and made possible by a Palestine Exploration Fund grant.

Future research will focus on the complete pottery repertoire of Tall as-Sa'īdiyya, and the comparison of the results of this study with the analysis of the chronologically comparative material from the neighbouring site of Dayr 'Allā in an attempt to reconstruct socio-economic processes in the central Jordan Valley.

The large double mound of Tall as-Sa'īdiyya lies in the northern part of the central Jordan Valley, 1.8 km east of the Jordan River, south of Wādī Kufranja. The most recent excavations on this site have been taking place since 1985 and are funded by the British Museum.

The reasons why Late Bronze and Iron Age Near Eastern cooking pots are easily recognised is two-fold: their shape and dark brown colour. In this paper a preliminary description of these features is presented and a brief explanation is given as to why these two features were preferred by the ancient potters and their consumers.

## Analysis

During the first five seasons of excavations by the British Museum, work was carried out in seven areas (FIG. 1), which produced a total of 180 rim sherds and 16 complete cooking pots[2] found in areas AA and EE.

Stratigraphically, the material belongs to strata XII-IV (Late Bronze Age II-Iron Age III: c. 1250-600 BC). The sherds and most of the complete pots are in London, one is in Leiden, and one is in 'Ammān.

### *1. Raw Materials*

A small piece was broken off each sherd to obtain a clean break. When studied under a binocular microscope (10x magnification), these showed that the whole repertoire was made of one ware.[3] The potters used a mixture of clay, crushed calcite and organic material (i.e., dung or straw). Organic or animal iron oxide was probably also added (i.e., animal blood) but as yet this has not been proven. The presence of such oxide is deducted from the characteristic dark brown colour of the pots, which cannot possibly be solely the result of the oxidising firing atmosphere in the kiln, as calcareous clay shows pale colours when fired between 600-800°C.

In 11.3% of the sherd material lime spalling had occurred. Lime spalling occurs when the temperature in the kiln reaches about 800°C (Rice 1987: 98), because the added calcite is never unpolluted. During the firing process the calcite ($CaCO_3$) changes into quick lime (CaO) and when exposed to the moist air changes into slaked lime ($Ca(OH)_2$) (FIG. 2), resulting in the cracking of the body of the pottery.

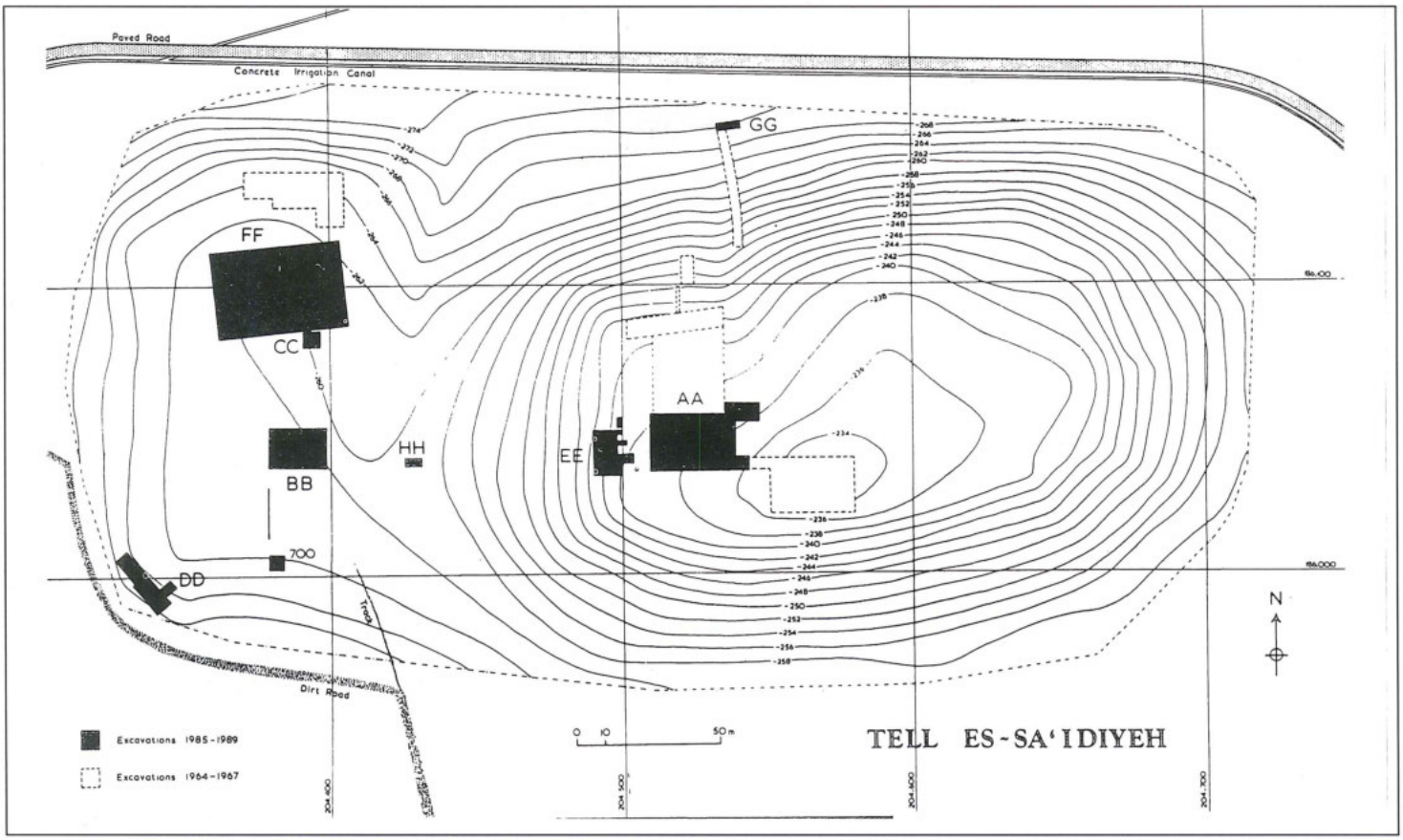
### *2. Basic Shaping Technique*

In all cases, a slab of clay was pressed into a mould (either from lime or clay) for the shaping of the base of the Tall as-Sa'īdiyya cooking pot, the advantage being that the potter had sufficient control over the thinness of the wall (FIG. 3). In addition, the base was sometimes scraped, a conclusion based on the scrape marks on one of the complete pots. The shoulder and neck were formed on the base with coils resulting in a sharp carination between the base and the shoulder. The last step was the attachment of the handles.

[1] This analysis could not have been carried out without the advice of Prof. H. J. Franken and Ms. M. L. Steiner of the Institute of Archaeology, Leiden, and Lou Jacobs of the Department of Pottery Technology, Leiden. Also, I would like to thank Erick van Driel for the drawings, Jan Pauptit and Allan Hills for the photographs and, last but certainly not least, Peri Bearman for the correction of my English.

[2] Twenty-eight sherds and two complete pots were defined as miscellaneous and not described in the typology.

[3] The term ware is used here to mean: the mixture of clay and inclusions. The inclusions are both those naturally present in the clay and the material added by the potter.




1. The excavated areas on Tall as-Sa'īdiyya (Tubb and Dorrell 1991: 68).



2. The conversion of a calcite grain (0.84 mm) into slaked lime (courtesy of Prof. H. J. Franken).

When the potters began using turntables[4] to finish the treatment, this carination became less distinct because one of the finishing touches was the smoothing of the shoulder and the carination with a piece of cloth to remove the construction marks. Within the Tall as-Sa'īdiyya repertoire, the Late Bronze II material shows both the sharp carination and the smoothed carination. In the Iron Age, on the other hand, the turntable was always used.

The Tall as-Sa'īdiyya type 1 cooking pot (FIG. 4) — the characteristic Late Bronze Age II cooking pot — did not have handles as far as we know. The other three distinguishable types always had handles. In almost all of the cases, these were attached to the rim and the carination, and only in a few cases was the handle attached halfway down the rim.

*3. Firing*

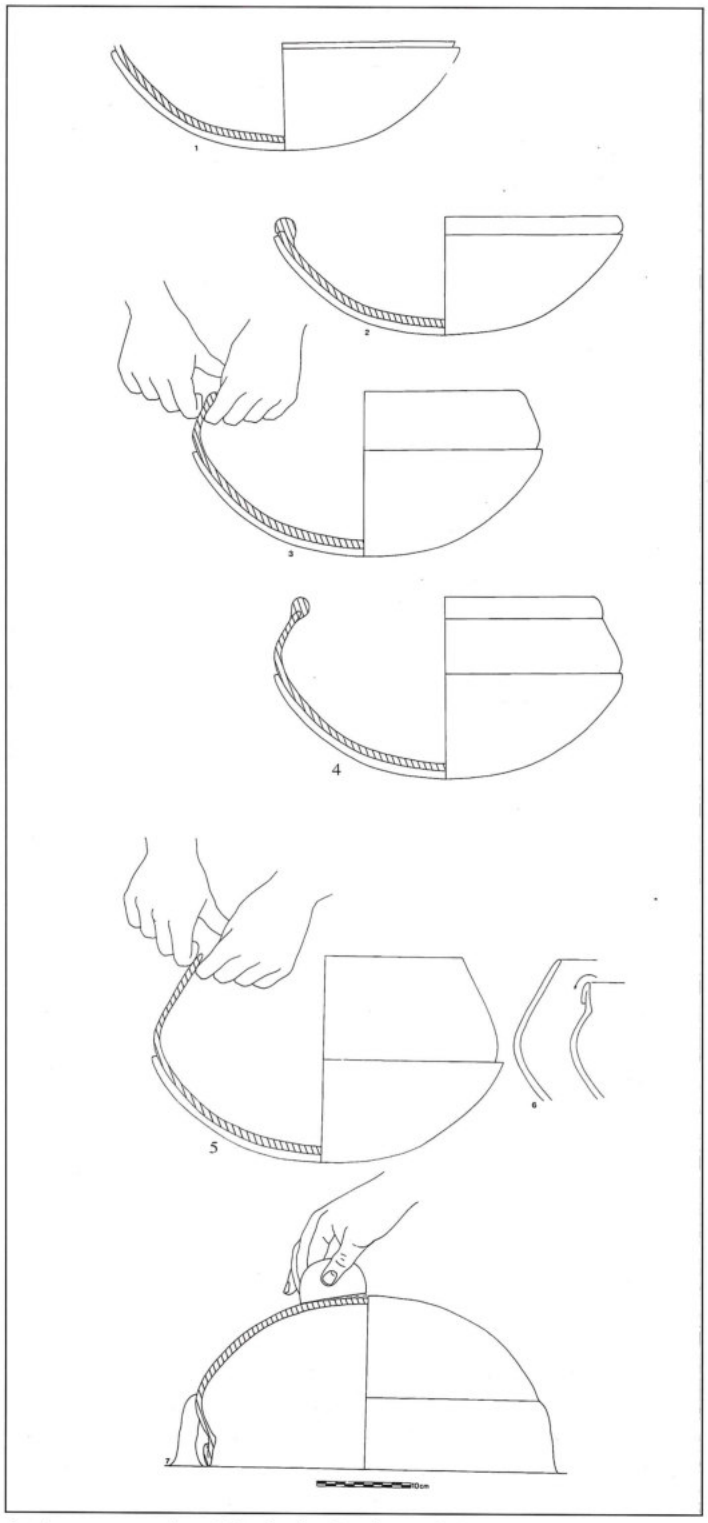
The colour is, predominantly, the result of the iron in the clay and the oxidising atmosphere in the kiln.

As yet no remnants of kilns have been found in either the vicinity of the site or anywhere else in the Jordan Valley, but considering the quality of the pottery found during this period, I assume that they were fired in a kiln and not in an open fire. If so, then the so-called updraught kilns, which have been found in Palestine dating from this period, must have been in use in the Jordan Valley as well.

**Typology**

Based solely on the basic shaping technique, it seems that we are dealing here with one type, but owing to a

[4] A turntable is a disk or device that can be revolved slowly by hand and supports a vessel being formed (Rye 1981:147).



3. A reconstruction of the basic shaping technique.

few characteristic differences in the actual shape, four types have been distinguished (FIG. 4). A further division within the types based on the finishing of the rims was possible for type 3, being the only type with a considerable amount of sherds and complete pots.

Except for two, all complete pots fitted into the following typology.

*Type 1* (sherds: 5.4%; pots: 18.7%)
A wide-mouthed (mean diameter: 29 cm) pot without handles. The rim was made using the last coil flattened and folded outwards, resulting in a somewhat flattened top with a sharp angle (FIG. 3).

Main occurrence of this type at Tall as-Sa'īdiyya is in the Late Bronze II and Iron I periods.

*Type 2* (sherds: 3.2%; pots: 6.2%)
An approximately 25 cm high cooking jug with a rim diameter between 10-14 cm, with one or two handles (FIG. 5).

The rim is unprofiled: the last added coil was flattened horizontally, probably by the potter's finger.

This type only occurs in the Late Bronze II and Iron Age I periods.

*Type 3* (sherds: 57.3%; pots: 56.2%)
Identical to type 1 except for a decrease in diameter to between 18-22 cm, and with two handles. Within this type three rim-variants were recognized.

*Type 4* (sherds: 15.1%; pots: 6.25%)
In shape identical to types 1 and 3, with a diameter between 16-20 cm, and two handles. This type is smaller in size than type 3, and completely different in colour.

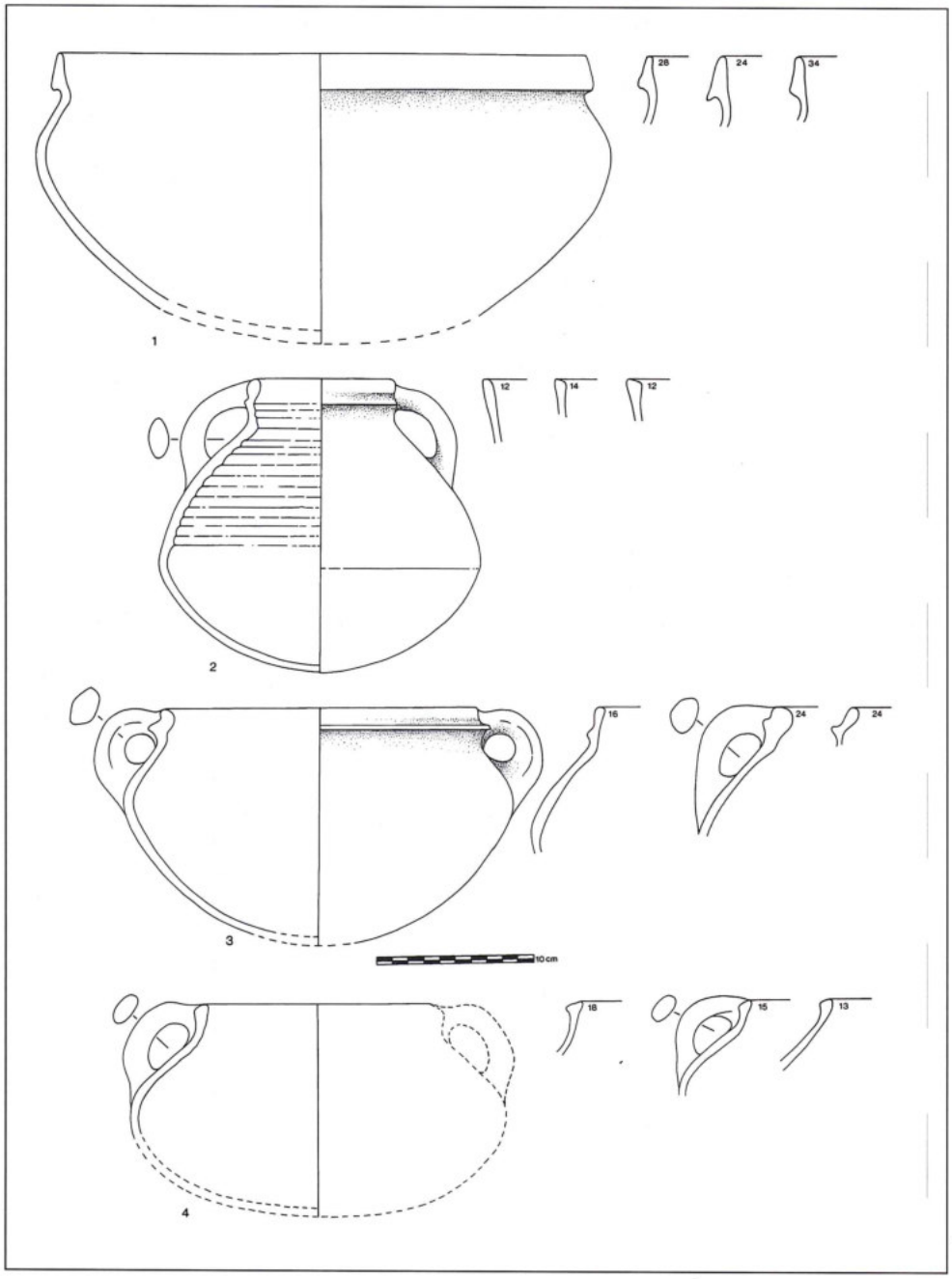
Initially I defined it as a cooking pot because of its shape and afterwards the microscopic studies confirmed this. However, because of the brownish yellow colour, I am not absolutely sure whether I am dealing with actual cooking pot sherds. It would appear that for this type no iron oxide was added to the clay.

**Reasoning for the Technology Used for Making the Cooking Pots**

The most important demand put on a cooking pot is its ability to endure sudden changes in temperature without immediately cracking and falling into pieces.

How did the potters solve this problem? They must have experimented for a long time, and once they found a satisfactory solution they stuck to it. Thus except for a few changes in shape, the cooking pot in this area was always constructed and tempered in the same way for at least the period in question. The potters discovered that:

a. by adding organic material the porosity of the pot increases, which provides elasticity to the body that allows for sudden expansion. A consequence of this was that the pot was not supposed to be fired at a temperature above c. 900-950°C. The reason for this restriction is that up to that temperature the porosity increases, but beyond it the mass starts to shrink, resulting in a decrease of the porosity;
b. the mineral inclusions make it possible for the con-




4. The four Tall as-Sa'īdiyya cooking pot types.

tents to heat faster and the pot to be more durable under conditions of heavy use-wear abrasion (Skibo *et al.* 1989), but also restricts the firing temperature, which means a decrease in the amount of fuel needed;

c. the rounded shape of the base permits a horizontal position both over a fire or on a *ṭābūn*;

d. also, the larger the surface of the rounded base, the greater the exposure of the contents to heat, and thus the most efficient use of the fire;

e. the thinness of the wall, obtained by the basic shaping technique, lessens the thermal gradient and hence the stress (Braun 1983: 119).

## Conclusion and Comparison

For a period of at least 600 years, the Tall as-Sa'īdiyya cooking pots were produced in the same manner using the same raw materials. During the Late Bronze II period two types of pots were in use. The shape difference between the two must be function-related: type 1, with the large mouth opening, for frying meat; and type 2, with the higher shoulder and neck, for boiling, e.g. vegetables. Introduced in the early Iron Age I and gradually overtaking the use of type 1 are types 3 and 4. This decrease in the size of the pot could well be a result of the economic decline in this period.




5. An example of the Type 2 cooking jug from Tall as-Sa'idiyya.

In 1969 the first technological description of Transjordanian pottery was published as a part of the final report on the Iron Age I phases at Tall Dayr 'Allā (Franken 1969).

In addition, the Iron Age II material excavated in 1967 from this site were published in recent years (Vilders 1989; 1992). Franken's analysis is the basis for the method used for the Tall as-Sa'īdiyya pottery, which makes it possible now to compare this with Tall Dayr 'Allā.

The preliminary comparison shows that the cooking pot repertoires from both sites are very much alike in the choice of construction method and of the tempering materials,[5] and show no major differences except for details such as different rim-variants. Also, no so-called "cooking jugs" were found at Dayr 'Allā. The similarities could be considered to point to the existence of a workshop specialised in the production of cooking pots for the region.

A possible location for this workshop could well have been along one of the many wadis, close to the mountains where the materials needed, such as clay, calcite, water and wood, were easily available.

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[5] In regard to Tall as-Sa'idiyya material, this conclusion is based solely on the microscopic ware study.

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# A Comparison of Bronze and Iron Age Pottery Production Based on Material from the Mādabā Plains Region

## Introduction

Bronze and Iron Age ceramics can be compared and contrasted in terms of raw materials, manufacturing techniques, form, and finish. An investigation of these aspects offers information concerning the organization of the ceramics industry as a whole. The primary question here concerns the similarities and differences in the organization of the pottery industries of the middle and late third millennium and the seventh-sixth centuries BC based on material excavated at Tall al-'Umayrī. The focus centers on those aspects of the pottery that provide evidence relating to the organization of the ceramics industry. Specifically, in addition to superficial differences in the form and finish of Early Bronze and Iron II Age wares, what can one infer about the organization of the industry based on analysis of the clays, manufacturing techniques, and distribution of potters' marks? Sherds excavated by the "Mādabā Plains Project" at Tall al-'Umayrī and nearby sites in 1984 and 1987 serve as the basis for the research.

## Petrographic Analysis

The preliminary petrographic analysis characterizes the mineralogical components of the clays for the purpose of addressing questions concerning the internal variation of the wares at Tall al-'Umayrī rather than the identification of the clay sources or origins (London *et al.* 1992). Each sample belongs to a different vessel form rather than multiple examples of any single vessel form. The Early Bronze Age sherds include a pithos with rope moulding on the shoulder, a holemouth jar, a round-bottomed cooking pot, and a painted bowl. The Iron II Age sherds include store jars, a large utilitarian vessel, cooking pots, and bowls (London *et al.* 1992: FIG. 23.1).

One of the most striking differences between the Bronze and Iron Age material is that each Bronze Age sherd has a different mineralogical composition resulting in four distinct clay bodies, but in contrast, there is overlap among the Iron Age sherds in that different vessel forms were made from identical or similar clays. For the Bronze Age wares, each sample was made of a different clay, but for the Iron Age wares, a large utilitarian vessel, a burnished bowl, and a cooking pot belong to a single petrographic group. Also in this group is a modern sherd from a jar produced at Zīzīa where Egyptian migrant potters use local materials to manufacture a wide variety of ceramic forms used throughout the 'Ammān region today (London and Sinclair 1992: 421-424). Given the presence of the modern Zīzīa sherd and the Iron II large utilitarian form in this group, there is reason to infer that it constituted a locally produced ware made some place in the 'Ammān region, but not specifically at Tall al-'Umayrī.

In addition to the major Iron II clay type, there is some differentiation within the Iron II material: the fine black burnished bowls sometimes described as "Ammonite" ware, constitute a separate petrographic group. A third ware category includes some of the Iron II cooking pots along with Iron I and the Early Bronze Age cooking pots. A fourth group includes large jars of the Iron II and the Hellenistic periods.

The petrographic data suggest that there were at least four groups of potters in the Iron II period, each working with a different clay type. The clay type suitable for a wide variety of forms, including a large utilitarian vessel, a small bowl, cooking ware, and either burnished or plain wares is the most likely candidate for locally produced material. A specific clay type seems to have been favored for some of the fine black burnished ware. A third clay body was selected for certain cooking ware, and a fourth clay characterizes large jars.

The preliminary petrographic analysis implies that the Iron Age industry was not a monolithic entity. Various sets of potters using diverse clays were at work, yet the variety thus far is less than that in the Early Bronze Age sample. Given the greater diversity of the Bronze Age clay bodies than for the Iron Age wares, the implication is that a larger number of people or producers were making pottery in the middle and late third millennium than in the mid-first millennium BC. In other terms, craft spe-

cialists supplied more pottery in the Iron Age than during the Early Bronze Age when domestic potters were active. Although a greater degree of craft specialization may characterize the Iron Age ceramics industry than at the end of the Early Bronze Age, there was not a monopoly on pottery production in either period. This is of interest not simply because it informs on the organization of one of the most important industries of antiquity, but because it suggests that despite the characterization of the two periods as urbanized complex societies, pottery production was not an enterprise under strong state or other control regardless of the organization and control which may have existed in other industries. On the contrary, pottery production may have involved a large number of enterprises operating and producing at different capacities, some small and others large. Given this differentiation within the ceramics industry, the locations of pottery production may have been equally varied and distributed throughout towns and villages rather than in any urban setting.

The initial groupings of clay types at Tall al-'Umayrī are not exhaustive. A larger petrographic study in progress may suggest the presence of additional clay groups and the coexistence of other potters, but the point is that regardless of the precise number of pottery producers, in neither period under discussion was the industry limited to a single supplier or a single source.

Once the petrographic analysis enables the identification of different clay bodies within each of the two archaeological periods, the next question concerns the manufacturing technique. Does each clay type coincide with a specific fabrication technique? If so, this would strengthen the inference that each clay type indicates a different producer of pottery.

## The Manufacturing Traditions

For the third millennium BC material, four manufacturing techniques characterize the ceramic tradition, but for the present there is no clear overlap between each clay group and a specific fabrication process. The four techniques include the use of a slow moving turntable; coiling; pinch pots; and moulds. Not represented thus far at Tall al-'Umayrī is the paddling technique identified among the Early Bronze Age material from Bāb adh-Dhrā' and Numayra (Beynon *et al.* 1986: 304).

For the EB III/IV material, the manufacturing technique varied according to vessel shape and size. The smallest vessels were made in the pinch pot technique. Many jars were coil made, except for the largest which involved the use of slabs in addition to coils. Moulds were used for the red slipped and burnished platters. Pots of all sizes and shapes could have been placed on the turntable at various stages of their manufacture. To determine whether or not different potters can be associated with each technique, preliminary studies of the jars, ledge handles, and potters' marks address the question of individuality among the Early Bronze Age potters whose wares were found at Tall al-'Umayrī (London 1992: 384-393).

For the Iron II pottery, a combined coiling and turning technique appears to have been common for many normal sized vessels of all types. After the rims and upper bodies were either coiled or constructed on the turntable with the use of centrifugal force, the lower bodies may have been trimmed and shaped as the vessel stood upside-down on a rotating turntable. To shape large jars, a second technique involved coils with minimal or no use of the turntable. The result is a handmade form with irregular interior surfaces and wall thicknesses. Evidence for the use of a fast wheel for small bowls and lamps thrown from a cone of clay is seen in the unmodified string cut bases. Besides these small lamps and bowls, the prevalence of throwing pottery is undetermined.

The presence of handmade wares in first millennium BC assemblages has been documented at Jericho (Franken and Kalsbeek 1974: 87) and at Tall al-Mazār (Homès-Fredericq and Franken 1986: 175-177 n. 574). Franken and Kalsbeek (1974: 108) describe the bulk of the seventh century Jericho material as coiled and turned rather than thrown, and suggest diversification of the pottery industry indicating that potters specialized according to vessel type and manufacturing technique (1974: 90).

## Potters' Marks

Another source of information concerning the organization of the pottery industry is the mark incised into the wet clay on the shoulders or bodies of jars prior to firing. Fourteen pre-fire potters' marks of Early Bronze Age date were found in the combined 1984 and 1987 assemblages at Tall al-'Umayrī. Most are incomplete, but they appear to be pictorial in contrast to the 23 simple linear marks found on the Iron Age jars (London 1992: FIGS. 21.8 and 10).

Among the Early Bronze Age marks, a tree motif incised on a red slipped jar is one of the more complete potters' marks in the assemblage. Some of the fragmentary linear marks might belong to the same or similar pattern. Animals are possibly represented below the rim of one holemouth jar. Another holemouth jar has a wavy checkerboard pattern and there are other potters' marks or insignia. A rectangular box divided by seven vertical lines, with fingernail impressions above was incised on the shoulder of a large jar or pithos. Two features characterize all of the Early Bronze Age marks: they are conspicuous and located on the shoulders of large containers. None are found on small pots.

Iron Age potters' marks, like those of the Early

Bronze Age, are found on large containers and are on the rim as well as the shoulder or upper body where they are immediately evident and visible. In contrast, post-firing marks on Iron Age II wares are restricted to the small and medium sized portable closed vessels used to carry liquids. The post-firing marks scratched into the fired clay are thought to represent signs of ownership rather than marks of individual potters and/or producers. No Early Bronze Age post-firing marks were found .

The Iron II pre-firing potters' marks include a variety of designs such as patterns of one, two, and three sets of vertical lines. Two sherds have four horizontal lines. A five-pointed star was found in addition to an incomplete mark resembling an asterisk or star. A "V" shape is incised into a jug handle and a jar. For all of the Iron Age II pre-fire marks, expediency and simplicity prevail. The minimal, yet recognizable distinctions in the marks on large jars suggest that each mark represented a different potter and/or workshop, and possibly more than one generation of a single family of potters. One person might have signed pots with a single incised line while the progeny or siblings used two. Another member of the family, perhaps a third generation, could have used three lines. The pre-firing marks are found on the very large jars whose life span may have exceeded 100 years, thus making it difficult to determine the relationship between the marks and potters. The longevity of the large jars implies that their use could have spanned much of the Iron II period. The similarity of the marks implies that they may have been manufactured or used simultaneously. The purpose of the mark was to differentiate the work of each potter in a subtle, yet recognizable manner.

Additional evidence of the work of individual potters might be encoded in the precise rendering of the rim and overall vessel proportions, but to test this requires reconstructible or complete jars. Nevertheless, jar rims with one incision resemble each other more than the other marked rims. The two rims with three strokes also resemble each other more than any of the other rims shapes. The similarity and distribution of the marks imply proximity, perhaps temporal (such as three contemporaneous workshops) or social proximity (such as several generations of potters in one family). There is nothing to suggest that the pre-fire marks signify the contents or the capacity of the containers. The different marks found on vessels of more or less the same size and shape suggest that the pre-firing marks do not refer to size or contents. If the marks designated vessel size, jars of a given size should all have the identical marks.

## Organization of the Bronze and Iron Age Pottery Industries

For the present, the data available from the petrographic analysis and study of the manufacturing techniques suggest that the Early Bronze Age ceramic industry involved potters who specialized in vessels according to size and shape. The largest jars, or pithoi, could have been the work of craft specialists who worked with a clay to which they added grog tempering material. In addition to the craft specialists who produced the large jars, other potters, either domestic potters or craft specialists, made the wares used daily in each household. The abundance of potters' marks on the holemouth jars suggests they were manufactured by domestic potters, each of whom identified her wares with a mark. The emerging picture is a ceramics industry consisting of domestic potters, who made pots for their own families, as well as specialists who produced for the general public.

Based on the petrographic analysis and a preliminary assessment of the methods of fabrication, the Iron Age pottery industry appears to have been divided into at least four sets of potters who produced: (1) the full range of open and closed forms, large and small, plain or burnished; (2) cooking pots; (3) hand built oversize containers; and (4) the highly burnished "Ammonite" ware. All were craft specialists, but each used different clays, tempering materials, and manufacturing techniques, including the coiling process.

In the areas thus far excavated at Tall al-'Umayrī there is no evidence of pottery manufacture at the site for any period. There are no wasters, tools, few imperfect sherds or pots, clay deposits, or other raw material. Nevertheless, a local clay industry either involving clay pots or possibly sacred artifacts alone is suggested by the presence of moulds for figurines and a shrine (Franken and Abujaber 1989: FIG. C.5, C.6), as well as a lion head mould (Geraty *et al.* fc.). If figurines used for religious purposes were the only ceramic items made at the site, perhaps Tall al-'Umayrī served as a sacred site with a small industry devoted to the production of religious artifacts, such as figurines and incense stands or shrines. If clay moulds were made and fired at the site, pottery could have been made as well unless the *tall* in antiquity had a sacred function. One of the most important raw materials needed to make pottery is water, and the spring could supply it. Although the remains of ceramic production are minimal, pottery production may have been carried out in individual courtyards. This is especially pertinent for the Early Bronze Age. Domestic potters who work seasonally, during the dry summer months, leave sparse evidence of the craft during the winter period when the same space is used for other purposes (London 1989).

In assessing the petrographic study and the manufacturing traditions, the reconstruction of the organization of the ceramics industry relies on ethnographic and ethnoarchaeological studies of traditional potters which demonstrate that individual potters do not normally use

two types of clay. Individual potters tend to work with one clay mixture. If one clay is used to create all types of pots, including cooking ware and decorated pieces, then all shapes can be made in one workshop or household. Differences in clays, however, represent different groups of potters and or workshops.

## Conclusions

Pottery is important for the chronological ordering of the deposits in which it is found, but it also represents the remains of an important industry. For the middle and late third millennium BC variations in the clay bodies, manufacturing techniques, surface treatment, and the marks incised prior to firing suggest a multi-facetted ceramics industry, with both domestic potters as well as craft specialists, but not very different from the seventh-sixth century industry. Since the Iron II pottery shows less variation in the clay bodies than the third millennium BC wares based on the preliminary petrographic analysis, craft specialists dominated an industry which was not necessarily an urban craft, but may have been centered in rural areas where the raw materials were available.

The evidence of the potters' marks, combined with the differences in the clay bodies and the manufacturing techniques, provide information about the people who made and used the pots. In antiquity the marks incised in the wet clay conveyed a different meaning to different members of the society. Cultural information within any community is always divided among its members. There is a division of labor in who knows what. The people who made the pottery found at Tall al-'Umayrī could probably identify and recognize the potter responsible for each mark. Archaeologists who find the marks can use them, in combination with other information, to learn about the organization of the industry and the society in which it functioned.

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# Iron Age II Pithoi from Tall Jāwa, Jordan: Construction Techniques and Typology

In his revolutionary classification of ancient pottery on the basis of its construction techniques, Franken (1982: 141) has opened a window that reveals new approaches to pottery analysis. In his typology, Franken analyzed and attempted to reproduce the manufacturing techniques employed by ancient potters in order to discern their intentions. For Franken, this intention "constitutes the basic criterion of a ceramic typology" (Frendo 1988: 109).

Franken first employed a technological approach in his analysis of the Iron Age I pottery from Dayr 'Allā (1969) where he used the word "type" to mean a specific ceramic vessel shape along with its distinctive construction techniques. For example, Franken distinguished three types of cooking pots on the basis of their "technical characteristics" which included the formation process for the pot as a whole, as well as the techniques used to fold the rim. As far as Franken could tell, all cooking pot bases were made in a mould although some may have been coil built (1969: 129). The shallow open-mouth cooking pots were classified on the basis of rim formation techniques; in Type 1 the rim was folded twice, while in Type 2 the rim was folded once. Type 3 includes round bodied vessels with a variety of rim forms and those with a handle.

In later reflection on his classification system, Franken revised his judgment on what constituted a type and reserved that word to refer to a specific technical formula for the production of various classes of ceramic wares (1982: 142). According to Frendo, such a formula serves as a taxonomic principle (1988: 115). In this system, a wide variety of ceramic vessels serving different functions would fall into the same type if they showed evidence of similar construction techniques. Thus one type might consist of all bowls and jars, whether large or small (Franken 1982: 142). In fact, Franken consolidates all Iron Age I vessels from Dayr 'Allā into four types (1982: 142). These four construction types within one corpus constitute a pottery tradition that can be compared to traditions from other sites and regions.

Within each type, the archaeologist can identify various classes of ceramic vessels depending on the research areas under investigation. Frendo suggests a two-fold classification of analytical categories. The first category involves direct study of the vessels for their physical, technological and stylistic aspects. The second category consists of an indirect analysis of pottery for its anthropological,[1] historical or chronological value (1988: 114).

Following Franken, McGovern organized his corpus of Late Bronze and Early Iron Age pottery from the Baq'ah Valley and Khirbat Umm ad-Danānīr into a stylistic typology supported by a study of the formation processes and physical characteristics of the wares themselves. In his analysis, McGovern has not only identified parallels with the Dayr 'Allā pottery making tradition but has also pointed out unique elements in the Baq'ah Valley corpus (1986: 65, 164).

While a typology based on ceramic formation techniques, comparable to either that of Franken or of McGovern, is not yet possible for the ceramic corpus from Tall Jāwa, and will not be for many years, a preliminary study of the construction techniques employed in the production of Iron Age[2] pithoi is a suitable starting point. This vessel form was chosen for analysis because it constituted the dominant type of large storage jar in use during the last phase of occupation (FPs 5-4) in Field A where these vessels formed part of a food preparation and storage assemblage of artifacts all in use in a single room (Field A13, L. 12,21). The pithoi were found smashed, apparently *in situ*, during the first season of excavations in 1989.[3]

[1] The intended function of a ceramic vessel may also impact on the construction techniques selected by the potter. For a study of the uses of pottery, see Ellison 1984; Henrickson and McDonald 1983; and Rice 1987.

[2] A study of selected pottery from secure loci in Field A suggests that the chronological range falls in the century from 850-750 BC. See Daviau 1991.

[3] The excavations at Tall Jāwa, 10 km south of 'Ammān, were initiated as a sounding of the Madaba Plains Project Hinterland excavation team under the direction of Randall W. Younker. P. M. Michèle Daviau served as Field Director and opened one area, Field A, consisting of five 6 m squares. The excavations recovered evidence for occupation during the Middle Bronze, Iron I, Iron II and Umayyad periods.

## Large Jars and Pithoi

For this study, we have analyzed five restored vessels and six partially restored pithoi[4] (TABLE 1). These jars were of plain, undecorated ware with almost-cylindrical bodies that tapered down to a rounded base. Two styles of rim form were employed; Type 1 had thickened inverted rims while Type 2 had thickened upright rims that sprang directly from the shoulder. A double groove marked the base of the rim and a double "string line" marked the shoulder at the level of the handles (FIGS. 1, 2).

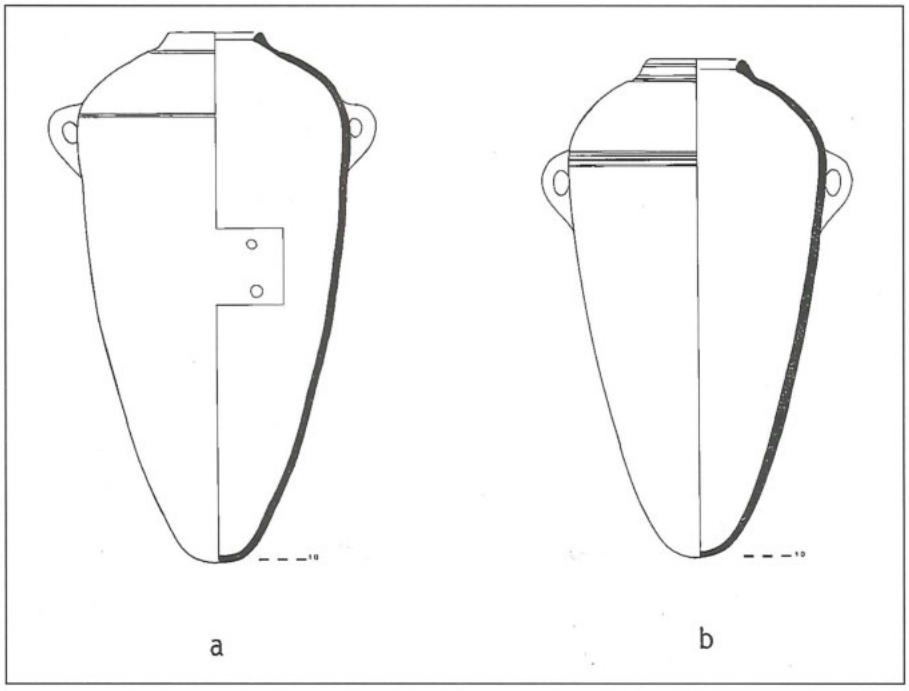
**Table 1.** Field Phase 5 pithoi: Registration numbers and sizes.

| Pithos | Reg. No | Total Height | Shoulder Diameter | Rim Diameter |
|---|---|---|---|---|
| 1 | A13.53.5 | 1.07 m | 0.52 m | 0.140 m |
| 2 | A13.39.2 | 1.11 | 0.53 | 0.160 |
| 3 | A13.29.1 | 1.01 | 0.50 | 0.155 |
| 4 | A13.29.3 | 1.07 | 0.56 | 0.155 |
| 5 | A13.29.2 | ? | 0.51 | 0.150 |
| 6 | A13.58.1 | ? | ? | 0.160 |
| 7 | A13.30.1 | ? | ? | 0.150 |
| 8 | A13.58.3 | ? | ? | 0.140 |
| 9 | unreg/partial body and base | | | |
| 10 | unreg/base | | | |
| 11 | A13.23.5 | | | 0.180 |

The pithoi that have been reconstructed from rim to base average c. 1.06 m tall, with a diameter of c. 50 cm at the shoulder, and a diameter of c. 15 cm at the rim. Comparable pithos rims are numerous at Tall al-'Umayrī from late Iron Age II phases (Geraty *et al.* 1989: FIGS. 19.4:1; 19.12:9,11,12; Geraty *et al.* 1992: FIGS. 3.19:1,2; 3.29:1; 8.12:2,3; 8.13:1,2,3; 8.13:4,5,6) although the rim styles show some modification probably due to minor changes over time. Few close parallels in form and style from other Iron Age II sites are published to date.

Of the vessels illustrated by Franken, only two large jars (75-85 cm tall) from Phase A at Dayr 'Allā (Franken 1969: FIG. 47:1) come close in size to the Tall Jāwa pithoi. These were both collared-rim store jars from the early Iron Age I. Comparable collared-rim jars from Saḥāb are even closer in size to the Tall Jāwa pithoi measuring 1.2 m tall (Ibrahim 1978: FIG. 1).

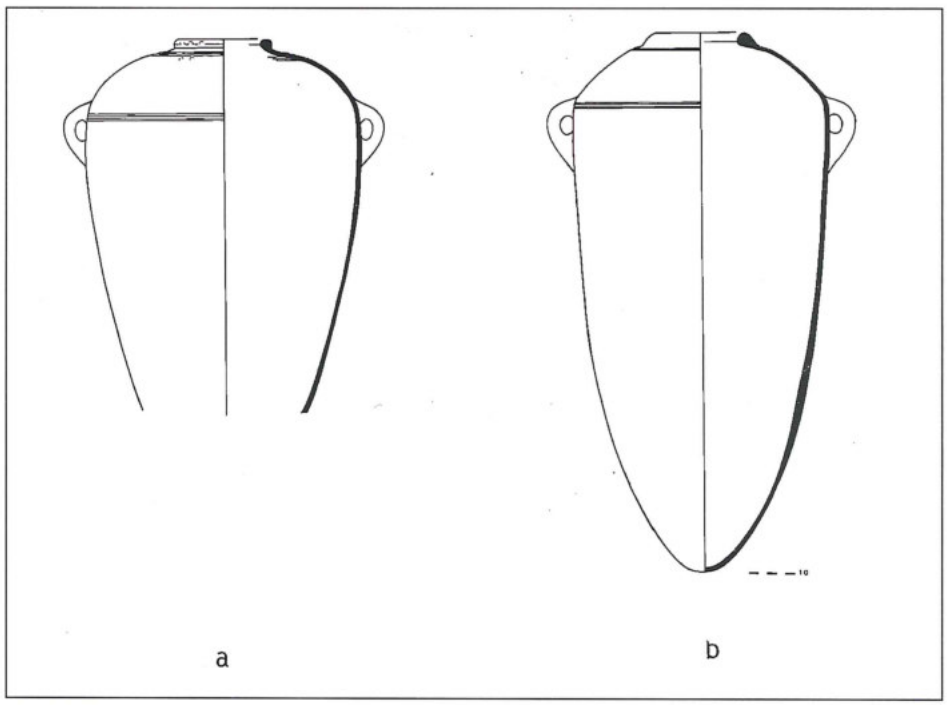
Kalsbeek did not discuss the construction techniques employed in the formation of such large vessels. Instead, he described the formation of a store jar that did not exceed 60-65 cm in height (Franken 1969: 161-262; FIG. 42). These vessels were ridged-neck jars with a broad, almost flat base that date to the late Iron Age I (1969 FIG. 62:30; and jugs[5] 60:34; 76:2). In body shape, they are very similar to a group of ridged-neck store jars from Tall Jāwa that measure c. 50-55 cm (A14.58.4;




1. Reconstructed pithoi from Field A: a. Pithos 1 (A13.53.5); b. Pithos 3 (A 13.29.1).

[4] The pithoi from Tall Jāwa were reconstructed by students employed under the Ontario Work Study Program. The students involved were Margaret Judd, Doriann Mclean, Brenda Silver, and Shawn Standfast. For this study, Laurie Cowell, a professional potter from Waterloo, ON, Canada served as consultant. This research was funded in part by an Initiatory Grant from Wilfrid Laurier University. The author's participation in the Fifth International Conference on the History and Archaeology of Jordan was generously supported by travel grant from Wilfrid Laurier University.

[5] Franken has identified both of these vessels (1969: FIGS. 60:34, 76:2) as jugs although he shows them with two handles, comparable in fact to Jar F 453 (1969: FIG. 62:30).




2. Reconstructed pithoi from Field A, showing two styles of rim, a. upright = Pithos 4 (A13.39.3); b. inverted = Pithos 2 (A13.39.2).

A14.59.1).[6] While much that Franken and Kalsbeek have said concerning the methods employed in the construction of coil-built store jars is useful for our study of the Tall Jāwa pithoi, the evidence from the pithoi themselves reflects a complex series of formation techniques somewhat different from those in use at Dayr 'Allā.

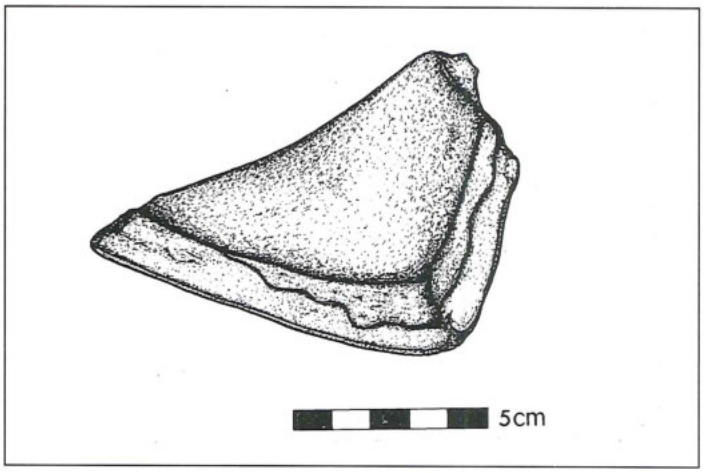
**Construction Details**

The initial stage of analysis of the Tall Jāwa pithoi consisted of visual observations made under magnification along with modern reproduction of certain vessel features observed during analysis.[7] The finished Iron Age pithoi reflect a complex forming process that included at least three distinct techniques, one for each of the major parts of the vessel: the base, the body, and shoulder to rim.

The evidence for the formation techniques that the Tall Jāwa potters used in the manufacture of pithoi can be pieced together from the total corpus of vessels under consideration. At the same time, this evidence is not univocal because the final finishing on the part of the ancient potter has obscured many aspects of those techniques or made the evidence ambiguous (Rice 1987: 124).

*The Base*

Beginning with the base, the potter may have used a disk or slab of clay that he smoothed into a shallow concave mould. In some cases the base was not sufficiently thick, so the potter added a second slab or smear of clay, visible in section in Pithoi 1, 9 and 10 (FIG. 3). The potter then turned the base on a wheel while smoothing and compressing the clay slabs together. While we may assume like Franken (1969: 89) that the Iron Age pottery was formed on a slow wheel turned by hand, the spiral marks in the base of Pithos 4 produced a central thickening that occurs only when a vessel is turned on a




3. Sherd with interior smear to thicken the base (Pithos 9, A13 unregistered).

[6] Although excavated from an adjoining room in 1991, these jars were part of the same FP-5-4 complex as the pithoi.

[7] Experimental reproduction of formation processes were carried out by Laurie Cowell at the Near Eastern Archaeology Laboratory at Wilfrid Laurier University. Attempts to arrange for xeroradiography of selected sherds to test the validity of our analysis presented in this paper are currently under way.

wheel, thus confirming our assumption (Pithoi 1, 9 and 10).[8]

Two techniques for finishing the interior of the base are evident. In Pithos 8, the potter finished the base with his thumb while turning the wheel slowly. These marks are very irregular and end where the first coil was joined to the base. From this point on in Pithos 8, the potter used a tool to make a very smooth interior surface. The second technique is apparent in Pithos 10 where the potter used a tool to smooth the centre of the base and continued smoothing the lower coils all in one operation. For this to be successful, the potter would have needed an assistant to turn his wheel.

Several bases (Pithoi 8, 9, 10) are the same size and have a small irregularity on the exterior surface below the point where the lowest coil was attached. At the same time, this irregularity does not seem to result from the final finishing on the outside of the lower body of the vessel. Such a pattern may be evidence for the use of the same mould to construct several pithoi.

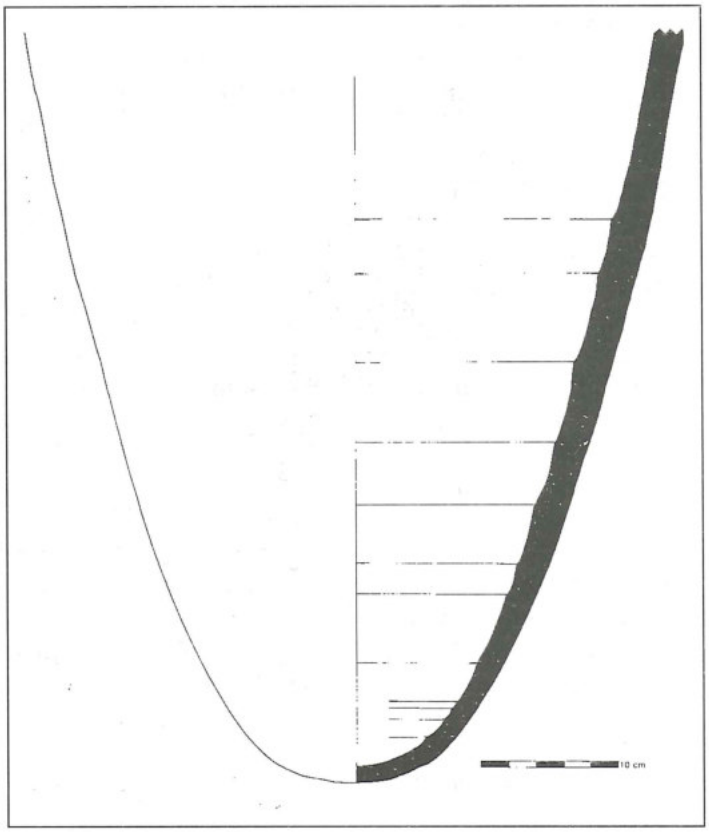
The addition of the first coil is usually perceptible on the interior immediately above the base (Pithoi 2 and 8) as Franken also observed for the Dayr 'Allā store jars (1969: 161). At Tall Jāwa, the potter worked the clay together and smoothed the upper edge of the base to the lowest coil on the interior with a finishing tool.

We have no evidence so far that could be used to support a different interpretation of the treatment of the base, for example the addition of a slab of clay to plug the base after the body had been formed or the use of the lowest coil to close the base once the vessel was removed from the wheel. Both of these suggestions assume that the vessel was inverted at some point in the formation process as illustrated by Kalsbeek for medium sized store jars (c. 60-70 cm; Franken 1969: FIG. 42). In the case of the Tall Jāwa pithoi, the potter most likely produced the finishing marks on the interior of the base and on the lowest coils while this section of the vessel was easily accessible. Secondly, because of the size and weight of the pithoi, it seems unlikely that the vessels were inverted at any time during their construction. As the pot grew, the potter supported the vessel in its mould with extra clay and did not trim the exterior face of the lowest coils above the base until the vessel was complete. While this may have helped to support the pithos and keep it centred on the wheel, the extra clay added significantly to the weight of the pot and necessitated the help of an assistant to turn the wheel as needed.

*The Body*

The body was built up of coils of clay attached to the preformed base and thinned to the desired thickness. These coils began just above the base and continued up to the shoulder line. The potter probably added coils in several stages so that a given number of coils could be finished on the interior before the vessel became too deep. The number of coils used cannot now be determined either by observation of the surface or in section because the steps in the process of joining the coils and finishing the pot have erased the evidence of the earlier stages of construction (Rice 1987: 124-125). One fracture that may have formed during firing is visible near the base of Pithos 4 indicating the join of two coils. However, this is a unique occurrence because the ancient potters worked the coils together so well that the sherds from these smashed vessels form vertical and diagonal lines when reconstructed and do not follow the horizontal divisions of the coils.

Soft ridges on the interior body of Pithos 3 show clearly that a large rib was used to smooth the coils and compact the clay (FIG. 4). The greatest extent between two ridges is 3.5-4.0 cm suggesting the use of a tool that was somewhat longer, comparing favourably with those illustrated by Dornemann (1983 FIGS. 85:3A; 86: 1, 2) which measure 8.5-10.0 cm and have a straight rubbing edge of 5.0-6.5 cm depending on the amount of curvature of the rib. These tools are similar to modern pot-




4. Thick-walled pithos with deep tool marks (A13.29.1).

[8] The finger marks on the interior of the base of Pithos 8 are less regular and sugges a slowly turned wheel.

ters tools where a rib of 10 cm is not unusual. The fact that these ridges are visible in Pithos 3, the vessel with the thickest walls (c. 2.5 cm), may be explained by supposing that the potter used greater pressure against the wall of the pithos because the original joining of the coils was irregular and somewhat crude. Secondly, the potter who made this vessel may have been less experienced than his fellow potters and had not thinned the coils sufficiently. Another variable may have been the speed at which the assistant turned the wheel.

The interior of the remaining pithoi also indicate the use of a tool or cloth to smooth the coils, although in these cases the potters were able to eliminate the ridges marking the extent of the tool's surface. This was done by using less pressure than was necessary to shape the body of Pithos 3. Thus the interior of Pithoi 1, 2, 4 and 5 do not have ridges but fine spiraling rill marks that produced a very smooth finish. At the same time, these vessels were thin-walled (c. 1.5 cm) in comparison to Pithos 3.

The first series of coils had to become leather-hard before the potter applied additional coils. For large jars the drying period may have been as much as one day[9] although in the climate of the Jordanian plateau this may have only taken a few hours.[10] The point at which the second series of coils was added or the point at which the potter began a second stage of interior smoothing, is recognizable in certain vessels, for example in Pithos 3 there was an interruption in the spirals c. 30 cm above the base. This suggests that the body of the pithos, from base to shoulder, was probably built in two sections, each about 30-35 cm high.

The coils of the upper part of the body were thinned and smoothed on both the interior and exterior surfaces. The type of tool used to finish the exterior is not apparent from the appearance of the surface although the same kind of rib used on the interior of the vessel or a cloth may have been employed. The care in joining the coils to one another is especially apparent in the shoulder area.

*Shoulder and Rim*

The shoulder and rim appear to have been formed while the pithos was being turned quickly on the wheel by an assistant. The rill marks (Rice 1987: 129) of the potter's fingers are quite clear on the inner surface of the largest vessels (Pithos 4). Those that are somewhat smaller (Pithos 8, and even Pithos 1) show signs of a fast turning wheel. No finger marks appear on the outer surface indicating that the potter smoothed the shoulder area with a tool or a rag. The possibility that the shoulder and rim section was made separate from the lower body cannot be seriously considered because of the smooth continuation of the vessel wall from the body into the shoulder area. Here too, the size of individual coils cannot be determined although it seems certain that the entire vessel was coil-built.

The clay of the uppermost coil was then pulled to form a folded rim which can be seen in section. These rims were quite heavy for the width of the vessel wall at the shoulder. In one instance (Pithos 1), the weight of the rim caused the shoulder to warp.[11] Decoration consisted of a double ridge at the base of the rim and a double "string line"at the join of the body to the shoulder. This line marked the horizontal at a point where there was a change of direction. In order for these lines to be horizontal, the potter had to etch them with a tool while the jar was revolving on the wheel. The lines do not seem to reflect the use of string on the vessel for support or decoration as Franken suggests (1969: 162).

The top of the handles were attached to the body at the shoulder and covered the horizontal lines. The shafts of the handles were then pulled from that point and attached lower down on the body. As Franken observed in his corpus, the upper part of the handle was usually broader than the lower end where it was pressed onto the wall of the jar (1969: 170-171). For greater strength, a small coil of clay was added around the base of the handle (TJ A13.unreg. handle; see London 1990: FIG. 52).

*Finishing*

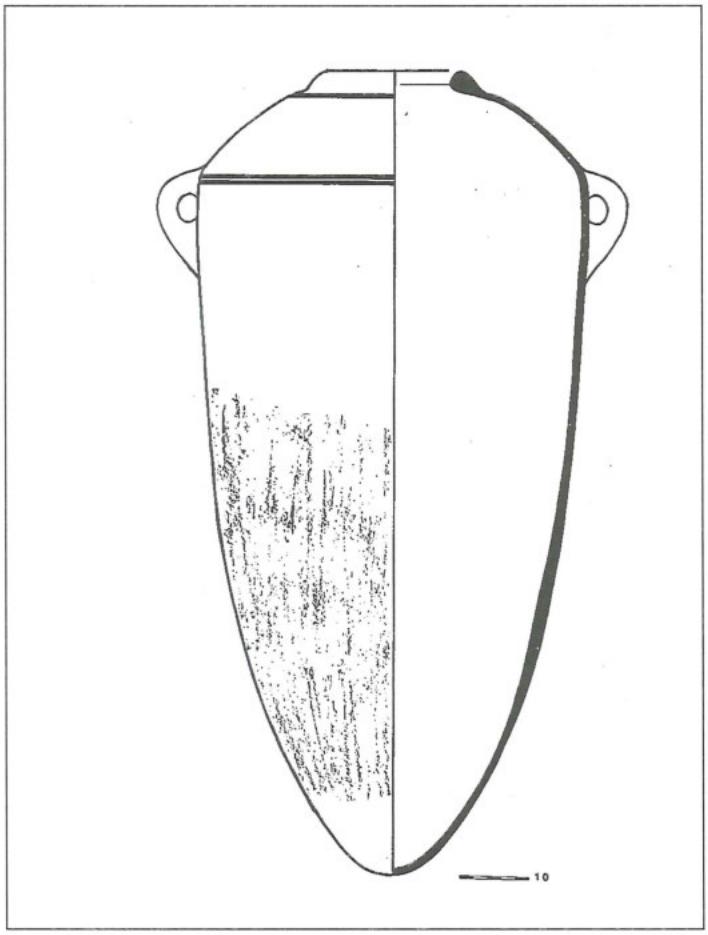
After the handles were added and the vessel was complete, it was allowed to dry to the leather-hard stage. It was probably at this point in the process that the pithos was turned upside down and rested on its shoulders. Then the excess clay was trimmed from the outer side of the coils. During the trimming process, the potter no longer could judge the thickness of the walls of the jar with the result that their thickness was very uneven. In some cases the walls were almost paper thin (especially Pithos 4). Vertical tool marks remaining on the area that was trimmed can be clearly seen extending from the middle of the body, c. 20 cm below the handles, to just above the base for a total of 40-50 cm (FIG. 5).

Another feature of these pithoi are the holes punched or cut into the side of the body. This phenomenon is observed in at least three of the jars (Pithoi 1, 4, 5). All

9 For a discussion of the techniques employed by Spanish potters who manufacture extra large storage vessels that reach almost 4 m in height, see below.

10 During the summer of 1991, Nazmieh Rida Tawfiq Darwish constructed a clay oven *(ṭābūn)* in 'Ammān. The oven was coil built and required approximately one hour to dry before an additional coil could be applied. This is evidence of the hot, dry climate on the Transjordanian plateau that lies at an elevation of c. 928 m above sea level. To my knowledge, no consideration has been given to the difference in climatic conditions between the Jordan Valley and the plateau region in evaluating the time needed for ceramic vessels to dry before burnishing or firing.

11 The shoulder of the pithos was probably formed while the clay was quite wet and supple. With the addition of the thickened rim the shoulder would be under stress and might slump inward as was the case for Pithos 1.




5. Pithos 2 with trimmed side walls (A13.39.2).

holes were formed from the outside to the inside where a compound fracture is apparent. In Pithos 1 there are two holes 8 cm apart and c. 25 cm below the shoulder. They were positioned on one side of the vessel, slightly off centre between the handles. In Pithos 4 the holes were 33 cm below the shoulder and in Pithos 5 the holes were very close to the base at 60 cm below the shoulder. The function of this feature is uncertain although it was clearly related to the function of the vessels themselves (Henrickson and McDonald 1983: 631-636; Rice 1987: 224-225). The ancient potters certainly made these large jars to contain liquid rather than dry ingredients. The size of the mouth opening is so small and the vessels are so deep that it would have been almost impossible to scoop out dry foods such as chick peas, lentils or grain from such containers. On the other hand, the pithoi may have contained a liquid such as wine that formed a sediment below the level of the holes.

*Potter's Marks*

One complete vessel (Pithos 4) and two partial rim and shoulder sections have potter's or owner's marks. The only complete mark, formed before firing, consists of five reed impressions, three on the rim and two on the shoulder (Pithos 4; see also Rice 1987: FIG. 5.15). A second impression, also before firing, is only partially preserved on a large sherd forming the rim and shoulder of a pithos (A13.23.5, Pithos 11). The mark consists of a single reed impression with a tail extending down and to the right. At this point the sherd is broken. The third mark was incised after the jar was fired. It consists of three parallel vertical lines resting on a single horizontal line (Pithos 6; FIG. 6).

**Ethnographic Parallels**

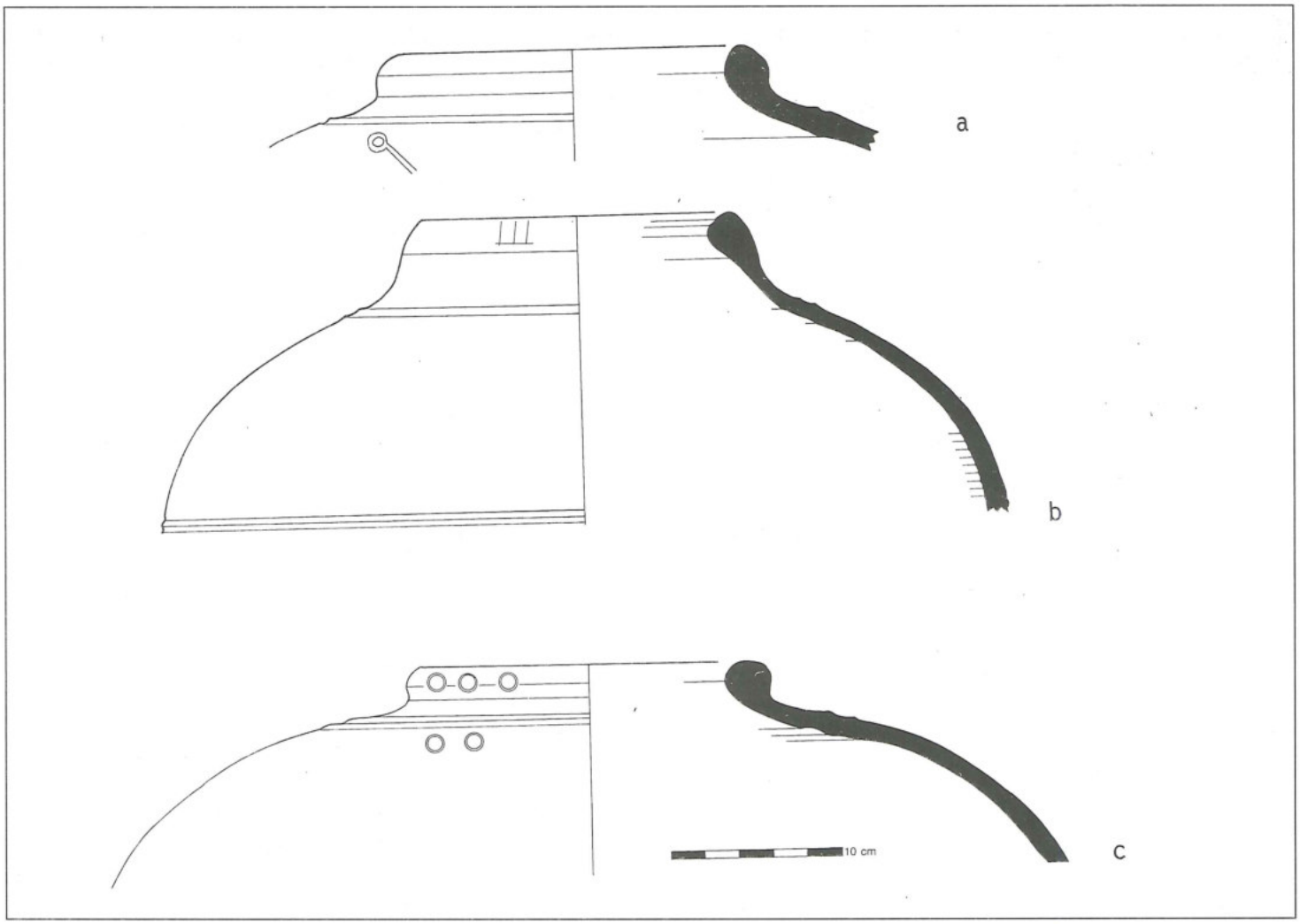
Several aspects of the construction of the Tall Jāwa pithoi appear to be problematic in that they do not follow the techniques suggested by Franken and Kalsbeek. In order to support our interpretation of the evidence from the vessels themselves, a survey of parallels from traditional potters has been assembled from ethnographic literature.

Four sources that deal with the construction of pithoi or large jars come from Spain (Cabasa 1990), Crete (Flodin-Moreno 1980),[12] Cyprus (London 1990), and Pakistan (Rye and Evans 1976).

The production of *pitharia* on Crete and in Cyprus are attempts to reproduce forms that have a long tradition in these respective islands. Models from the archaeological record dating to the Middle and Late Bronze Ages have been preserved at Knossos, where they functioned as storage containers for water, oil or wine (Flodin-Moreno 1980: 51). The modern production of comparable containers involves the use of a hand turned wheel to "throw" these coil-built vessels. Each vessel has a flat base formed from a thick slab of clay. Coils are added to the base and the join between coils is marked by a string to indicate the juncture where later decoration will be located. The lower body is cylindrical and then flares out until it reaches the maximum body diameter. These *pitharia* are wide-mouth vessels with a horizontal thickened rim.

Several of the construction techniques employed in forming the Cretan *pitharia* seem to parallel those we suggest were used in the production of the Tall Jāwa pithoi. First, the *pitharia* were formed on a wheel that was turned continuously during construction. Secondly, the thick coils were added, one at a time, and left to set up before another was added. At no time during the formation process was the vessel inverted. Only at the time of stacking in the kiln were some vessels positioned upside down over others that remained right side up. And thirdly, the string marks appear to be locators for decoration rather than functionally important.

[12] An earlier example of modern potters producing vessels similar to those made on Crete in antiquity was observed by Xanthoudides, cited in Wood (1990: 37).




6. Potter's marks on rims; a. Pithos 11 (A13.23.5), b. Pithos 6 (A13.58.1), c. Pithos 4 (A13.29.3).

Details of construction and finishing reported for the *tinajas* made in Spain add to our understanding of the work involved in making large jars. These coil-built vessels are formed on a clay or wooden bat beginning with the base which is made from a long coil (5'=1.5 m long) that is draped over the shoulder of the potter while he works. The lower body is then shaped in the form of a cylinder and left to dry before additional coils are added (Cabasa 1990: 47). When sufficiently dry, the vessel is scraped with the fingers and with a metal scraper to compress and finish the lower body. Then another coil is added, the body expanded, and the process repeated. When the vessels become taller than 1.5 m, a scaffold is built so that the potter can continue to enlarge the vessel. The largest vessels of this type reached c. 4 m tall, with a capacity of 8000 litres, and required 2 tonnes of clay (Cabasa 1990: 47). For the most part, the potter was required to walk around the *tinaja* while applying a coil of clay, although in some cases the lower body was formed on a hand wheel (Cabasa 1990: 48).

Here we have another case where a vessel is completely formed in an upright position and is finished in stages as the jar gets taller. There is no suggestion that the Spanish potters used string, rags or rope around the body for support as was depicted by London in her study of Cypriot potters who produced much smaller vessels (1990: FIGS. 50-57, 71).[13] This technique appears to be the continuation of a traditional practice rather than a technical necessity. For this reason, and because no evidence for such treatment is preserved on the Tall Jāwa pithoi, we suggested that the so-called "string marks" were decoration applied by the potter using a tool while each vessel was turned on the wheel.

The largest vessel that London documented on Cy-

[13] What the precise purpose was of the string or rags around the lower part of these vessels remains unclear. The vessels appear to be only 25-30 cm tall and do not really need support for the clay unless it is very thin. Even so, the pressure of the string would either cut the clay or cause it to collapse inward. It is almost unimaginable that hand built jars or jugs would be likely to warp or collapse or that the string would prevent this if, in fact, the clay slumped.

prus was a coil-built flower pot that was formed in an upright position on a flat surface. In this case, like the *pitharia*, the potter had to walk around the vessel when adding new coils. A cane hoop was used to measure the greatest diameter and maintain symmetry (London 1990: FIG. 31). Only after the vessel was complete and partially dry was it inverted and the base scraped and trimmed of excess clay (London 1990: 62).

Another large vessel in the repertoire of the Cypriot potters was a clay oven in the shape of a large jar with a wide mouth. This vessel was built in a similar fashion to the flower pot. London judged that it was too heavy to be built on a turn table and that the potter walked around the oven when adding new coils. When this vessel is compared with the Cretan *pitharia* that were formed in their entirety on the wheel (Flodin-Moreno 1980: FIG. 8), weight does not seem to be a real issue. It is possible that the Cypriot potters used an entirely different type of potter's wheel that could not support a large vessel, although this cannot be determined from the published illustrations.

In very few instances do ethnographers document the actual appearance of the vessel's interior or the types of smoothing tools used for its finishing. Did potters use their fingers to compact and smooth the base? What is the appearance of the join between the base and the first coil? Is there any evidence for the use of a mould and what does that evidence look like?

The only ethnographic study known to this writer which describes the formation of large jars (c. 1 m tall) in a mould is the "Ethnotechnology of South Asia Research Program" in Pakistan reported by Rye and Evans. Water jars made in Musazi, a village 11 km southeast of Peshawar, were coil-built with the base being formed in a mould. The mould was concave and positioned on the wheel head before any clay was added. Then the potter formed a flat disk of clay and laid it in the mould. He then smoothed the clay into the mould and added the lowest coil, throwing it to form the wall of the jar (1976: 33, FIG. 24).

No time for drying was left before the next coil was added.[14] The formation process was the result of throwing the jar on the wheel and did not incorporate the use of a paddle or anvil to beat out the shape of the jar as with smaller vessels, except on the upper part of the jar after it became leather-hard. Clearly, the base was finished as soon as it was placed in the mould because the addition of coils and the throwing of the walls of the jar made further smoothing of the interior impossible. In fact, the jar was left in the mould until it was completely polished and decorated. Only at this point is the vessel removed from the mould and inverted to continue drying. When the jar is sufficiently dry, the potter scraped the base to remove the excess clay at the join of the base and the lowest coil (Rye and Evans 1976: 33-34).

This study answers several of our questions while suggesting others. It is now clear that a jar of approximately 1 m in height can be formed on a wheel in a base mould. At the same time, the jars made at Musazi were cylindrical, facilitating the use of a dish-shaped mould. By comparison, the Tall Jāwa pithoi have a tapered base making it more difficult for the potter to centre the mould on the wheel head and keep it balanced. However, the body of these Iron Age pithoi are strikingly cylindrical, suggesting that the lower part of the body was supported on the wheel by the addition of clay that was later scraped away. This was only done when the pithos was finished and sufficiently dry to be inverted and rest on its rim or shoulder. Because of the final finishing of the pithoi, some aspects of the formation process must remain unknown. However, the potters of Pakistan provide an image of what may have been possible at Tall Jāwa in the Iron Age.

## Conclusions

The Tall Jāwa pithoi were coil-built vessels constructed on a wheel in an upright position. Finger marks inside the shoulder suggest that during the formation process the vessel was "thrown." At least by the ninth century BC in the Madaba Plains region, coil-built vessels turned on a wheel are contemporary with red slipped vessels and wheel burnished bowls (see note 2). This use of the wheel corresponds to Franken's research at Jordan Valley sites which suggests that the wheel was reintroduced during Iron Age II after a lapse in its use during Iron Age I (1969: 92). Subsequent study by McGovern confirms the use of a true potter's wheel for Late Bronze Age I (1986: 173) and suggests formation processes comparable to those used at Dayr 'Allā for both the Late Bronze and Iron Age I. However, large store jars comparable to those from Tall Jāwa were not present in McGovern's corpus and the collared-rimmed jars from both Saḥāb and Tall al-'Umāyrī have not yet been studied and will probably reflect the Iron Age I traditions[15] rather than the techniques that developed during Iron Age II. Therefore the evidence from the Tall Jāwa pithoi may provide our first glimpse of these developments.

The complex construction techniques employed in the formation of the pithoi from Tall Jāwa may be seen to constitute a pot making tradition of the Ammonite plateau during the ninth-eighth centuries BC. Evidence for the use of these techniques at other sites or of alternate

[14] See note 10 above.

[15] To the best of this writer's knowledge, the technical characteristics of these jars have not yet been studied.

techniques will enable archaeologists to determine the spatial diffusion of the Tall Jāwa tradition on the Transjordanian plateau (Wood 1990: 58). Such comparison will supplement other types of ceramic analysis that study the physical properties of the clay and its sources,[16] the distribution of ceramic styles, as well as functional and typological analysis.

I would like to dedicate this paper to the memory of Prof. Albert E. Glock whose interest in ceramic technology and ethnographic observation should not be forgotten.

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[16] To date, no comparison of the chemical profile of clay samples and local ceramics has been undertaken for the Madaba Plains area comparable to that for Jordan Valley sites, such as Tall al-Ḥayyāt (Falconer 1987: 251-259), and for the Baq'ah Valley region (McGovern 1986: 178-193). A preliminary analysis of the petrographic characteristics of the pottery sherds from the Madaba Plains Project area (London *et al.* 1991) included cooking pots from Iron Age II loci.

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# The Late Iron II-Persian Ceramic Horizon at Tall al-'Umayrī

Before the excavations at Tall Ḥisbān, the pottery from the late Iron II and Persian periods in central Transjordan was known only from a few isolated tomb deposits. Dates were given to these assemblages in the Iron II period based on rather weak parallels from western Palestine and on one or two inscribed seals.

James Sauer refined the dating with pottery recovered from the first season of excavation at Tall Ḥisbān. In his 1972 study, co-authored with Lugenbeal, he dated the Ḥisbān assemblage to the seventh and sixth centuries, based on general trends in the pottery of Palestine during the late Iron II period. At the same time, he called attention to the unique Transjordanian forms making up the lion's share of the corpus. His dating has been followed by most researchers since.

However, sometime later, Sauer began to suspect that the pottery forms making up the core of the Ḥisbān corpus were not limited to the late Iron II period, but continued later than the sixth century, perhaps even into the fourth century. This suggestion was made in oral lectures and personal communications. But because his ideas were not published, others working in the region could not take the suggestion very seriously.

The vast majority of bowls were ring burnished. Could ware types and forms datable to the seventh century (based on the palaeography of associated inscriptions) continue through most of the Persian period? How could there be so little change through almost three centuries? Where was the Babylonian disruption suggested by Josephus (*Antiquities*, 10.9:7)?

The Ḥisbān material was, moreover, problematic in that almost all of the corpus came from a massive Hellenistic fill in the Iron II reservoir. No sub-phasing could be established. After the Ḥisbān excavations, the same pottery began to appear in large quantities at other sites in a region roughly corresponding to that of the ancient Ammonites. But groups of pottery, such as that from the 'Ammān citadel published in Dornemann's synthesis of 1983, came from limited excavations, or were from one-period deposits, or were from tombs for which the length of use was impossible to discern clearly. They were thus of little help.

Of course, there were hints that this corpus of late Iron II pottery extended slightly longer in time than that of western Palestine. Some of the Aramaic ostraca from Ḥisbān had been dated by Frank Cross on palaeographic grounds to the late sixth century (Cross 1969; 1973). Although we were content to admit that the pottery corpus seemed to continue through most of the sixth century, we were not yet ready to go further (Herr 1989: 311). There was apparently no Babylonian disruption in the Ammonite region, but we could not muster the courage to suggest a longer-lasting corpus.

However, there was no historical reason to explain the disappearance of occupation in Transjordan during the Persian period. We reached for economic explanations, such as stagnation due to the disruption of trade caused by the Babylonian conquest to the west.

Then came our excavations at Tall al-'Umayrī which, in the first season in 1984, included a detailed surface survey of the site. Two cylinder seals turned up in the survey which Edith Porada suggested were best dated to the sixth to fifth centuries (Porada 1989). In the excavations, a closed lamp was found, ordinarily suggesting a Persian date at the earliest. However, the exterior surface was highly burnished, an Iron II feature (Herr 1989: 345, no. 14). Many of the open lamps, moreover, displayed the shallow form more typical of the Persian period than Iron II (e.g. Herr 1989: 345, nos. 15-16). But because the site did not seem to contain any pottery later than that familiar to us from the Ḥisbān corpus (which we maintained belonged to the seventh and sixth centuries), we suggested that perhaps a date in the late sixth century for these items would be acceptable. After all, typical Persian forms were missing, such as mortaria, necked cooking pots, and sausage jars.

In our 1987 excavations at Tall al-'Umayrī in Field A, we had removed the floor in one of the rooms of the top phase of our Ammonite Citadel. In the fill beneath the floor was a sherd from an Attic kylix (Herr 1991: 34, no.

31) best dated to the fifth century (Waldbaum 1991). Another Attic sherd, again dated to the fifth century, was found in Field B (Waldbaum 1991; Herr 1991: 64, no. 30).

It was becoming increasingly difficult to retain an end date of 500 BC for the corpus of pottery associated with these finds. I have thus come to the conclusion that Sauer is probably correct that the late Iron II/Persian corpus of pottery seems to have lasted through most of the Persian period. Regional differences between the assemblages in western and eastern Palestine must explain the absence of "typical" Persian forms in Transjordan.

To illustrate this conclusion let us first look at some of the more typical forms in the corpus of the Ammonite region. Although we have found these forms in at least three separate phases at Tall al-'Umayrī, we have not yet been able to isolate changes in the ceramic forms from phase to phase.

Pithoi are typically large holemouth storage vessels, often with bulbous rims and ridges, and waves or grooves outside the rim (Herr 1991: 191, nos. 1-6).

Typical necked jars have narrow openings, a triangular rim, and an insloping neck (Herr 1991: 191, nos. 9-14; 42, nos. 3-4). Many times, the neck sports three to five grooves (Herr 1991: 191, nos. 9-14). Similar rims with grooved necks are also found atop upright necks (Herr 1991: 191, nos. 7-8).

Jugs can also carry triangular rims (Herr 1991: 191, nos. 24-26 [nos. 24-25 may be a jar]), but more typical is the thickened, crescent-shaped rim (Herr 1991: 191, nos. 27-31).

A type of vessel rare outside our region are basins with flat bases, relatively straight walls, and everted rims (Herr 1991: 209, nos. 18, 20-23).

Holemouth kraters, with curving sidewalls and turned-over, holemouth rims, are ubiquitous (Herr 1991: 191, nos. 37-40)

There are many kinds of bowls distinctive to our corpus. The most prolific vessel at both Ḥisbān and Tall al-'Umayrī is the bowl with off-set rim (Herr 1991: 42, nos. 15-21). Another type has an upright wall with a simple rim and a small ridge below the rim (Herr 1991: 42, nos. 22-23). Extremely frequent are forms with a 90-degree inturned rim (Herr 1991: 28, nos. 15, 17-27) and bowls with rounded, grooved sidewalls and an everted rim (Herr 1991: 215, nos. 16-19) with a few ungrooved variants (Herr 1991: 215, no. 20). Less frequent are shallow bowls with carinated or rounded sidewalls and widened, flat-topped rims (Herr 1991: 31, nos. 1-5, 7).

Cooking pots also come in more than one common form. The normal late Iron II cooking pot with a thickened and ridged rim is very frequent (Herr 1991: 34, nos. 10-12; 219, no. 7), but most distinctive are the forms with bulbous rim, sometimes pointed at the top (Herr 1991: 34, nos. 23-24; 219, nos. 9-12; 205, nos. 23-25).

A type of vessel rare elsewhere, but quite common in our region is the mortar (Herr 1991: 34, no. 28; 219, nos. 3-5). They are usually made to look like basalt mortars with thick, gray ware.

Tripod cups are not frequent, but are distinctive to our region (Herr 1991: 205, nos. 16-17).

The question of the beginning date of this corpus is not clear, but it would seem to have begun by the seventh century, based on a black-burnished bowl of typical "Ammonite" ware and form discovered at Tall Batash in western Palestine (Kelm and Mazar 1985: 110, no.4). I have examined this bowl myself and have confirmed that it is identical to the black-burnished ware we find so frequently in the Ammonite region. A precise parallel to this rim form in black-burnished ware was found at Tall al-'Umayrī in 1984 (Herr 1989: 329, no. 25).

However, more important to this paper is how late the corpus of pottery outlined above goes. I will illustrate several forms found together with this corpus which appear to have Persian parallels, based especially on the work of Stern (1982) and, more recently, the results from Tall al-Ḥiṣī (Bennett and Blakely 1989) and Gezer (Gitin 1990).

Triangular jar rims on a variety of forms are reminiscent of Persian rims (Herr 1989: 321, nos. 9-17, 22-24).

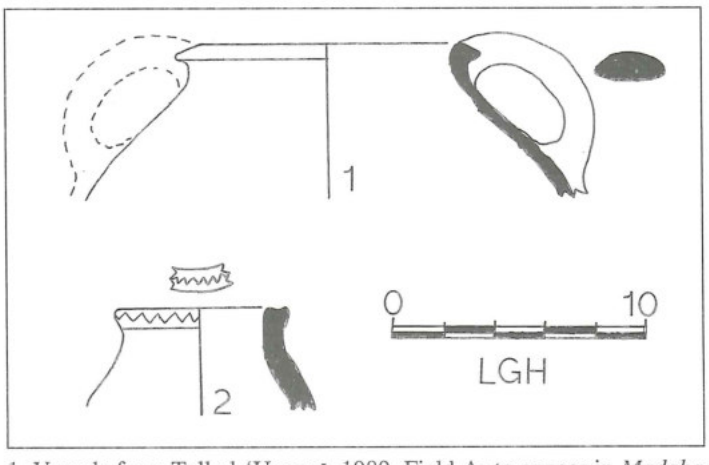
One jug has a triangular rim similar to early Hellenistic forms (Herr 1989: 323, no. 19).

One of our rare necked kraters is also similar to Persian forms (Herr 1989: 325, no. 11).

Some bowl forms also appear more Persian than Iron II (Herr 1991: 42, nos. 24-25; 31, nos. 22-27).

Although Persian necked cooking pots have not yet been found, one form from Tall al-'Umayrī is close (FIG. 1.1).

Chevron decoration also occurs on a few vessels (FIG. 1.2), and lamps are very frequently made in the flat style




1. Vessels from Tall al-'Umayrī, 1989, Field A; to appear in *Madaba Plains Project 3*. 1. Persian cooking pot; 2. Persian juglet.

noted above. We should also again note the two Attic sherds found in 1987.

Much more work needs to be done in the future on this corpus of late Iron II and Persian pottery in the Ammonite region of Transjordan, but it seems to me that many of the forms lasted virtually unchanged through most of the Persian period. This includes Iron II characteristics like wheel burnishing.

Totally absent from the corpus are Persian standbys, such as sausage jars, high-necked cooking pots, and amphoras. Very rare are mortaria and shallow rounded bowls.

In conclusion, not only was there a regional corpus of pottery in the Ammonite region of the central Transjordan plateau during the Persian period, but the separation between the Iron II and Persian periods that has been classically stated for western Palestine, does not apply to eastern Palestine, where the late Iron II corpus seems to flourish right through the Babylonian period and continue well into the Persian period with no discernible break in the corpus.

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# Preliminary Thoughts on the Tall Nimrīn Krater

The 1990 season of excavations at Tall Nimrīn, under the direction of James Flanagan, David McCreery and Khair Yassine, continued the excavation of a series of plots on the east side of the *tall* near its center. A late Iron I through Persian period sequence was exposed but excavations stopped just at the top of the Late Bronze through Early Bronze Age IV sequence excavated at the road cut in the 1989 season (Flanagan and McCreery 1990).

The single most important object from the 1990 season was a krater that was reconstructed from many fragments that were found on and above the floor of an Iron II building (FIG. 1). The krater, measuring 33 cm high and 34 cm in diameter, is unique with its fascinating, 8 cm high decorative frieze providing a rich addition to the corpus of artistic materials from Transjordan (FIG. 2).

## General Description

The profile of the handless krater is unusual but fits in a general eighth-sixth century BC context with exterior wheel burnishing of a cream to pink-cream surface. The decorative freeze includes representations of animals, naked men, palm trees and an incense altar. The figures were probably applied to the vessel in the leather hard stage before it was fired (FIG. 3). They were formed by applying small individual molds over patches of clay that had been applied to the surface of the vessel. This created greater relief in the figures and made fuller impressions from the molds. Many of the figures are repeated impressions from the same mold. There are 20 separate impressions in the freeze.

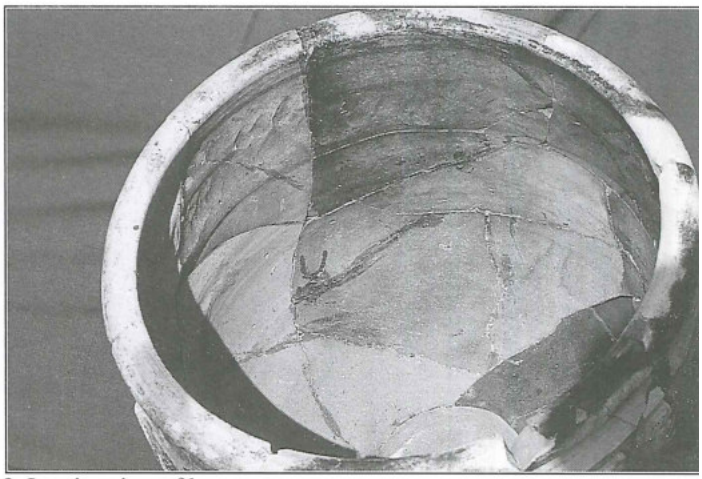
The freeze progresses in two directions around the



1. General view of the Tall Nimrīn Krater.

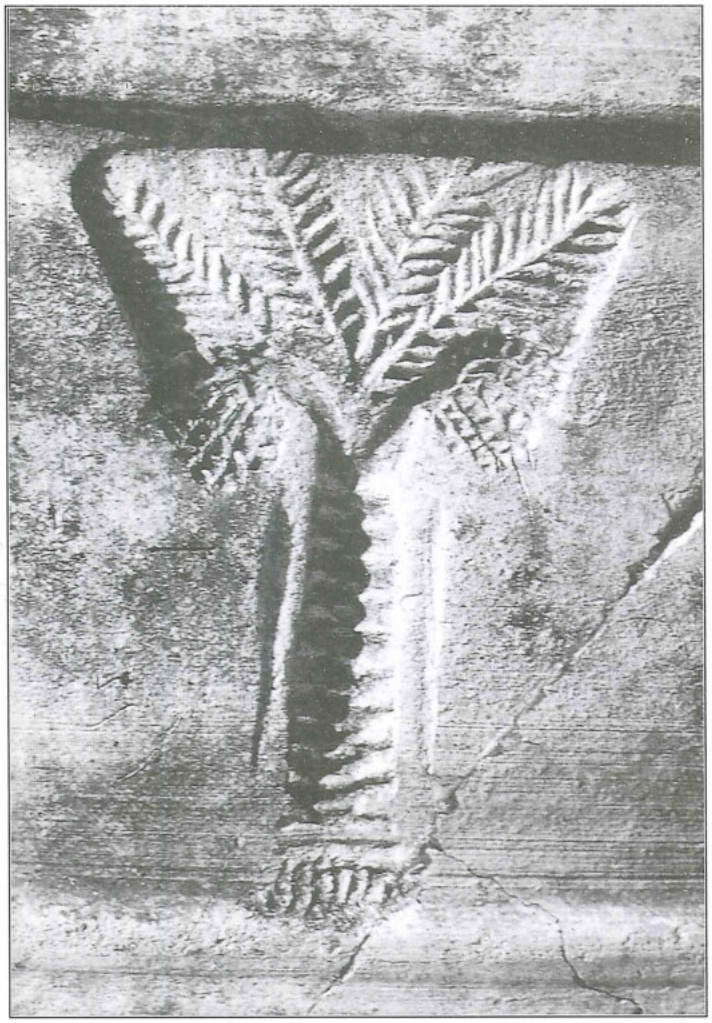


2. Sherds of krater smashed on floor of room.

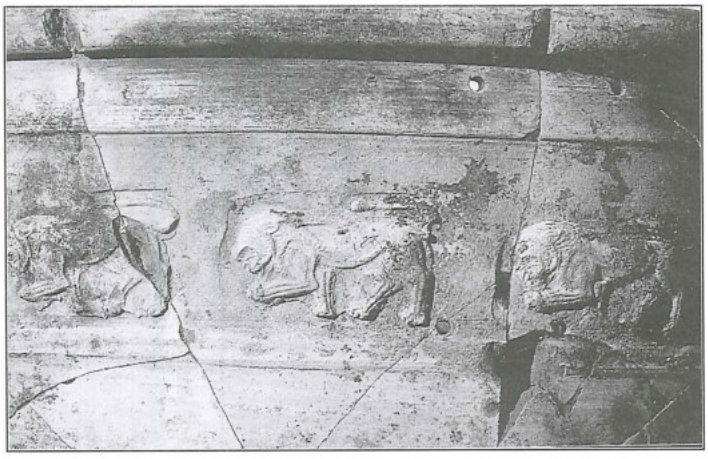


3. Interior view of krater.

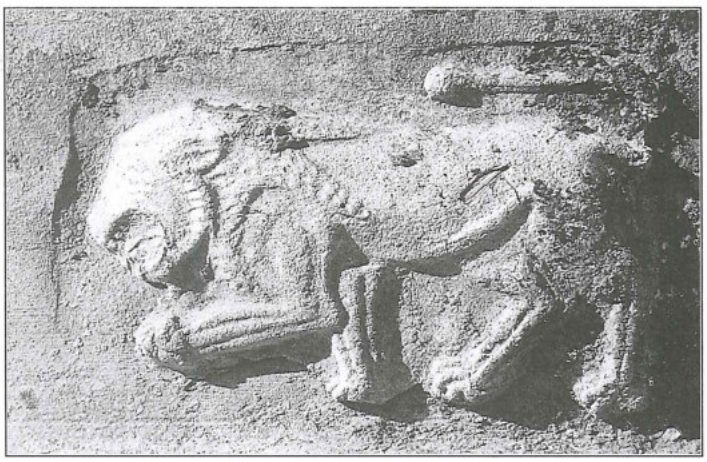
vessel. A palm tree (FIG. 4), repeated four times, is used as a divider between the five groups of figures. Three lions (FIGS. 5 and 6) in profile, stride to the left and are separated by a palm tree from three stags (FIGS. 7 and 8), also in profile, striding in the same direction. Another palm tree separates the stags from a third group, a row of three naked Bes figures represented frontally (FIGS. and 10). Another palm tree separates the remaining figures which proceed in the opposite direction. This sequence starts back to back with the lions but without a palm tree divider. The fourth group is two naked men, in profile, proceeding to the right, separated by an incense altar (FIGS. 11 and 12). A palm tree separates this group



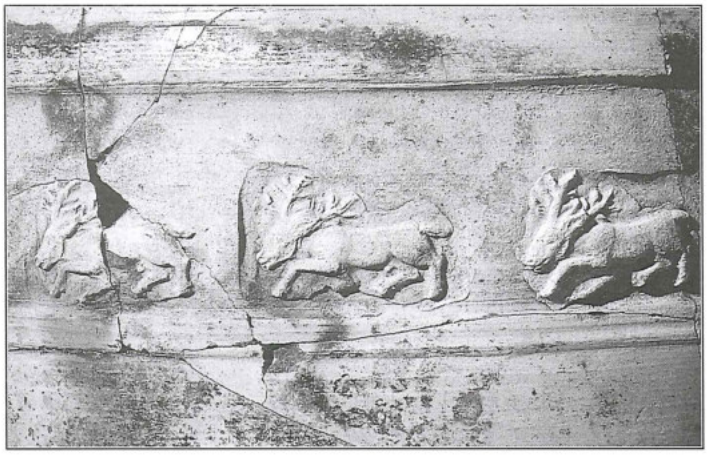
4. Palm tree impression.



5. Impression of lions.



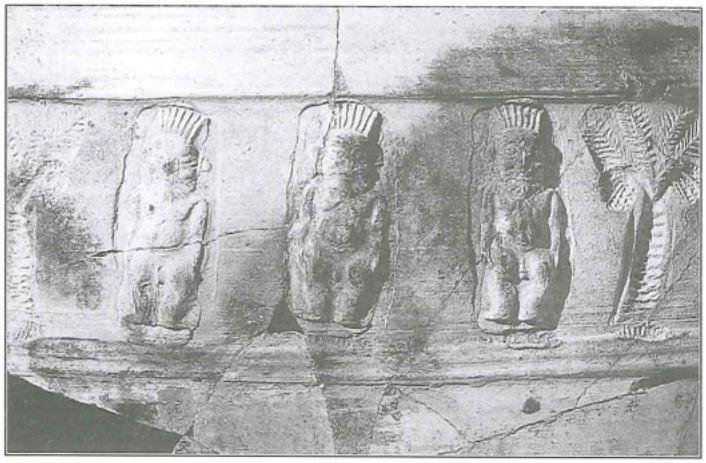
6. Impression of lion.



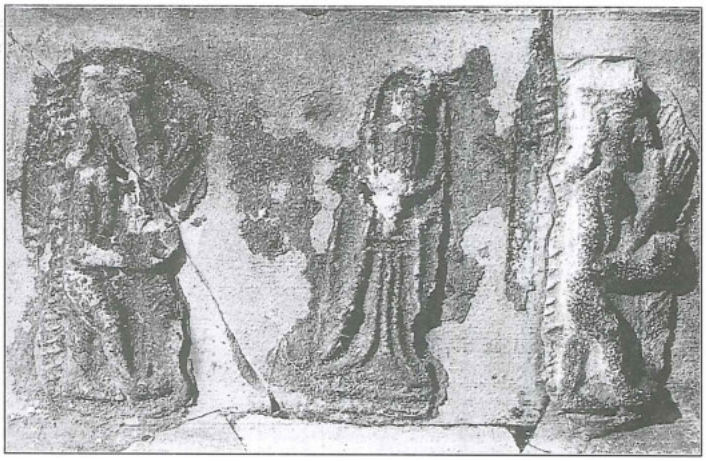
7. Impression of stags.



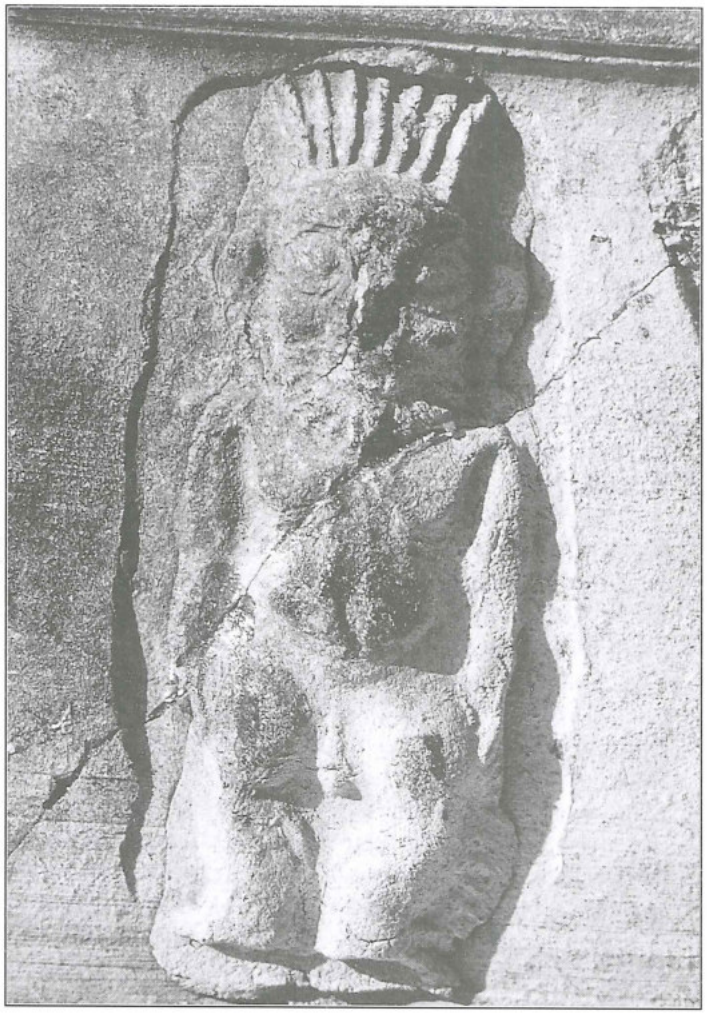
8. Impression of stag.



9. Impressions of Bes figures.



11. Impression of two naked men and incense altar in ritual scene.



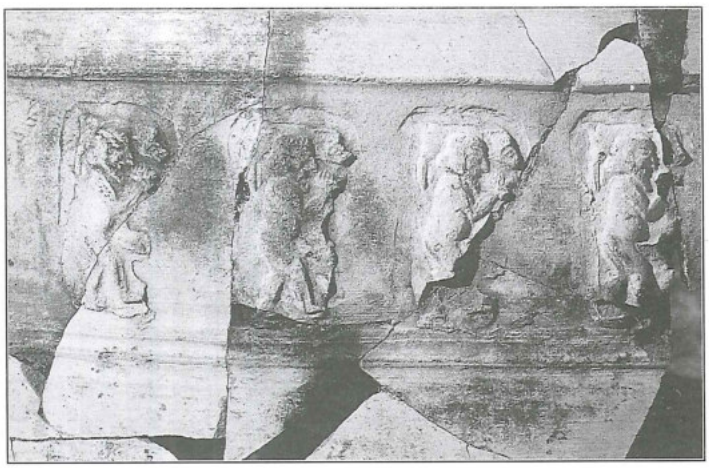
10. Impression of Bes figure.



12. Impression of one of the naked men in the ritual scene.

from the last group of four naked men in profile (FIGS. 13 and 14), striding to the right, quite clearly sexually aroused and carrying boars on their shoulders.

Each of these representations provides tantalizing details that help link its art style with well known pieces from elsewhere. The examination of each figure reveals many general parallels in a broad Near Eastern context, but the combination of features has no exact parallels. The style is uniform with well modeled, realistic representations developed by a school of art belonging to the



13. Impression of naked men carrying boars.



14. Impression of naked man carrying boar.

late Assyrian or Neo-Babylonian periods but not conforming precisely in details to well known Assyrian, Syrian, Phoenician or Egyptian representations of the time. Of course, the figures are reduced to small scale for the molds and this adaptation may have influenced the style somewhat. The pottery found in association with the krater is primarily large, reconstructible storage jars and a small number of other types of vessels. Though the stratigraphic sequence in this area of excavation at Nimrīn covers at least the tenth through fourth centuries BC, our study of the ceramic sequence has just begun and the repertoire of forms is quite restricted. At this time it is premature for us to be more precise than the date range we have proposed — the eighth through the sixth century BC.

The use of mold-made figurines for decorative purposes is known from many periods. Roughly contemporary molds were found near the Roman theater in downtown ʻAmmān, in the excavation of an Iron Age tomb (Dornemann 1983: 132-142). The stylistic details again do not conform precisely to Phoenician, Syrian, Assyrian or Egyptian models though they are clearly heavily dependent on all in detail and choice of motifs. It is not yet possible, in our opinion, to subdivide Transjordan into Ammonite, Moabite or Edomite styles until specific features characterizing these designations can be separated from a broad common tradition. The only known use of small molds like those from ʻAmmān has been to produce terra cotta plaques or to provide facial detail on human figurines hand-molded in clay. Only the excavation at Buṣayra have provided precise parallels with the Nimrīn treatment of molded decoration on a pottery vessel. At Buṣayra a sherd of a fine ware bowl (Bennett 1975: FIG. 8.9, 10) was decorated with a mold impressed stag that is almost identical to the one on the Nimrīn krater.

The art style employed for the decoration of the Nimrīn krater is a combination of normal, expected conventions in Near Eastern art and some unique or very unusual features. The presentation of files of animals and humans can be traced back to proto-dynastic art work in Egypt and Mesopotamia (Frankfort 1970: 26-29, 81, 212, etc.; Barnett 1982: PL. 3). The lion is extremely common throughout the Near East and parallels can be illustrated for the position of the tail, the folded-over ear, the menacing snarl bearing the teeth and tongue, and the ruff of the mane framing the face. The molding of the muscles of the legs, body and paws are somewhat patterned but not excessively. The treatment of the mane is unusual as it tapers to two points on the back. The bodies of the stags, similarly, are not rendered by a stylized treatment of the muscles or hooves, but are realistically treated. The head and horns dominate the body. The horns are elaborate and in good proportion to the head but the head seems oversized in comparison to the body. The greatest amount of detail is concentrated on the head and the rack of horns. This, however, may be deceptive and a result of the lack of uniformity in the impressions with some true to the rendering of the mold and others inaccurate, where

the full detail was not impressed or was obscured.

Date palms, again, are extremely common in Near Eastern art and the depiction of the bark, fronds and date bunches seems less stylized than realistic. The representation of the god Bes is well articulated (Wilson 1976: 88, 100) with feathered crown, a large mask-like face with large eyes, moustache, beard and protruding, perhaps non-human ears. The body is plump with rounded features, short proportions, particularly short legs, and only a slight belly with several folds beneath, and a clearly articulated penis.

Tall, narrow incense altars are depicted in Phoenician, Assyrian and later art work (Forte 1976: FIG. 39; Strommenger 1962: FIG. 260) but again, not conforming to the precise details shown here. The human depiction on the krater is most provocative. The two figures with the altar should, in typical Near Eastern iconography, be represented so that they face the altar, the object of their attention. Apparently it was not considered essential to produce an additional mold for a left-facing individual, so the same mold was used here for both figures flanking the altar. It is difficult to see if the right hand holds an object or simply is positioned with the palm up. The left hand is open and raised in an attitude of salute or prayer. The treatment of the head and face is similar to the depiction of many "Semitic" figures. It has almond-shaped eyes, beard and is somewhat flattened on the top of the head. The impression is indistinct and the figure may be wearing a flat, shallow hat. The shoulder-length hair is common. It is difficult to interpret the function of the herring bone pattern behind the man, whether this is used simply as a decorative space filler or is intended to represent some kind of a tree, like a pine. The nakedness of the figure is unusual in a formal context. Normally worshipping figures are clothed and nakedness is reserved for individuals in disgrace; a common depiction of prisoners of war, as it is in the scene on the 14th century ivory carving found at Megiddo (Loud 1939: no. 295; Strommenger 1962: 214). In our case, the nakedness is clearly intended and is consistent with the representation of the four male figures in the next group.

The repetition of four rather than three figures in the final group must have been intended for emphasis. In contrast to the relatively lean figures at the altar, the bodies of these figures are fuller and more rounded. The musculature of the bodies is not particularly emphasized, though this is difficult to determine because the mold is not fully impressed on all of the figures. The face is represented with almond-shaped eyes, small mouth, large pointed nose, and fairly long pointed beard. The hair style is slightly different and fuller than that shown on the figures of the other group, with fuller shoulder-length hair this time covering rather than pulled behind the ear. This rendering is very similar to that of the figurine head published by Glueck from the Moabite site of al-Madaiyina (1968: 145). No hat is indicated on the figures of this group but rather the figure is bare-headed. It is possible that a band may have been used to hold the hair, but this cannot be seen in the impressions. The right hand is drawn up to the face and may be intended to help hold the animal on the shoulders but looks more like the hand is holding a shallow cup to the mouth. The erect, apparently circumcised, penis is explicit. The identification of the animal is surprising. The squared back end, short tail, sharp rounded juncture from shoulder to head, small squared-off snout, rounded lower jaw, centrally positioned eye and placement of the ear, conform to representations of boars rather than any other animals, like lambs, goats, calves or deer. A figure carrying a young boar is unique while animal bearers with sheep, calves or stag are documented elsewhere in Near Eastern art (Orthmann 1971: TFL. 30).

**Function of the Krater**

*Given the wealth of detail on the krater, what insight can the choice of figures provide for an understanding of its function?* Some figures like the stags, lions and palm trees are such common representations that they can be considered "standard" motifs. The Bes figures would seem to have a more specific meaning in defining the context. The two worshippers are again standard, but provide illustration of a specific ritual act. The final scene, again basically standard as a file of men, has clearly been placed in a very specific context with the depiction of the nakedness — taken to the point of seeming lewdness, and the choice of an unusual animal to be carried, a pig, that would be classed as unclean in many Semitic contexts. The possibility of the figures shown as drinking, brings to mind the consideration of a wine krater for this vessel. It almost seems as if these four figures are intended to present as acceptable what, in many contexts, is usually considered taboo: inclusion of swine in a ritual act, nakedness to the point of lewdness, and drinking. Highlighting some religious purpose with an emphasis on fertility is obvious in this group, but is also emphasized by the choice of the god Bes and the use of the palm tree.

**Art Style on the Freeze**

Before proceeding with a brief examination of broad parallels and pertinent literary and cultural evidence to help place the artistic representation in its cultural framework, I would like to look in greater detail at parallels for some of the representations. I have already mentioned the lion as a common animal in Near Eastern art. It is difficult to connect the lion specifically with a certain deity, though it is shown in relation to a number of deities. One of its most common functions is as a guardian at the doorways

of temples or other important buildings, or as a guardian at the entry to important rooms in a building complex. The lion hunt is a standard topic for artistic representation, giving the hunter, usually royalty, particular status in overcoming an animal of fierce power. Such scenes are best known from Assyrian palace reliefs and contemporary Neo-Hittite reliefs (Frankfort 1970: FIGS. 185, 210-212; Bittel 1976: FIG. 306).

The representation of a stag is somewhat less common but is found in Assyrian period art, as at Arslan Tash (Barnett 1982: FIG. 47e, f), as an individual motif and as an animal worthy of chase. Again, a powerful animal successfully hunted would provide glory to the hunter. The stag has a long history of representation in Anatolian art from earliest times and is well at home in Neo-Hittite context (Frankfort 1970: FIGS. 210-211; Bittel 1976: FIGS. 224, 280). Whether or not this choice is included on the krater out of a "catalogue of standard motifs," as may be the case with the lions and palm trees, is not certain. Our repertoire of Transjordanian art work is too limited to allow us to determine any favorite animals for the region. The illustration of a boar is clearly uncommon in Near Eastern art, though good examples occur. Again, like the stag, an Anatolian context may be closer to home than elsewhere. A 14th century BC relief from Alaca Höyük includes a boar with a stag in a hunt scene (Bittel 1976: FIG. 225).

The intended allusions to fertility in the choice of motifs is far from clear in each case, and leaves room for considerable speculation. The palm tree, as an independent motif or in a small group scene, can symbolize fertility, whether grouped with human figures in a variety of ways or with a heraldic pair of animals. The illustration of a palm tree and the abstracted use of a tree as a stylized tree of life has a long history in Near Eastern art.

The god Bes was taken up as an outside element in Egypt, apparently by the Middle Kingdom (Ions 1973: 110; Wilson 1976), and occurs in amulets, ivories and sculpture from the second millennium on in Palestine and Syria. The range of functions for Bes in Egypt included the use of his depiction as a "good luck charm" related to fertility and more specific associations as a protective force in childbirth. Precisely what function, association and meaning this god had to the northeast of Egypt is of course speculative and could range from very general symbolism, like the palm tree, or a very specific function like the protective force for child birth, or a local modification of the fertility theme to a distinct but, to us, unknown function. The feathered headdress is typical but not always present in representations of Bes. Bes is often characterized by leonine features but here only the facial features tend in that direction with the scraggly beard, large eyes and protruding ears (unfortunately the frequently found short stump nose is poorly preserved). No further indication is given: like the frequently found paws and tail of a lion to indicate that a lion's skin is worn by the figure (Moscati 1988: 357-361, 623, 653, 684, 723). The figure is isolated and not further embellished with representations of snakes or monkeys, as is sometimes the case on Neo-Hittite sculptures (Bossert *et al.* 1950: TFLN. XIV:71, XVI:78).

One mold fragment found in Tomb F near the Roman theater in 'Ammān (Dornemann 1983: FIG. 88:5), was found with other molds and pottery maker's tools. It was intended for the production of a simplified figurine of Bes that must have yielded an impression also roughly 8 cm high. The feather head dress is indicated, and the face, which is large in comparison to the body, has a lengthy beard, fat cheeks, large flattened nose, normal-sized eyes and large but indistinct ears. Only one shoulder and arm are preserved and nothing below the waist. The arm does not rest at the side but the hand is brought in toward the belly. The 'Ammān mold could have been used to decorate a vessel, as was done when the Nimrīn krater was produced, or it could have been used to produce small plaques. The date range for the tomb is given as second half of the seventh century to the beginning of the sixth, but there is no precise overlap of details between the 'Ammān and Nimrīn figures to require precise temporal agreement.

If the choice of motifs for the Nimrīn krater is intended to stress a consistent theme, then the nakedness of the male figures may be intended to carry the fertility theme further and accentuate the human fertility aspect in some sort of worship or ritual setting. This seems more likely than an alternative of interpreting the final scene simply as an erotic depiction.

Aspects of fertility rituals or worship are associated with the common representations of naked women (van Buren 1930: FIGS. 25-29, 34-50; Dornemann 1979: 113-151) on plaques or seals from the late third millennium on, but the representation of male nudity is extremely rare. The representation of the ithyphallic Min of Koptos in Egypt is of course obviously similar when rendered in profile. Min's worship is clearly related to fertility and he is well known as "Lord of the Eastern Desert, for he was the tutelary deity of the caravan routes to the Red Sea which departed from Koptos passing through dangerous tribal lands. He was called Lord of Foreign Lands and was the protector of nomads and hunters" (Ions 1973: 110). A possible connection in this light between Min and Transjordan is intriguing.

The only other representations which could be related to the naked Nimrīn figures are occasional, mostly Mesopotamian, scenes classed as erotic or as representations of the sacred marriage. It is possible that our representations are related to such fertility ceremonies but a

quick review of relevant artistic representations provides no concrete similarities. Also, a quick review of Near Eastern and Biblical references to fertility ceremonies yield some possibilities, but again nothing concrete. One thinks of the repugnance of King David's wife Michal at his dancing before the Lord when the ark of the covenant was moved to Jerusalem. One wonders about the background of this ceremony and whether David remained clothed with the linen ephod through the ceremony, as 2 Samuel 6:20 has him "disrobing in the sight of slave girls of his servants as any vulgar fellow would." Exactly what the Transjordanian religious practices from Moab, Ammon and Edom were, that were similar to those rebuked by Israelite prophets as practices taken up by the Israelites from their neighbors, are known in only a general way. Can a clue be found in the mention of ceremonies dealing with the drinking of wine or associated with swine? Our preliminary remarks cannot pursue these matters in detail but references to consumption of pork broth brings us into the area of practices dealing with the cult of the dead (Heidir 1985: 389-391) and the possibility of a ritual involving the offering of semen in place of human sacrifice (Heidir 1985: 402) may connect several other vague threads which, upon further study, may lead to some clarification.

**Broader Cultural Connections**

*What cultural thread connects practices in Transjordan with those in the Phoenician homeland and beyond?* A quick review, again, provides nothing concrete but indicates that as more information becomes available, the associations of the figures on the Nimrīn krater may help to pull together and clarify some of these practices.

The date of the krater coincides with the period of Phoenician expansion in the Mediterranean area. Many of the distinctive features of Phoenician culture can also be found in Transjordan (Homès-Fredericq 1987: 89-96) as for example, a similar repertoire of artistic conventions including the "woman in the window" and naked women wearing polos hats, representation of the god Bes, the use of terra cotta masks, including grotesque masks, as well as many shared features in the form and decoration of pottery vessels and the use of votive sculpture as found in the 'Ammān district and on Cyprus.

Beyond the Phoenician world, the Greek world picked up Near Eastern ideas at this time and incorporated them into their art, rituals and many areas of life and culture (Boardman 1967: 73-108; Amyx 1988: FIGS. 15-17, 19, 20, 23, 24, 52). One of the earliest features of Orientalizing Greek Art on pottery was the use of animal friezes which included the lion, stag and boar. Common representational conventions are evident, as on lions in the patterning of the mane, the representation of the snarl, depiction of the tongue and the positioning of the tail. Stags with ample racks of horns are included in the repertoire and boars occur frequently (Boardman 1967: FIGS. 40, 55, 83). Even mold-impressed decoration is found on contemporary vessels in Crete, though with little similarity in artistic rendering to our Nimrīn krater (Boardman *et al.* 1970: TFLN. 24-37).

The most tantalizing connection of our krater with artistic representations of the Greek world are the scenes showing male nakedness. The Greek artist's delight in depicting the human form is a cornerstone of Greek Art, and the freedom of expression and abandon of the Greek artists finds great delight, rather than shame, in the depiction of cavorting erotic figures (Boardman 1964: FIGS. 90, 91, 150; Berard and Vernant 1984: 175-216). No animal ears or tail can be discerned on the figures of the Nimrīn krater, so connections with the god Silenus or with satyrs, cannot be established. The Dionysiac scenes with cavorting satyrs (Boardman 1967: FIGS. 89, 90; 1964: FIG. 78; Berard and Vernant 1984: 175-216), often represented as accompanied by music, with dancing and with wine, take on a haunting similarity if the one group of Nimrīn figures are to be understood in dancing postures with cups at their mouths!

It is impossible at this point to accentuate the similarities we have indicated, but clearly we have much to learn before we can securely place the Nimrīn krater into a clear and well understood cultural and religious context. On the other hand, the uniqueness of the krater and its depictions will provide a significant reference point for our understanding of the art of Transjordan and its place in a broader cultural context.

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# An Investigation into the Firing of Nabataean Pottery

## Introduction

This paper presents part of a project aimed at investigating the methods of manufacture of fine Nabataean pottery (Mason and 'Amr 1990; 1992a; 1992b; 1993). The project was carried out jointly by the Department of Antiquities of Jordan and the British Institute at Amman for Archaeology and History who have funded the project along with, initially, Yarmouk University and later on the Wainwright Fund of the Oriental Institute at Oxford.

The part under discussion here is the building and firing of an experimental pottery kiln, carried out in 1990 and 1992 at Jarash. The experimental structure was based on the plan of a kiln excavated at Zurrāba, to the east of Petra, in 1980 (Zayadine 1981: 350-351; 1982: 380-382; 1986: 185-187). It was meant as a 'research tool' to investigate the effects of firing on pottery made from clay thought to have been used by the Nabataean potters (Mason and 'Amr 1990: 287-290).

## The Zurrāba Kilns

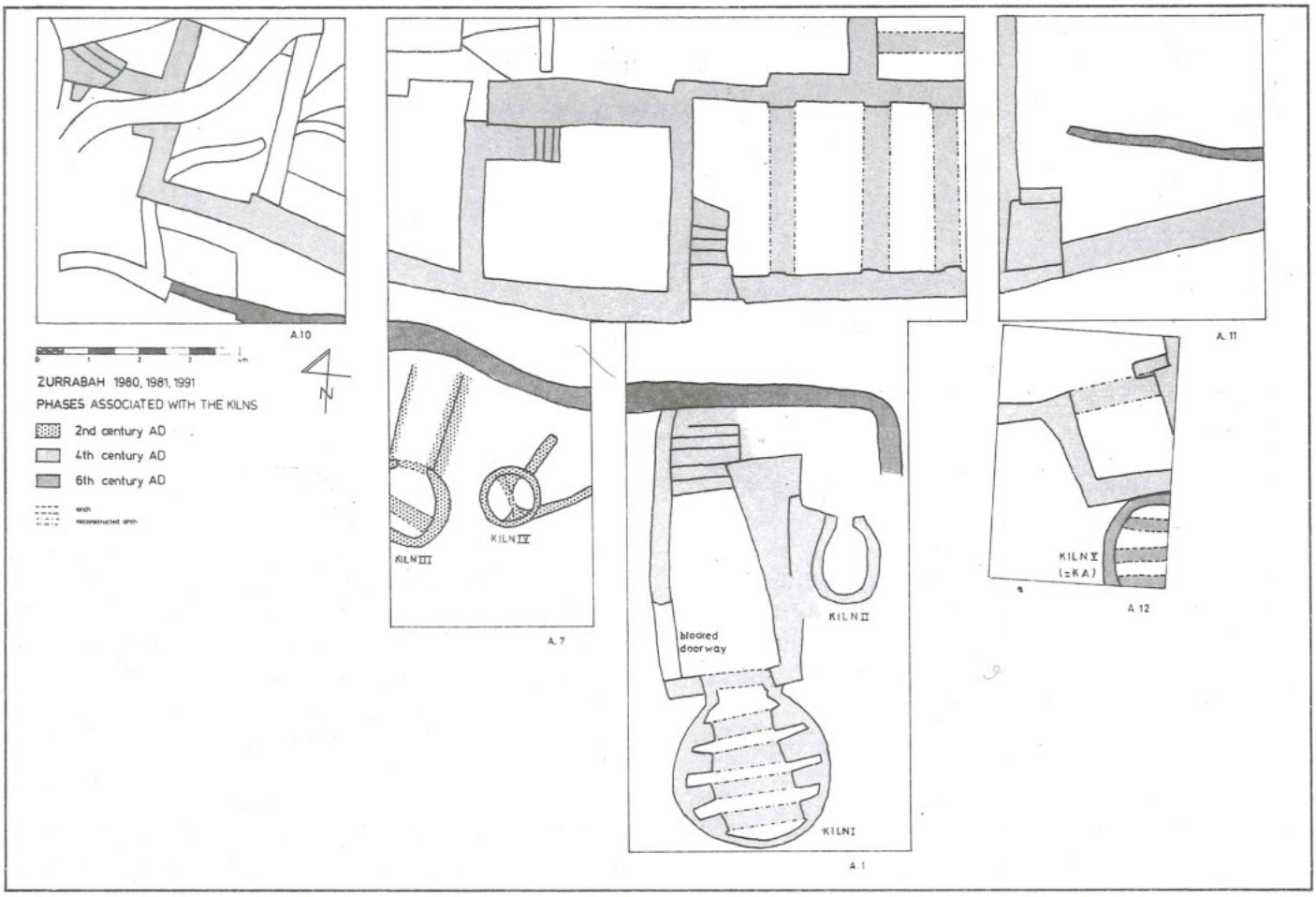
To date, five pottery kilns ranging in date from the second to the sixth centuries AD had been uncovered at Zurrāba ('Amr 1991) (FIG. 1). When the project was started in 1990, however, only two kilns (Kilns I and II) were available for inspection, as Kilns III and IV had been re-buried in 1980 and Kiln V was discovered in 1991. Kiln I was chosen as the model for the experimental kiln as it is the larger and more complex of the two kilns.

Kiln I was dated to the "Roman period", more specifically late third or early fourth century AD (Zayadine 1982: 386; 'Amr 1991: 320), thus placing it slightly later than the "classical" Nabataean fine wares. Because the experimental kiln was regarded as a research tool, its use was justified especially since the Nabataean pottery tradition continues well past the date of Kiln I at Zurrāba ('Amr 1991: 315-318, 321).

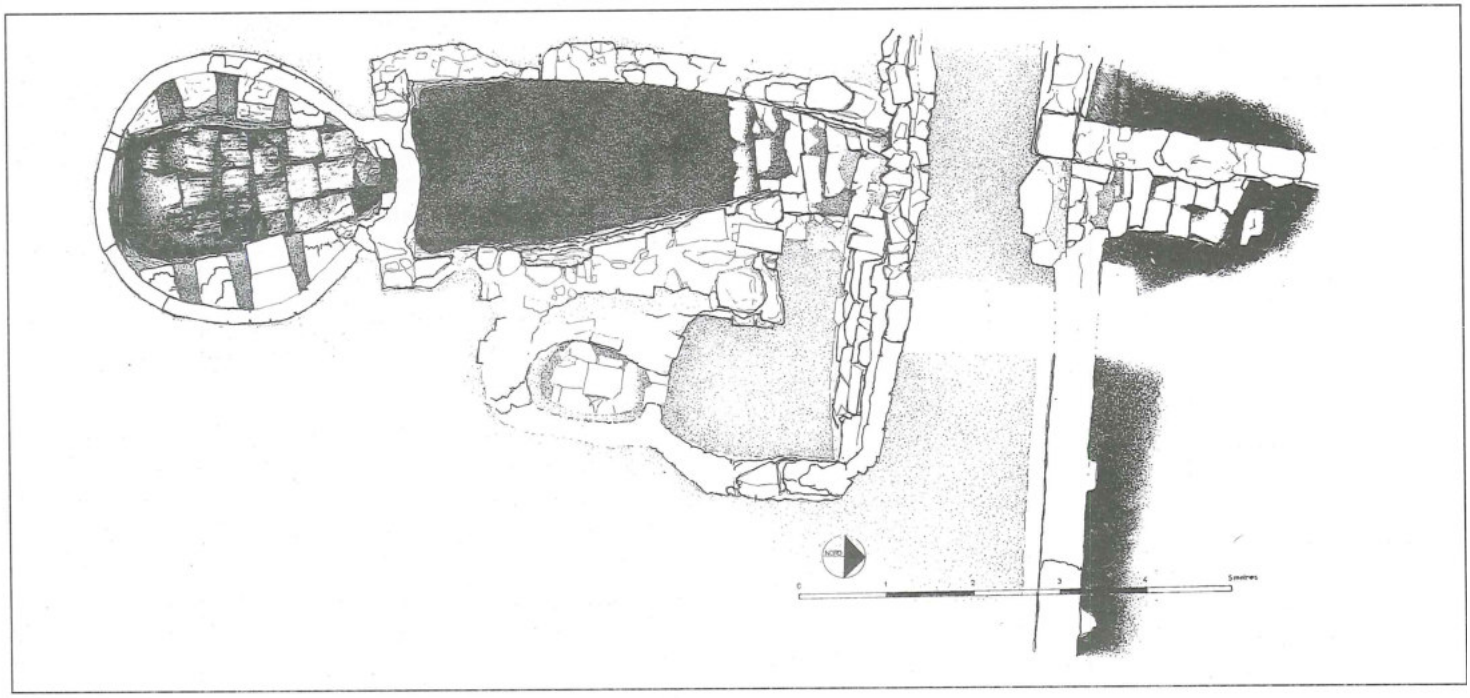
A problem in kiln studies is the variety of terms applied to the kiln components. In this paper, the terms defined by Swan (1984: 29-32) will be used. Thus the *stoke-hole* is the opening through which the fuel is introduced, the *combustion-chamber* is where the fuel is burnt, in the combustion-chamber are built *supports* for the *raised oven-floor*, above which is the *superstructure* defining the *oven*, in which the pots are stacked for firing.

Kiln I is a simple updraught kiln, with the combustion-chamber directly below the oven. This principle is common in kilns of the area since the Bronze Age and is still seen in modern kilns. The plan of Kiln I is unique, however, in that the combustion-chamber is almost rectangular in shape, measuring 1.15-1.35 x 3.0m with a height of around 1.0m, paved with bricks, while the oven is circular (the oval shape described in Zayadine 1982: 380 is actually a distortion due to the position of the entrance at the northern side) with an average diameter of about 3m (FIG. 2). Four heavy arches spring from the long sides of the combustion-chamber and would have supported a dome defining the oven. The spaces between the arches would have acted as flues for pulling the hot gases from the combustion-chamber into the oven. The plan of this kiln should not be confused with the "central corridor with cross walls and cross flues" kilns (Cuomo di Caprio 1978/9: Class I/d), where "the arches supported the floor" (Schaefer and Falkner 1986: 421). No traces of the oven-floor or its supports were found. The opening of the kiln faces north, and is a corbelled stone arch protected by brick insulation, which would have acted both as a stacking and stocking hole. This arch is the only stone element in the kiln structure, which is otherwise built of brick.

A passageway accessible from the north by a flight of steps leads to the opening of Kiln I. This is due to the fact that the combustion-chamber and part of the superstructure were dug into the ground — i.e. into earlier deposits, a common solution for additional insulation (see for example Adams 1961: 33, 37; 1962: 65, 66; 1986: 31-32; Golvin *et al.* 1982: 42, 43, 47, 66; Coulson and Wilkie 1986: 66; Anderson 1987: 42). The floor of this passage is paved with stone and its side walls are also of




1. Schematic plan of the excavations at Zurrāba.



2. Plan of Kiln I at Zurrāba (drawing by Jacques Rougetet, courtesy F. Zayadine).

stone, none of which show traces of firing, so it could not be assumed that any part of this passage acted as an external combustion-chamber.

**The Experimental Kiln Construction**

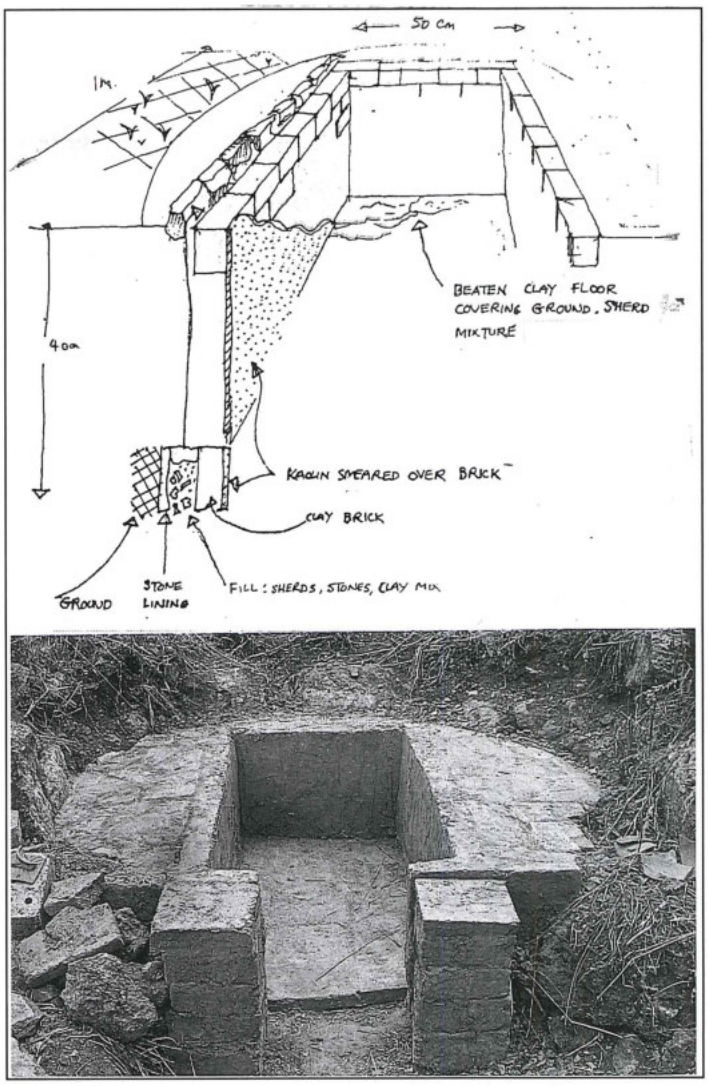
The kiln construction took place at Jarash, where the Department of Antiquities kindly offered us some space in a secluded area in the northwestern sector of the city. The area was an agricultural field prior to its acquisition by the Department, and we were assured that at least the top metre was disturbed by modern agricultural activities.

All the bricks for the structure were hand-made using clays from the Sākib area on the Jarash-'Ajlūn road. These were a blue marl and a yellow plastic which we mixed with crushed sherds and sand for making the bricks. Ash and lime were added to these clays and used as mortar.

The kiln was built with unfired bricks, dried for at least two weeks before using in the construction. "Pre-firing" of the kiln was done at two stages, first upon the completion of the combustion-chamber, then when the structure was completed. These firings were done using dry grasses and scrap wood with no pottery in the kiln and were meant to test the structure. It is also quite natural to assume that the most appropriate firing for the bricks would be that of the kiln itself (for ethnographic examples of kilns built of mud brick which fires *in situ* see Nicholson and Patterson 1989: 73 and Golvin *et al.* 1982: 48-50; while Melkawi *et al.* 1994: 451 report seventh century AD examples of the same practice).

Initially it was decided that the reconstructed kiln be half the size of Zurrāba's Kiln I, so the bricks were made accordingly. Thus bricks for building the walls were made approximately 20 x 10 x 10cm, and bricks for the arches measured approximately 20 x 20 x 3cm. Due to practical reasons, however, the kiln was moved to another spot in the same area and it was decided to build it a third of the original size. This change in plan meant we had to accommodate the half size bricks to a third size kiln, which affected only the number of arches that could be accommodated.

A pit was dug into a bank for the combustion-chamber, approximately 1.10m long, 50cm wide and 40cm deep. It was decided that the passageway in front of the original kiln was not basic for the structure. The pit was lined with sherds and clay and the combustion-chamber floor and walls were built with bricks. The interior was lined with the blue marly clay from Sākib, which proved more refractory than the plastic yellow during experimental firings in an electric kiln at the Ceramics Department, Yarmouk University. The area around the top of the combustion-chamber walls, in a circle of 1m diameter, was consolidated with stone and clay




3. The combustion-chamber of the experimental kiln.

to support the weight of the superstructure arches (FIG. 3).

No traces of the original oven-floor or its supports were detected for Kiln I at Zurrāba, despite close inspections of the combustion-chamber by us, Kenneth Russell and Robert Schick. Therefore it was decided that the support could not have been a "tongue" — which would have been connected to the back wall where its subsequent removal would have been detectable — nor a central pillar/core, which would have left a definite mark on the floor.

Initially seven pillar supports were erected along the walls of the experimental kiln combustion-chamber, onto which three shelves were placed, these had a series of holes in them to allow the upward flow of the gases. The pillars were later replaced with three small arches spanning the combustion-chamber, which proved more stable (a solution suggested by Zayadine 1982: 380 and later presented by Kiln V at Zurrāba, 'Amr 1991: 315). On a visit to Zurrāba in June 1992, Zbigniew Fiema noted

rough sections in the brickwork of the combustion-chamber walls of Kiln I, directly below the superstructure arches. These may have been the remains of arches that were broken off when the kiln was reused for purposes other than firing pottery, such as storage.

For stacking the pottery in the experimental kiln, tiles were placed above the combustion-chamber arches instead of the shelves. Many over-fired tiles were recovered at Zurrāba but not a single piece which may represent a shelf with circular holes was found there.

After the combustion-chamber was completed and a fire lit in it to harden the bricks, the superstructure arches were built around formers (FIG. 4). Only three instead of four arches were built as we had to adapt the half-size bricks to the third-size kiln (see above). The arches were placed 10cm apart to allow for the flues. The dome was built around the arches, leaving gaps (exhaust-vents) at the top to allow the flue gases to escape. An entrance was constructed at the front (north side) and corbelled resembling the original, in brick instead of stone (FIG. 5). Finally the dome was coated with a thick insulation layer of clay.

**Choice of Experimental Fuel**

Many different potential fuels would have been available to the Zurrāba potters. Of these, hard woods are the most unlikely candidates as they would have been too valuable for burning in the given environment. Additionally, the tons of ash excavated at Zurrāba contained almost no charcoal (although almost complete absence of charcoal had been reported for wood firings, Hartley 1961: 3 postulated that may be due to "the oxidizing nature of the firing", compare Bryant 1978/9: 20 who reported large amounts of charcoal resulting from reducing firings). At any rate, both the 'pre-firing' of the experimental kiln using scrap wood, and the first firing using pine produced large amounts of ash and charcoal that proved difficult to deal with, as they occasionally choked the combustion-chamber and in the absence of an ash pit — no evidence for which was found at Zurrāba — the raked out embers made very uncomfortable work conditions despite the use of a long iron rake (see also Bryant 1978/9: 21; Mayes 1961: 14 Code Letter I).

Considering that modern "Hebron tradition" potters use waste products such as saw dust and wood chips, the outer shells of old car batteries and dirty engine oil or diesel oil ('Amr 1987: 43) or even rubber tyres (Rye 1981: 103; see also Golvin *et al.* 1982: 74), waste material should be investigated. Near Eastern commercial —



4. Building the superstructure arches.



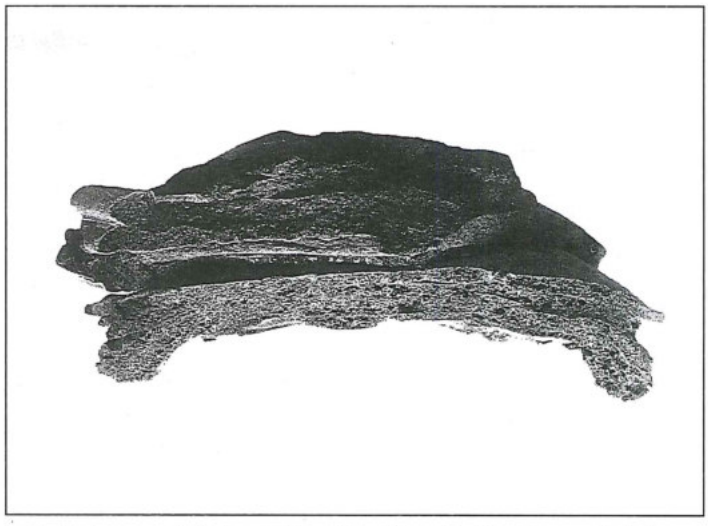
5. The completed experimental kiln.

rather than household — potters closer to nature seem to choose agricultural waste (see for example Golvin *et al.* 1982: 54; Nicholson and Patterson 1989: 77; Peacock 1982: 25, 31, 41). At Zurrāba, the only charred plant remains that appeared frequently were olive pips (Zayadine 1982: 384). Today, much of the agricultural land of Wādī Mūsā is planted with olive trees and although their owners take the olives to Ṭafīla for pressing, there is evidence for the existence of an ancient olive press system only a few hundred metres west of the Zurrāba pottery workshop (Zayadine 1982: 384, 559), but unfortunately the remains are too disturbed to allow for dating. Strabo's claim that the Nabataeans did not use olive oil was negated by the discovery of a first-second century AD olive press at Khirbat adh-Dharīḥ (Villeneuve 1990: 369), and there is historical evidence for the use of olive pressings in firing pottery kilns in Roman Palestine (Vitto 1986: 54). This makes olive pressings, which is still widely used for fuel in Jordan, an almost certainty for fuel used by the Zurrāba potters. The wild bushes for fuel postulated by Zayadine (1982: 380) would have produced even more ash for choking the combustion-chamber and most probably would have less calorific value, but they may have supplemented the olive pressings firing. Other fuels such as animal dung cannot be dismissed and mixtures of fuels may have been used.

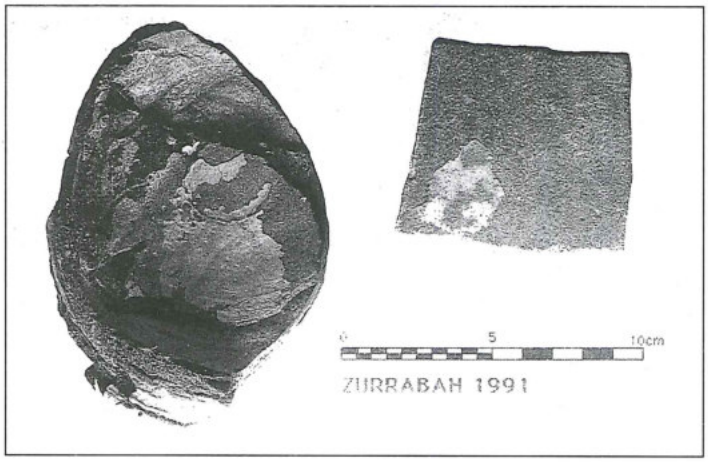
## Saggering and Stacking the Pottery

The Zurrāba excavations produced exceptional examples of over-fired wasted stacks, where sometimes over thirty bowls had melted and fused together in one mass (Zayadine 1982: 563 PL. CXXXIX; 1986: 188). Close examination of some of the waster stacks gave the impression that the bowls "melted down" rather than "up", i.e. they seem to have been stacked right way up rather than upside down when the melting occurred, with parts of the rims sometimes giving the impression of having melted through something, e.g. a fracture in the oven-floor. In many cases parts of the rims had melted "lower" than the bases (FIG. 6). Additionally, a frequent occurrence were small rhomboid clay shapes stuck to the bottoms of stacks (FIG. 7). These were made of a coarse (more refractory?) clay and occurred in deposits from all phases. Most probably they served to stabilize the stacks of round based bowls. A consistent observation is that the bowls were stacked on top of each other with no separators.

No clear evidence for saggers was found. However, plain coarse large bowls or pipes — sherds from many of which were found — may have served as saggers (see for example Golvin *et al.* 1982: 51). Saggering is a simple, though space and heat consuming, method for producing well oxidised wares, but it is not necessary if a clear oxidising fire can be maintained and the flames kept away from contact with the pots (Billington 1962: 163). The numerous over-fired pots and stacks from Zurrāba seem to indicate unprotected firing, still we decided to wait for the results from our first firings to make a decision on the matter.



6. A stack of wasted bowls from Zurrāba with the rims melted lower than the bases.




7. Rhomboid coarse ware pieces from Zurrāba, sometimes found stuck to the bottoms of stacks of wasted bowls.

## The Experimental Firings

By April 1992, the kiln had been fired five times, excluding the pre-firings (see kiln construction above). The first "loaded" firing used pine — which happened to be abundant at the time — in order to familiarise ourselves with the kiln and observe its firing characteristics. We were encouraged by the superb "pull" and the 850°C reached over six hours. On the other hand, the problem of ash and the frequency of stoking convinced us to turn over to the olive pressings.

The other four firings used olive pressings as the basic fuel. During all the firings the opening of the oven

was bricked up. The kiln was left to cool for at least three days after each firing before it was unloaded, after which time the embers and combustion-chamber floor were still too hot to handle. A brief description will be given of these firings.

*First Olive Pressings Firing: 30 November 1990.* There was almost no breeze throughout the firing, dry warm weather. Dry pressings from the 1989 season were used. In order to help the fire become established, pine cones and twigs were used in association with the pressings in the initial phases so that a good bed of hot ash developed. Some time was taken over this stage. It was noted that lumps burnt more efficiently than loose pressings, which tended to cover unburnt fuel thus preventing further combustion. An estimated temperature of 800+°C was reached over four hours (recorded by cones). The stoking was *extremely* relaxed compared to the pine firing. Ashes filled almost two thirds of the combustion-chamber, no raking was necessary but some poking was done to get air to the unburnt fuel. The vessels had patches of strong reduction especially where not protected by stacking. No over-fired wasters but there were a few heat spalled vessels.

*Second Olive Pressings Firing: 21 June 1991.* There was little breeze throughout the firing, dry hot weather. Dry pressings from the 1989 season were used. The behaviour of the olive pressings at the beginning was the same as the first firing. A top temperature of 800+°C was recorded (by cones). An attempt at full oxidation was carried out at the end of the firing for twenty five minutes using dry palm branches which well oxidised the bowls. A heat variation from front to back of approximately 100°C was estimated.

*Third Olive Pressings Firing: 5 November 1991.* There was varying breeze with a few gusts of wind. A mixture of old and new olive pressings shaped into cakes were used. By now we were familiar with the initial behaviour of the olive pressings. Dry olive leaves were used to invigorate the fire from time to time. An estimated top temperature of more than 850°C was reached over 5hrs 50mins. This was the first firing with a full load, 75 vessels of varying forms and sizes were stacked. We experimented with flues to try to even out the heat. Some bowls had reduced portions where not protected in the stack (FIG. 8). One bowl, made of Jarash clay, was an over-fired waster (it was placed at the back of the kiln). The temperature variation between the back and front was noticeable.

*Fourth Olive Pressings Firing: 15 March 1992.* The kiln was soaked through with water due to the prolonged wet weather. A fire was lit a few days earlier for several hours but the kiln was still very wet. A fire with twigs was lit for two hours before stacking the pots but still the kiln was wet. There was some breeze, cool weather, a few rain drops towards the end of the firing. New olive pressing cakes were used. There was a full load, again of 75 vessels. We decided to sagger some vessels in large fired bowls. The fire was started a bit too rapidly, reaching 300°C in the first hour which resulted in the shattering of some of the bowls. There was much more smoke than experienced in the preceding firings and the kiln consumed significantly more fuel, certainly as a result of the excess water in the fabric. A temperature of 850°C was reached over five hours, occasionally rising to 860°C (readings from one thermocouple placed at the centre back). Cones were placed at several positions in the front, centre, back, top and bottom. The kiln was left to soak at the top temperatures for one hour. The firing was finished off with a load of dry palm leaves. Flues were left open throughout. The pottery was well oxidised with the exception of one small vessel that was covered in soot. One saggered bowl showed signs of over-firing, another one was shattered (although probably during transport in the saggers rather than from heat). Nine vessels were shattered by the initial rise in temperature, all at the back. There was an estimated variance of about 100°C between the front and back of the kiln.

## General Considerations and Conclusions

*The Kiln Structure*

The structure fared very well after almost three years of exposure and six firings. One large crack appeared at the back during the first firing, most likely caused by thermal stress. It was repaired, reappeared in the second firing, then did not seem to give problems after the second repair. Repairs also had to be made to the outside insulation layer after the winter storms of 1990/91 then 1992. The latter also caused the wear of part of the pillars in front of the stokehole. One of the pillars initially supporting the oven-floor collapsed during the second firing. All of the shelves used on top of these pillars had to be replaced after each firing (three of them collapsed during firings). The combustion-chamber arches fared better and only once a spanning brick collapsed during firing, most bricks could be re-used. No damage occurred either to the superstructure arches or dome.

All the inner surfaces were good, having fired to a light pink, however under the insulation layer the bricks were still green to about a quarter of their thickness. This seems usual in low fired kilns (see Mayes 1961: 7).

The variation in temperature seems normal in updraught pottery kilns with the combustion-chamber directly below the oven. Nicholson and Patterson (1989: 84) report a variation of 100-150°C between different

parts of a kiln 4.50m in diameter and 3.40m high, although larger kilns are supposed to have better heat distribution than smaller ones (David Killick, pers. com.). Similar variations have been reported for updraught kilns with external combustion-chambers and slightly larger size (Mayes 1961: 11).

The pull of the flue is satisfactory. One difficult feature is the stacking, due to the size of the opening. The original at Zurrāba, however, is of a size through which a man could easily go through on his knees, over the oven-floor.

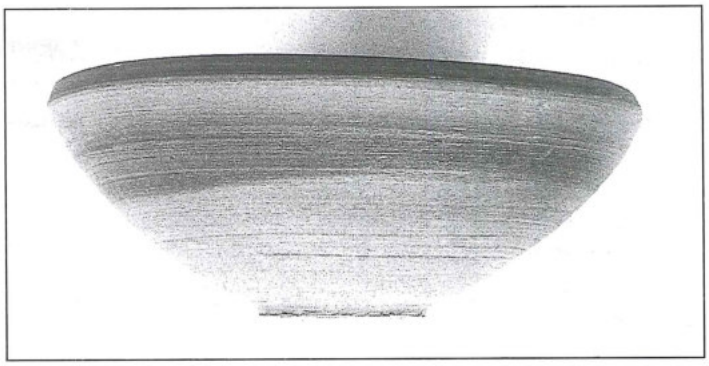
*The Olive Pressings*

The kiln was fired using two different seasons of olive pressings waste. It was observed that with age the pressings consolidated into dry lumps, which burnt well. New pressings with higher moisture content required fairly hard compression to consolidate into 'cakes'. Some were pressed into brick moulds while others were simply rolled into balls. After the pile of pressings was exposed to the heavy rains of 1991/92, it was easier to produce the blocks, but they required a very long drying period.

The pressings release a strong heat, burning with a yellow flame that breaks into a green/blue flame, and temperatures in excess of 800°C could be reached without much effort. During the earlier stages of firing and until a bed of embers is established, it releases a good deal of unwanted gases which slows the heat rise down (more so in the case of fresh pressings, the workers at the olive press where we obtained the pressings said they use pressings from the previous season for their heaters). This slowing down in heat rise, however, was to some extent advantageous since the amount of wasters was almost eliminated. The main problem seems to be the partially reduced vessels by the end of the firing, which is most probably due to the clay composition (see the assessment of the resultant pottery below). Several solutions may exist which have not been exhausted yet. Saggering is one of the less likely to have been used by the ancient potters. It should be kept in mind that some of the reduced rings around the rims of the bowls closely resemble grey rings found on the exterior rims of some Nabataean open vessels (see FIG. 8).

*The Resultant Pottery*

The clay from which the pottery was made showed special properties and requirements (Mason and 'Amr 1990: 289-300). To start with, the resultant red colour upon firing is, as expected, due to the amount of iron oxide present in the clay. The pots were made using the green clay at 'Ayn aṭ-Ṭīnah, which has an average *elemental* iron content of over 5% (pre-levigation content, 'Amr



8. A bowl with oxidised body and reduced rim where not protected by

1987: 307). Shepard (1980: 150) states that, generally, red colour will result from an *iron oxide* content of greater than 3%.

X-Ray Diffraction analysis carried out at the Geology Department of the University of Jordan showed the clay to be composed of kaolinite and a mixed layer of illite and smectite.[1] Smectites are a major component in soils of arid regions (Rice 1987: 48). Their characteristics dominate the clay properties that we had to come to terms with, starting with the high plasticity and shrinkage (Rice 1987: 44, 49), thus the possibility of throwing very thin sections and the required extremely slow drying in order to avoid cracking (Mason and 'Amr 1990: 295, 297-298). During firing, the required slow start is due to the fact that smectites give up much water between 100-200°C (Rice 1987: 87, see the fourth olive pressings firing above for explosions due to an impatient start). Finally, an explanation for the tenacious reduced patches on the pots could be found in the fact that smectites strongly retain organic material in their structure and carbon is not readily given up in firing (Rice 1987: 88). Here it should be noted that carbon can have an effect on the iron content present in the clay, which acts as a flux thus raising the temperature on the pottery surface (Franken and Steiner 1990: 84-85).

Other analyses carried out at the Chemistry Department of the University of Jordan showed the clay to have surprisingly high base exchange as well as high adsorptive capacity, both characteristic of smectites as well (Rice 1987: 48, 60).

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[1] Since the presentation of this paper, extensive analyses of the clay from 'Ayn aṭ-Ṭīnah formed major sections of two post-graduate research projects at the Departments of Chemistry and Geology, University of Jordan (Baker 1993; Abu Dayyeh 1993).

tinuous support, turning hard work into a pleasurable experience. All the staff at the Jarash Antiquities Office were extremely generous throughout the long period of the project. Hazem Zobi and Rula Attalah came to the rescue several times when equipment failed. Thanks also to Mohammad Sadooq Melkawi who helped with the kiln construction, and Giovanni Caravaggio who helped with the test firings. Joseph A. Greene, Roland-Pierre Gayraud and Estelle Villeneuve provided some of the reference material.

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___1986. The Pottery Kilns of Petra. Pp. 185-189 in D. Homès-Fredericq and H. J. Franken (eds.), *Pottery and Potters - Past and Present.* Ausstellungskataloge der Universität Tübingen Nr. 20. Tübingen: Attempto.

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# Nabataean Fine Ware from Petra[1]

The Nabataean fine ware with its egg-shell thinness is unique among the contemporary Hellenistic and Roman pottery. After Conway's and Horsfield's identification of this special kind of pottery as a product of Nabataean potters, Nelson Glueck established the painted fine ware as a reliable criterion for Nabataean presence in settlements and trading centres.[2] The search for reliable criteria to establish a typology that is connected to stratigraphy, therefore leading to precise classification and dating of this pottery, has nevertheless failed so far. This situation is, on the one hand, due to the fact that research has concentrated mainly on the stylistic development of the painted ware,[3] and on the other that the stratigraphy in the excavations was too unclear[4] or the quantity of the excavated material not representative enough[5] to allow for painstaking differentiation. The understanding that only a carefully done typological and statistical registration of the sherds will lead to further results has only been generally accepted recently.[6] To get further knowledge of the provenance and chronology of the Nabataean fine ware, attempts have lately been made by the use of chemical analysis.[7]

The pottery found during the four campaigns which were carried out by our team beneath the peak of az-Zanṭūr in Petra[8] meet the fundamental conditions for a promising classification — both in what concerns the quantity[9] as well as the provenance of stratified find units. Our main interest focused on the shapes of the Nabataean plain ware because these seemed to have — in contrast to the painted specimens — more similarity to Hellenistic and Roman pottery of the Near East. It became apparent that it is possible to class the Nabataean fine ware into three groups with the frequently occurring shallow bowls and plates as leading shapes.[10]

The first group includes mostly vessels which are derived from the Hellenistic wealth of shapes. On the one hand we are dealing with fairly high bowls with incurving rims and considerable diameters (FIG. 1:1) and on the other with shallow plates and dishes with more or less incurving rims (FIG. 1:2-4). Apart from these shapes,

1 The Following abbreviations will be used in this paper:
Preliminary Report 1988: R. A. Stucky und Mitarbeiter, Schweizer Ausgrabungen in Ez Zantur, Petra. Vorbericht der Kampagne 1988, *ADAJ* 34, 1990, 249-283.
Preliminary Report 1989: R. A. Stucky *et al.* Swiss-Liechtenstein Excavations at ez-Zantur in Petra 1989. The Second Campaign, *ADAJ* 35, 1991, 251-273.
Preliminary Report 1991: R. A. Stucky *et al.*, Swiss-Liechtenstein Excavations at ez-Zantur in Petra 1991. The Third Campaign, ADAJ 36, 1992, 175-192.
Preliminary Report 1993: R. A. Stucky *et al.*, Swiss-Liechtenstein Excavations at ez-Zantur in Petra. The Fifth Campaign, *ADAJ* 38, 1994, 271-292.

2 G. Horsfield and A. Conway, *The Geographical Journal* 76, 1930, 359ff.; N. Glueck, *AASOR* 14, 1933-34, 74ff.; for a short synopsis on the history of research with the relevant quotations see R. Wenning, Das Nabatäerreich, in: H.-P. Kuhnen, *Palästina in griechisch-römischer Zeit, HdArch* II 2 (1990) 414.

3 K. Schmitt-Korte, *Archäologischer Anzeiger* 1968, 496-519; *idem*, in: M. Lindner (ed.), *Petra und das Königreich der Nabatäer* 5 (1989) 205-232.

4 As it is true for most of the finds made in Oboda; see A. Negev, *The Late Hellenistic and Early Roman Pottery of Nabatean Oboda, Qedem* 22 (1986).

5 P. J. Parr, A Sequence of Pottery from Petra, in: J. A. Sanders (ed.), *Essays in Honor of Nelson Glueck: Near Eastern Archaeology in the Twentieth Century* (1970) 348-381.

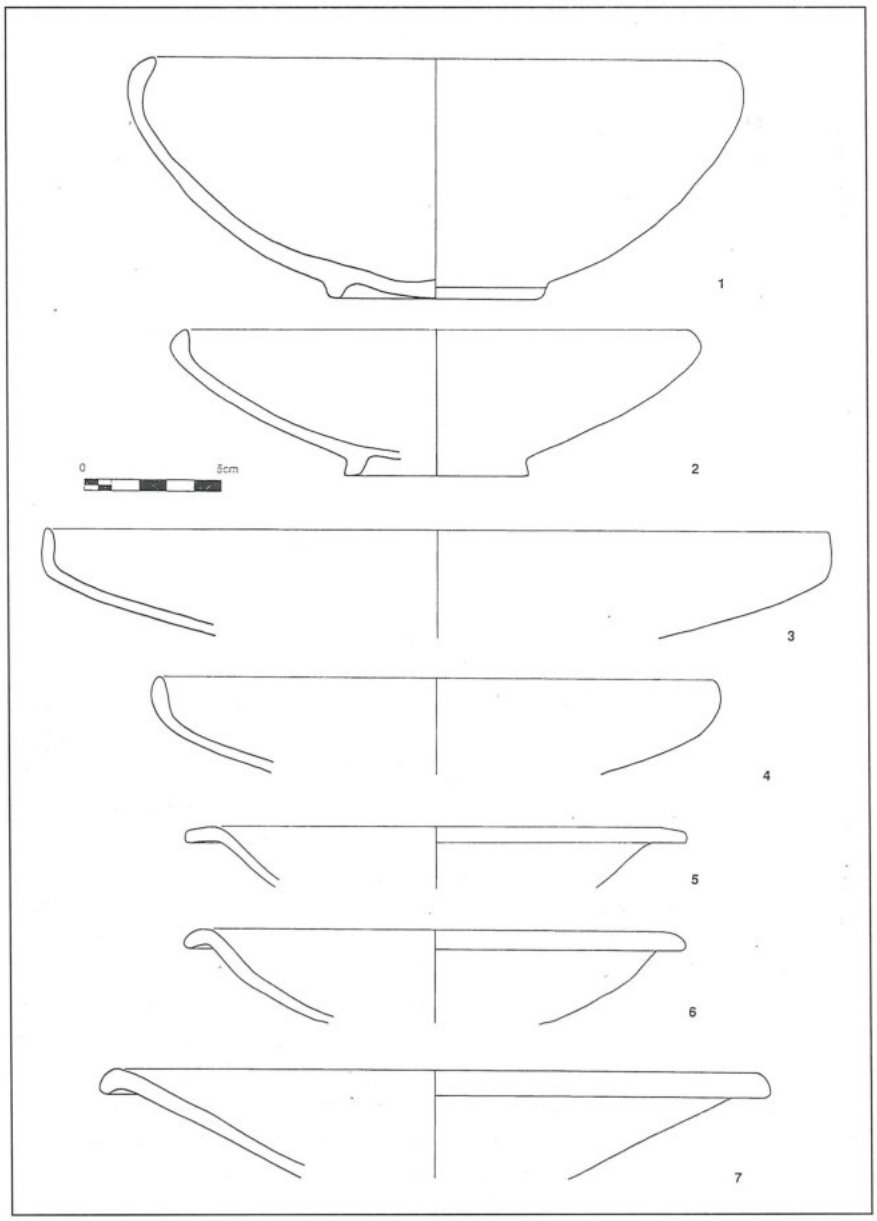
6 M. Weippert, Nabatäisch-römische Keramik aus Hirbert Dor im südlichen Jordanien, *ZDPV* 95, 1979, 87-110; J. P. Zeitler, Houses, Sherds and Bones: Aspects of Daily Life at Petra, in: *The Near East in Antiquity, German Contributions to the Archaeology of Jordan, Palestine, Syria, Lebanon and Egypt.* Vol. 1 (1990) 44ff.

7 K. 'Amr, *The Pottery from Petra. A Neutron Activation Analysis Study,* BAR International Series 324 (1978); J. Gunneweg, I. Perlman and F. Asaro, The Origin, Classification and Chronology of Nabataean Painted Fine Ware, *JbRGZM* 35, 1988, 315-345.

8 See Preliminary Report 1988; Preliminary Report 1989; Preliminary Report 1991 and R. A. Stucky, The Nabataean House and the Urbanistic System of the Habitation Quarters in Petra (in this volume); an abstract on the Late Roman Pottery is given by Y. Gerber and I. Brogli, The Late Roman Pottery from az-Zanṭūr, Petra (in this volume). The catalogue of the exhibition *Petra und die Weihrauchstrasse*, which was shown at Zurich and Basel in 1993 gives further information about the Swiss-Liechtenstein excavations in Petra.

9 The achieved typology of shapes is based mainly on sherds of the Nabataean fine ware of which we registered and catalogued several tens of thousands.

10 See also Preliminary Report 1989 and Preliminary Report 1991. In an unpublished MA thesis from the University of Basel, the author established a typology and a chronology of the most frequent forms of the Nabataean fine ware; the aim of the author's doctoral thesis (preliminary title: *Die Feinkeramik der Nabatäer. Typologie, Chronologie und kulturhistorische Bedeutung)* under the supervision of Prof. Dr. R. A. Stucky at Basel University, will be a more complete study of Nabataean fine ware.



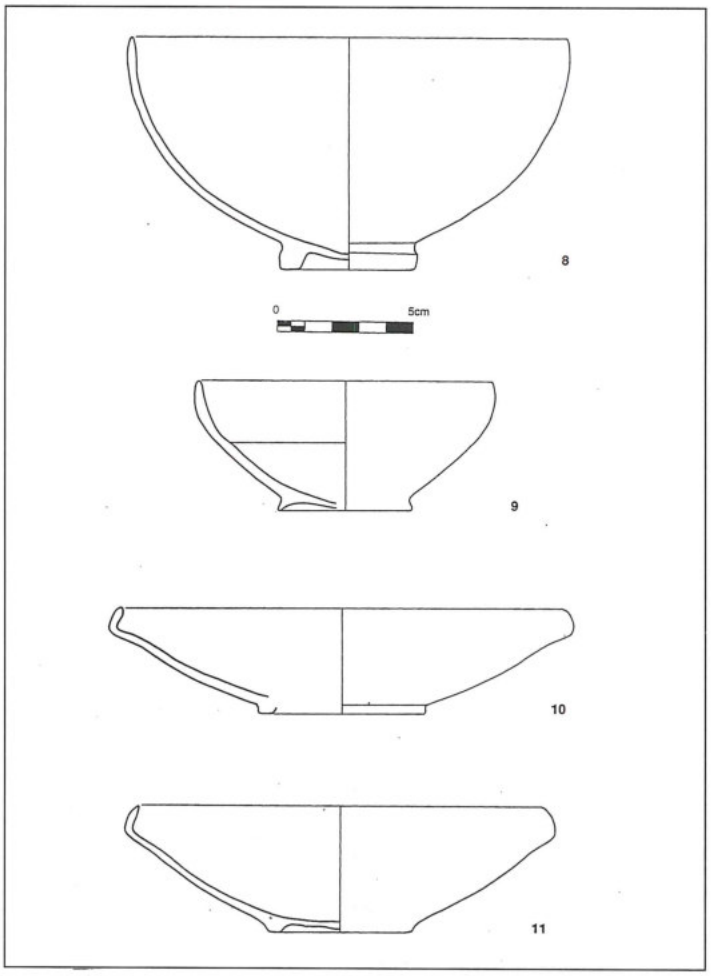

1. Nabataean fine ware forms, Group 1. **1**: Bowl with incurving rim; ware, interior and exterior: 2.5YR 5.5/8 (light) red. **2**: Shallow bowl with slightly incurving and thickened rim; ware: 2.5YR 5.5/8 (light) red; interior: 2.5YR 6/8 light red; exterior: 2.5YR 5.5/8 (light) red. **3**: Shallow bowl with vertical rim; ware: 7.5YR 6/3 pinkish gray/light brown; interior and exterior: 10R 4/6 red. **4**: Shallow bowl with incurving rim; ware: 2.5YR (light) red 5.5/8; interior: 10R 5/7 red; exterior: 2.5YR 5.5/8 (light) red. **5**: Plate with projecting rim; ware: 10R 6/8 light red; interior and exterior: 5YR 6.5/6 reddish yellow. **6**: Plate with slightly outturned rim; ware: 10R 6/8 light red; interior: 5YR 6/4 light reddish brown; exterior: 10R/2.5YR 5/8 red. **7**: Plate with slightly outturned rim; ware: 2.5YR 6/8 light red; interior: 10R 4.5/8 red; exterior: 2.5YR 6/8 light red.

there are sporadic plates with outturned rims (FIG. 1:5-7). A characteristic of these sherds is the mainly reddish slip which may sometimes merge into reddish brown.[11] A further distinctive mark is the "normal" wall thickness, that is to say the thickness of the sherds corresponds to that of comparable pottery from Hellenistic sites and is far from the finesse of the egg-shell ware.

A second group already shows indications of an independent development; the shapes get more elegant and the wall thickness decreases considerably. The most important representatives of this group are hemispherical bowls (FIG. 2:8-9) and shallow bowls with incurving rims (FIG. 2:10-11). Beside these shapes, we sporadically find dishes with projecting rims. Compared to the first group, the frequency of sherds with reddish slip is smaller. Specimens made of light, orange coloured clay predominate; they often show a white slip on the exterior, beneath the rim.

The third group reflects a further and final refinement of the shaping. This ware has a thickness of only a few millimetres and the clay is fired to a metallic hardness. In this group the open shapes predominate as well, mainly represented by shallow bowls with vertical rims which are either left plain (FIG. 3:13) or are decorated

[11] The preference for a reddish ware fits well into the picture of Near Eastern Hellenistic pottery; generally speaking it seems that the Greek prototypes of shapes have been readily imitated but rarely the Greek black glazed decoration. This special liking for red pottery leads finally to the initiation of the Eastern Sigillata; see L. Hannestad, Change and Conservatism. Hellenistic Pottery in Mesopotamia and Iran, in: *Akten des XIII. Internationalen Kongresses für Klassische Archäologie,* Berlin 1988 (1990) 179-186.



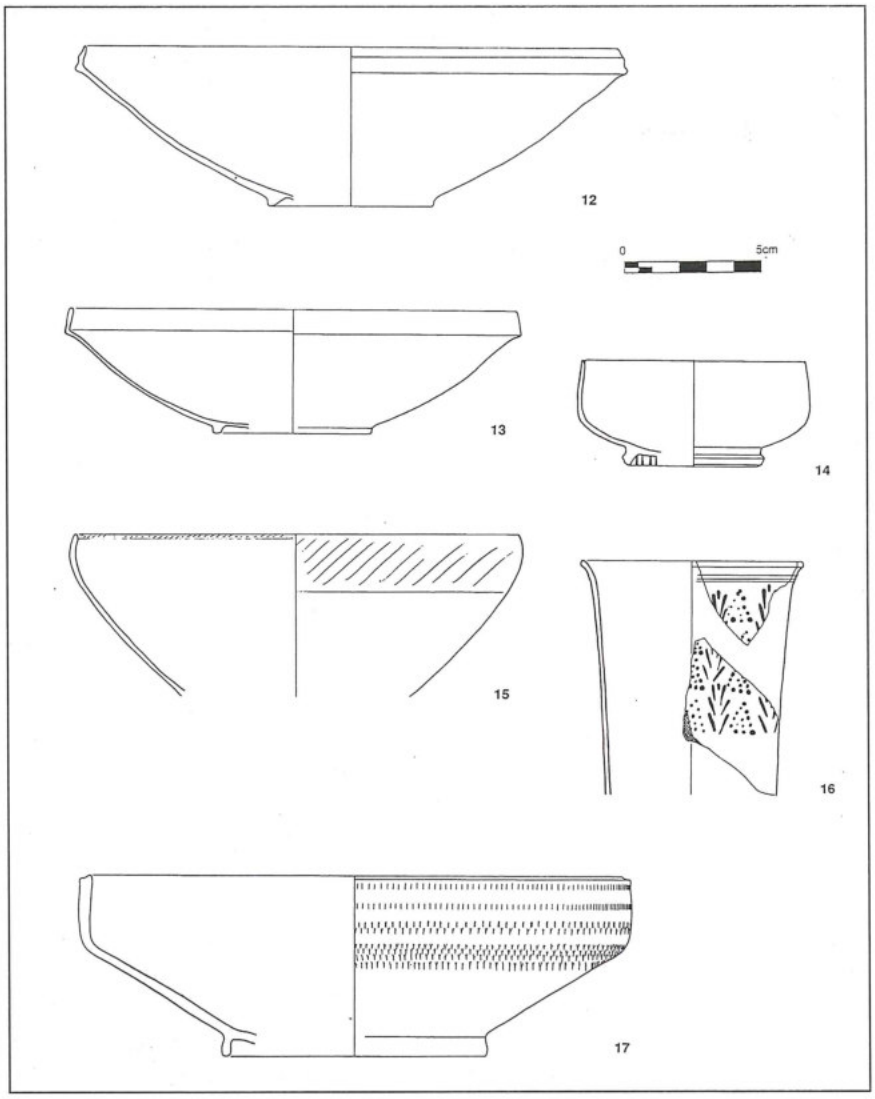

2. Nabataean fine ware forms, Group 2. **8**: Hemispherical bowl; ware: 2.5YR 6/8 light red; interior: 10R 5/4 weak red; exterior: 5YR 6/6 reddish yellow, upper part with slip 5YR 5/2 reddish gray. **9**: Hemispherical bowl; ware: 10R 6/8 light red; interior: 2.5YR 5.5/8 (light) red; exterior: 2.5YR 6/7 light red, upper part with slip 5YR 3/1.5 very dark gray/dark reddish brown. **10**: Shallow bowl with incurving rim; ware: 2.5YR 5.5/8 (light) red; interior and exterior: 2.5YR 5.5/2 pale red/weak red, upper part of exterior with slip 2.5YR N4/2 dark gray/weak red. **11**: Shallow bowl with incurving rim; ware, interior and exterior: 2.5YR 6/8 light red, upper part of exterior with slip 7.5YR 8/4 pink.

with ridges (FIG. 3:12). Also a very common shape is the small, somewhat deeper bowl (FIG. 3:14) and the further developed variant of the thin-walled hemispherical bowl — known from our group 2 — which shows incurving rims (FIG. 3:15). Dishes with projecting rims which appeared sporadically in groups 1 and 2 are missing here completely.

The considerations on the formal development of the Nabataean fine ware were confirmed by the analysis of the stratigraphical sequences in different trenches and soundings on our terrace beneath az-Zanṭūr (FIG. 4). Specimens representing the first group were found in the lowest strata of our large trench EZ II (FIG. 5, layers 9-31) as well as in the lowest strata of soundings A (FIG. 6, layers 19-21), D, E and F. Vessels assigned to the second group were recovered in strata somewhat above the ones aforementioned in trenches A (FIG. 6, layers 1-18), D, E and generally in sounding B as well as in some layers of the large trench EZII (FIG. 5, layers 2-16). A common feature of these finds is that they were recovered under the level of the pavements belonging to the Nabataean house built at the end of the first century BC or at the beginning of the first century AD.[12] The forms belonging to the third group were found directly on the pavement and just outside the house in a thick layer of ashes that was interspersed with quantities of pottery (FIG. 4, trench C; FIG. 7, layer 2). A comparable thick layer of ashes, again full of sherds that belong to group 3 was found on the terrace beneath our main excavation. The recovered pottery was encrusted with ash and a few specimens showed blisters and cracks resulting from extreme heat. Under the destruction layer, we came upon the collapsed remains of a once sumptuous building (FIG. 7, layer 3b); in its debris pottery belonging to the third group was again found. The conclusion that we are dealing here with evidence of a destruction is unquestionable but the reasons for the fire remain unclear.

The collected statistics and the analysis of the different stratigraphies prove that the separation of the formal groups into three subsequent phases in a relative chronology is justifiable: In strata with pottery of one par-

[12] For the Nabataean building see Preliminary Report 1988, 258; Preliminary Report 1989, 258ff.; Preliminary Report 1991, 175ff.; R. A. Stucky, Das nabatäische Wohnhaus und das urbanistische System der Wohnquartiere in Petra, *Antike Kunst* 35, 1992, 129ff.; *idem,* The Nabataean House and the Urbanistic System of the Habitation Quarters in Petra (in this volume).




3. Nabataean fine ware forms, Group 3. **12**: Shallow bowl with vertical moulded rim; ware: 10R 6/8 light red; interior and exterior: 10R/2.5YR 6/8 light red. **13**: Shallow bowl with vertical rim; ware, interior and exterior: 2.5YR 4.5/8 red. **14**: Small deep bowl; ware, interior and exterior: 2.5YR 6/8 light red. **15**: Thin walled bowl with incurving rim; ware, interior and exterior: 10R 6/7 light red, upper part of exterior with slip 7.5YR 8/4 pink. **16**: Cup with impressed decoration; ware and interior: 2.5YR 6/7 light red; exterior: 2.5YR 5/8 red. **17**: Bowl with moulded lip and rouletted decoration; ware, interior and exterior: 2.5YR 6/7 light red.

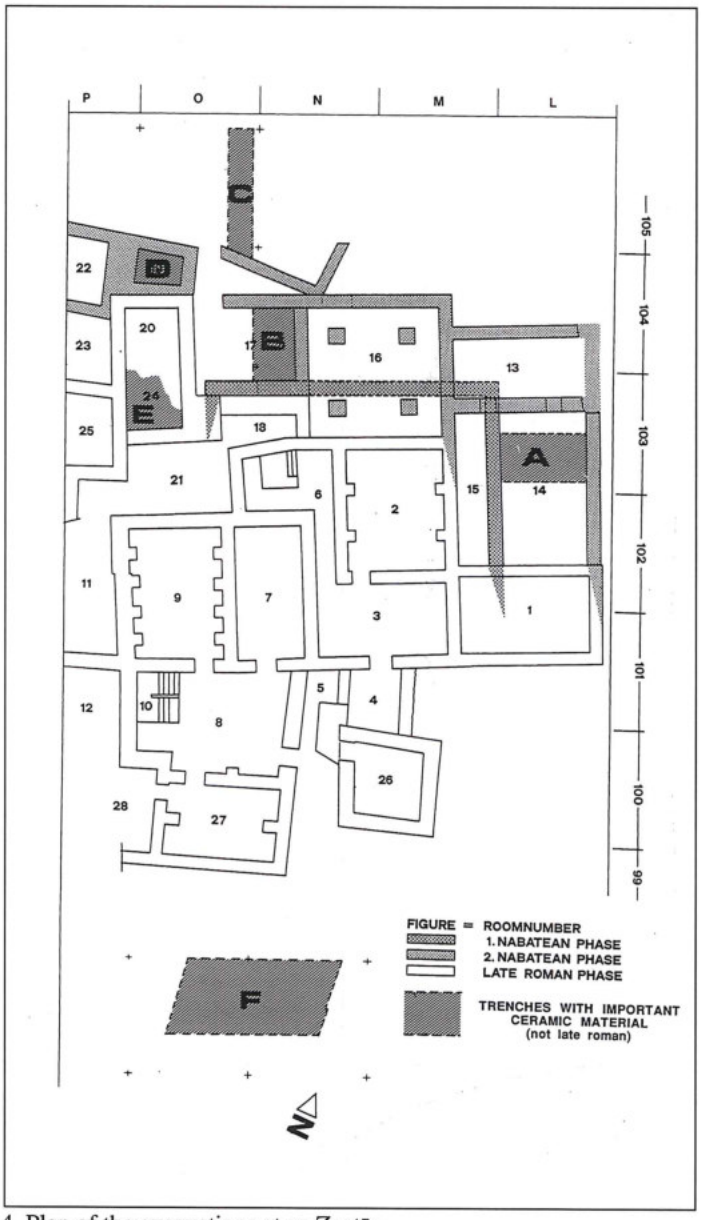
ticular group, sherds of another group were not or rarely found.

The question of the chronological position of the different phases remains to be answered. Because of the large quantity of fine ware recovered from the excavations, we could establish many combinations with datable objects such as terracotta lamps, coins and imported pottery. As a start, Eastern Sigillata A gives fairly reliable criteria for the dating of the fine ware found in combination with it.[13]

The strata with ceramics of phase 1 also produced Sigillata of the shapes Hayes 2A, 2B, 4A, 9, 18, 19A and 19B, which allow a dating of phase 1 in the late second and the early first century BC. Fine ware of phase 2 was found in conjunction with several fragments of Sigillata Hayes 7, 22B and 45. Accordingly we may establish an approximate dating of phase 2 in the second half of the first century BC to about AD 20. Most interesting in this context are the finds made directly on the pavement of the Nabataean house that must have been built — according to the numismatic evidence — during the reign of Aretas IV. The recovered pottery in question showed hardly a shape belonging to phase 2; the vast majority of the sherds could be assigned to phase 3. Consequently phase 2 must have come to an end in the first decades of the first century AD. Phase 3 runs from then on to the destruction of the house which is datable — on account of the recovered Sigillata Hayes 51, 54, 56, 58 and 60A — to about AD 100.

Graphically expressed the situation looks as follows (see FIGS. 8 and 9). The transition from one phase to the other must not necessarily be abrupt. It is imaginable that two phases coexisted for a certain time. Because the main material of phase 3 was recovered from destruction layers dating around AD 100, it is not possible yet to define the transition in a closer sense. At least the coin ev-

[13] In the following all shapes will be quoted after J. W. Hayes, Sigillate orientali, in: *Atlante delle forme ceramiche* II (Enciclopedia dell'arte antica, 1985) 1ff.; the numbers relate to Hayes numbering of the Eastern Sigillata A; see also Preliminary Report 1989.




4. Plan of the excavations at az-Zanṭūr.

idence shows that the change from phase 2 to phase 3 must have happened during the reign of Aretas IV. Three coins of his early reign were found in strata under the pavement, i.e. in strata with pottery of phase 2; five coins of his later reign were found with fine ware of phase 3 (cf. FIG. 9).[14]

Further investigations on the pottery will concentrate on a refinement of the chronologically differentiable typology, which will allow us to classify less common shapes as well. Even now it is possible to make some statements in connection with certain other shapes of fine ware.

Not a single vessel with rouletted or impressed decoration (FIG. 3:16-17) occurred in strata assignable to phase 1 and 2 but numerous examples were found in strata of phase 3, that is to say an analogous dating of these characteristic decorations is probable.[15]

The reported observations and preliminary results were not limited to the plain Nabataean fine ware but included the painted fine ware as well. Proceeding in just the same way — by distinguishing types of forms and analysis of the stratigraphical correlations — it was again possible to define three groups.[16] The earliest group consists of deep bowls which are carelessly painted with thinly applied pale red slip. The patterns of decoration consist mainly of straight and undulating lines which cut across each other at the bottom of the vessels (FIG. 10:18-19); furthermore, the rims may show a bead-like decoration. Another group consists of thin walled bowls painted with branches of palmettes which may radiate from the bottom of the vessel (FIG. 10:21) or run concentrically around the vessel's body (FIG. 10:20). The rims of these bowls are slightly incurved, whereas the examples with the radial decoration show an additional "step" in the wall (FIG. 10:20). The third group is made of very delicate bowls with diminished rims. These bowls are usually painted with stylised palmettes and rhomboid to trapezoid motifs which generally are interconnected with hatchings of the same dark brown to nearly black colour (FIG. 10:22).

Not only the clear distinction of the shapes and the schemes of decoration but most of all the regular co-finds of corresponding unpainted sherds allow a doubtless assignment to the chronological phases defined above. Accordingly, the simple painted examples belong to about the second half of the second and the first half of the first century BC[17] and are our earliest witnesses of Nabataean ceramics.[18] In the second half of the first century BC, the "realistic" florally painted sherds occur, and in the first century AD the dark coloured ones appear.[19]

14 See also S. G. Schmid, Die Feinkeramik der Nabatäer, in: *Petra und die Weihrauchstrasse,* Exhibition catalogue Zurich/Basel (1993) 55ff.

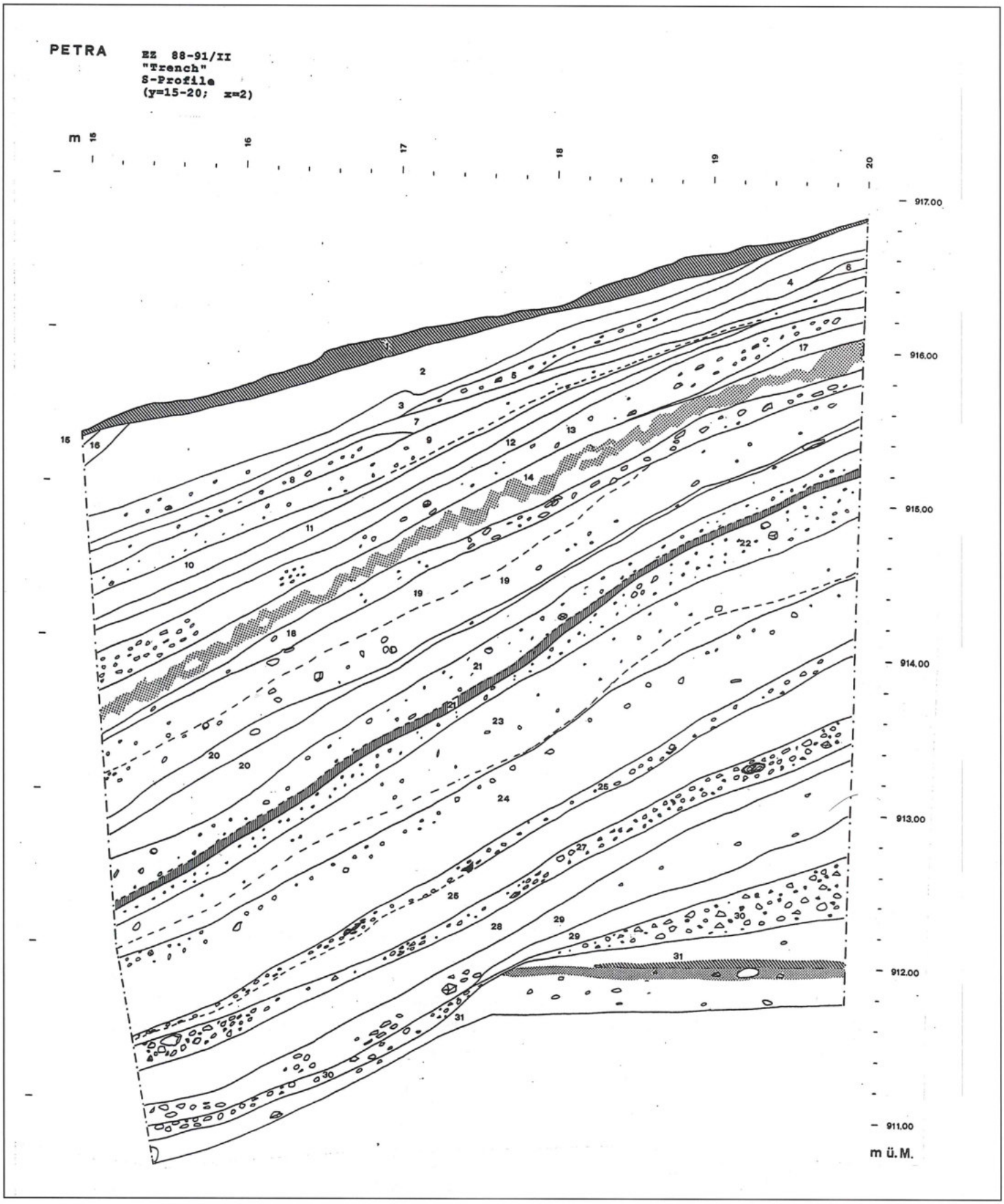
15 For the decorated Nabataean pottery see also N. I. Khairy, Fine Nabataean Ware with Impressed and Rouletted Decorations, in: A. Hadidi (ed.), *Studies in the History and Archaeology of Jordan I* (1982) 275-283.

16 For the groups see also Preliminary Report 1989.

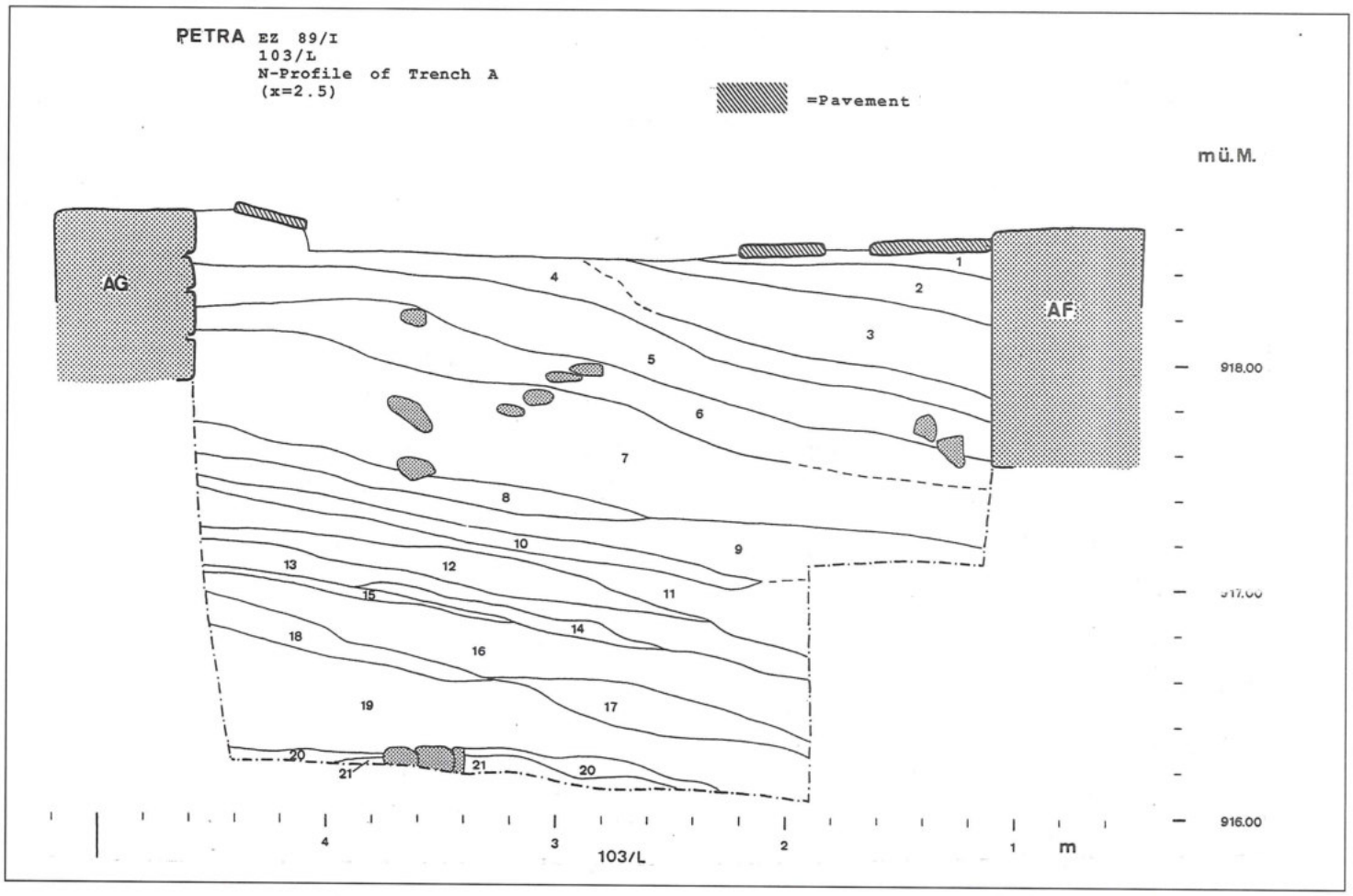
17 Because nowhere in our excavation have we reached the bedrock, not even in the over 5m deep stratigraphical trench EZ II, it is not possible to say when phase 1 starts. On account of ESA (Hayes 2A), our earliest documented strata should not be earlier than about the second half of the second century BC.

18 The smooth transition to phase 2 justifies the term Nabataean, and the opinion that the painted pottery starts only in phase 2 (so K. Schmitt-Korte, in: M. Lidner (ed.), *Petra und das Königreich der Nabatäer* 5 (1989) 220; *idem, Archäologischer Anzeiger* 1968, 500ff.) must be revised.

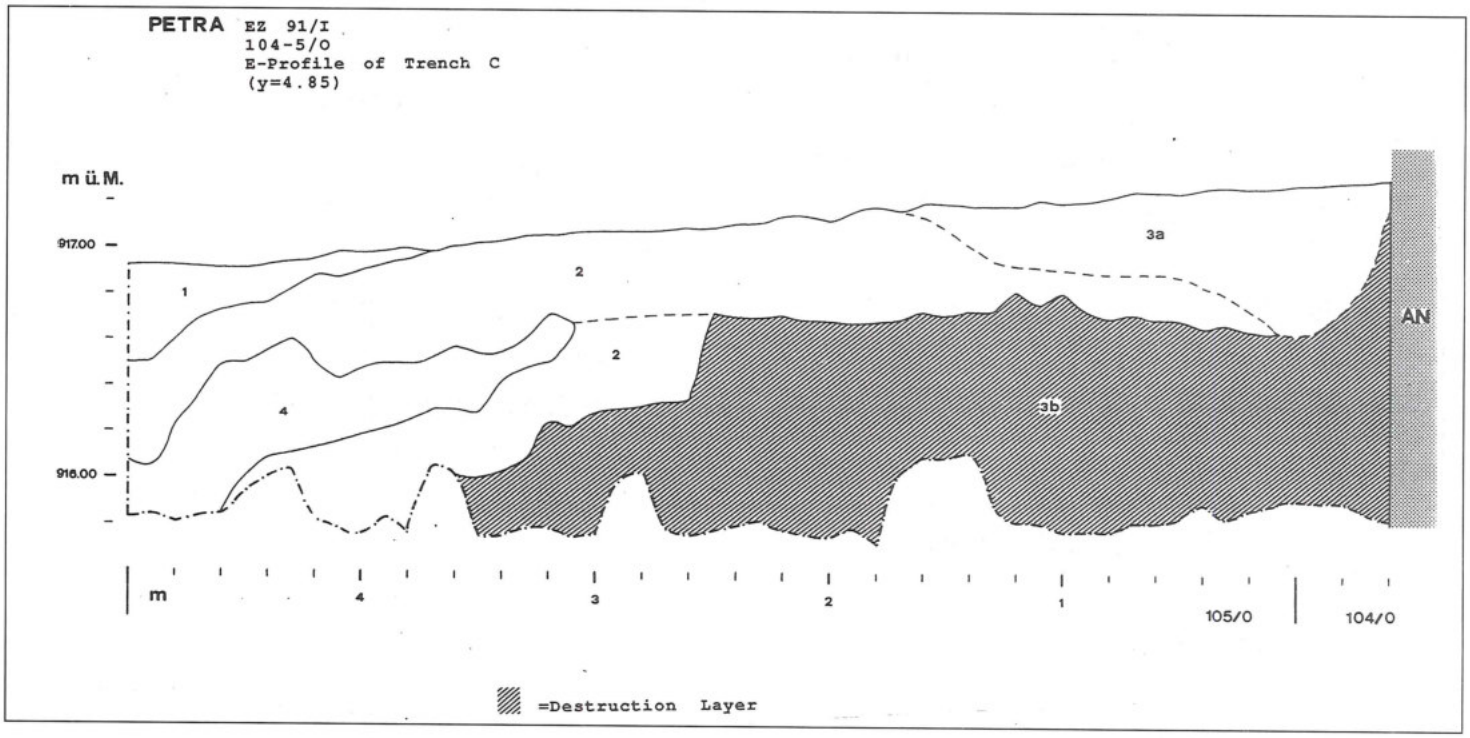
19 It is not certain that the same break in about AD 100 happened elsewhere in Petra; cf. the kilns discovered near Petra in which the potters seem to have continued producing the known types: F. Zayadine, *ADAJ* 26, 1982, 380ff.; K. 'Amr, *ADAJ* 35, 1991, 313ff. The fact that the tradition of painted pottery was maintained in later times is proved by some painted specimens found in destruction layers from AD 363 on az-Zanṭūr; cf. Preliminary Report 1988, 269 FIG. 8 N-R. On the other hand there are other places showing comparable destruction layers with corresponding fine ware pottery; see for example F. Villeneuve, The Pottery from the Oil-factory at Khirbet edh-Dharih (2nd Century AD), *ARAM* 2, 1990, 367ff.



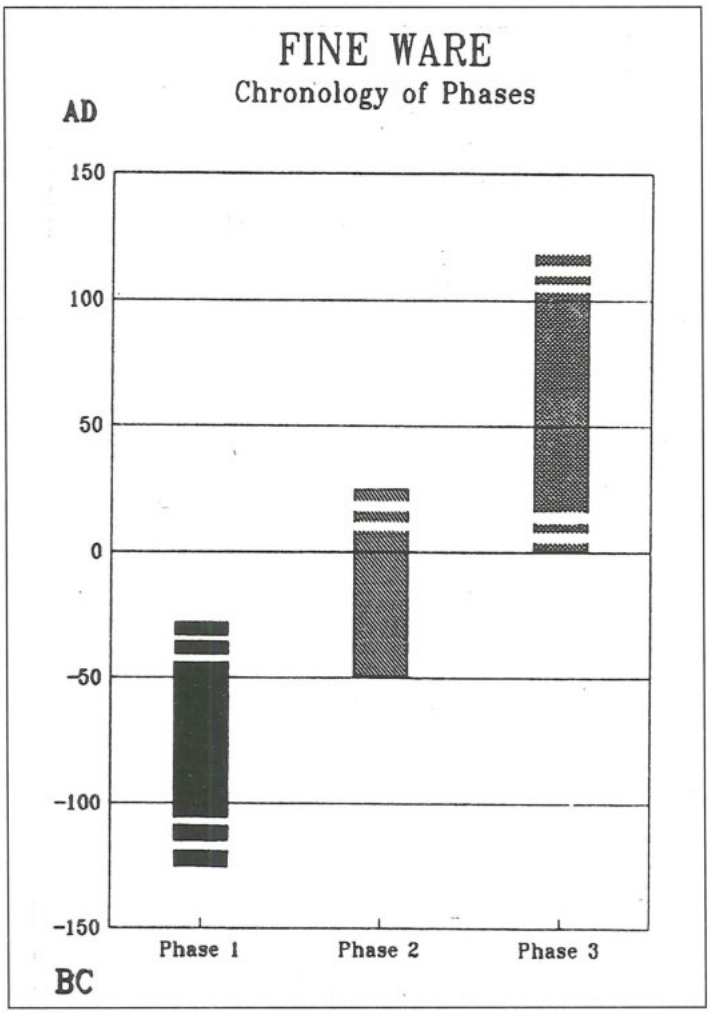

5. Az-Zanṭūr: Trench EZ II, southern section.




6. Az-Zanṭūr: Trench A, northern section.




7. Az-Zanṭūr: Trench C, eastern section.




8. Chronology of the Nabataean fine ware phases.

That there was not a clear break from one phase to the next but a continous development is illustrated by painted bowls like the one shown on FIG. 11. The shape is a mix between the characteristic forms of phase 2 and 3 (cf. FIG. 10:20, 22) and the decoration shows the same palmettes as in the case of the late examples of phase 2 close to the rim, but on the inside motives typical of phase 3 occur.

Until now very few examples of Nabataean pottery with figural decoration are known.[20] The four campaigns of the Swiss-Liechtenstein excavations at Petra produced some examples which allow further interpretations. Absolutely unique is the sherd with a bearded male face painted in polychrome (FIG. 12).[21] It should be noted that the paint was applied after firing. The sherd was found in a layer with phase 2 material and one could be tempted to declare it as imported from a centre of Hellenistic pottery production in Egypt or Syria. But very close to the polychrome sherd, a rim sherd with the shape of a "commonly" painted Nabataean bowl was found, showing the characteristic drops at the rim as well as polychrome painting on its body.[22] This observation and the fact that both sherds show identical traces of manufacturing on the outside prove that they belong to the same bowl which was originally a "commonly" painted bowl of phase 2 with a painted figural scene in polychrome. Another unusual example shows a figural scene (FIG. 13).[23] A squat bird with a marked beak is depicted in the centre of the vessel. Around the bird are two human figures and two quadrupeds which can be identified as donkeys due to their long ears. The whole scene is framed by two rows of dots and a palmette.[24] The somewhat clumsily painted figures and the carelessly painted floral ornaments could invite a dating in the third or fourth century AD. But this bowl shows exactly the same shape as the bowls characteristic of phase 3 (cf. FIG. 10:22)[25] and it was found in the thick destruction layer dateable to about AD 100 or shortly afterwards.[26] Obviously the Nabataean potters were much more familiar with the floral elements of decoration than with figural scenes.[27]

To sum up, we may declare that it is possible to divide the fine ware found on az-Zanṭūr into three groups which show clear distinctions concerning typology of shapes and relative chronology. Thanks to the fact that we found the different shapes of fine ware together with numerous sherds of Eastern Sigillata A which are most helpful in dating the Nabataean pottery, we succeeded in formulating a chronological scheme for the different groups and in establishing a classification in phases on this ground (FIG. 9). Consequently, we may say that the spectrum of shapes represented in the Nabataean pottery in its earliest so far identifiable phase corresponds more or less to that of other Hellenistic sites in this area.[28] The second phase shows on the one hand a development and refinement of the latter shapes and on the other the first

[20] For a short abstract see Preliminary Report 1991, 181ff.

[21] See also Preliminary Report 1989, 263 PL. VI: 2; S. G. Schmid, Die Feinkeramik der Nabatäer, in: *Petra und die Weihrauchstrasse*, Exhibition catalogue Zurich/Basel (1993) FIG. 58.

[22] See preliminary Report 1991 PL. VI: 1.

[23] Cf. Preliminary Report 1991 PL. V: 2 and FIG. 5 with a tentative reconstruction; see also S. G. Schmid, Die Feinkeramik der Nabatäer, in: *Petra und die Weihrauchstrasse*, Exhibition catalogue Zurich/Basel (1993) FIG. 121; during the 1993 campaign more fragments belonging to this bowl were found and allowed for a new reconstrcution (see also Preliminary Report 1993).

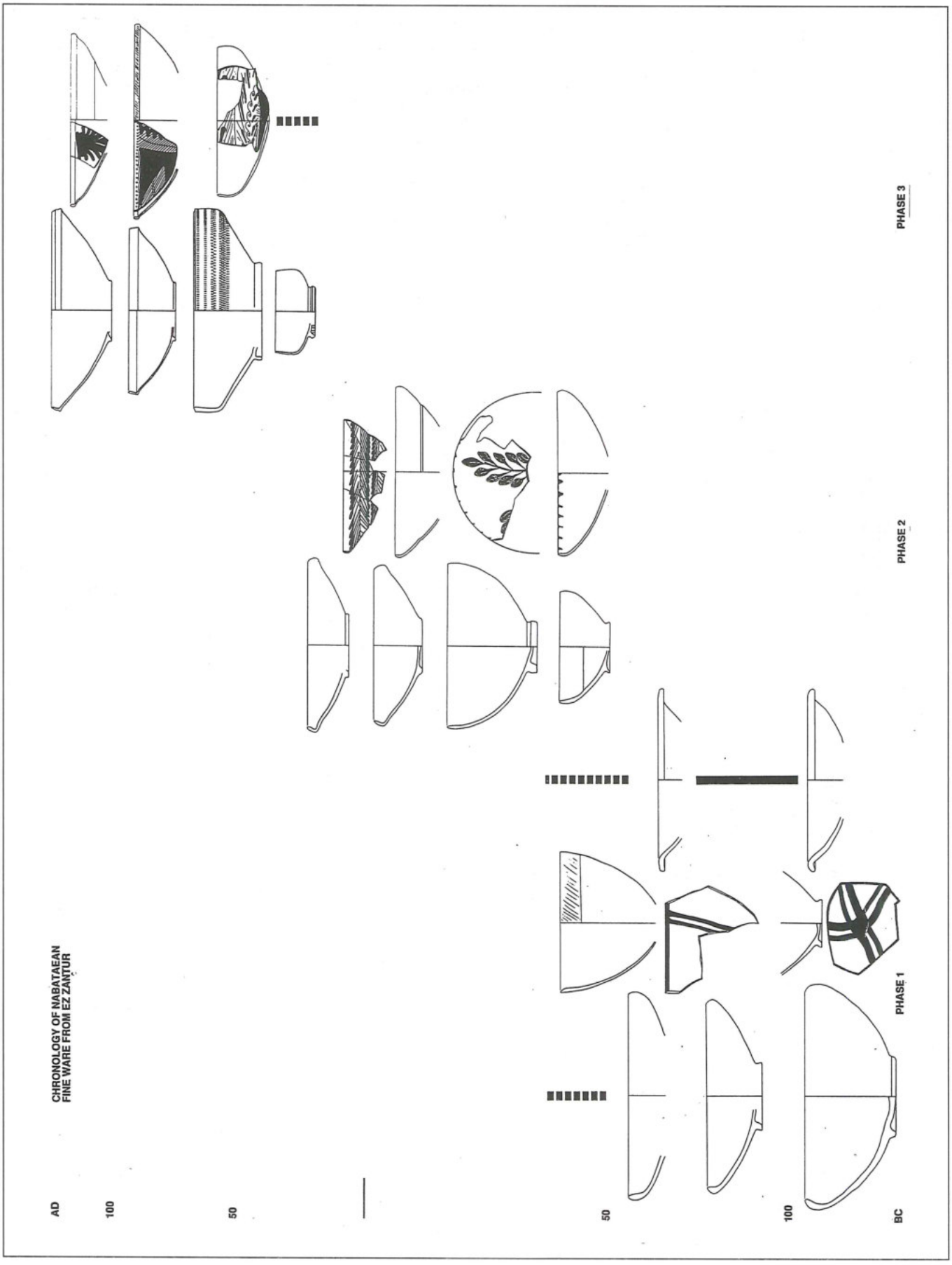
[24] As for painting and ware, K. Schmitt-Korte showed a very similar specimen from his private collection at the Fifth International Conference on the History and Archaeology of Jordan.

[25] See Preliminary Report 1991 FIGS. 5 and 9.

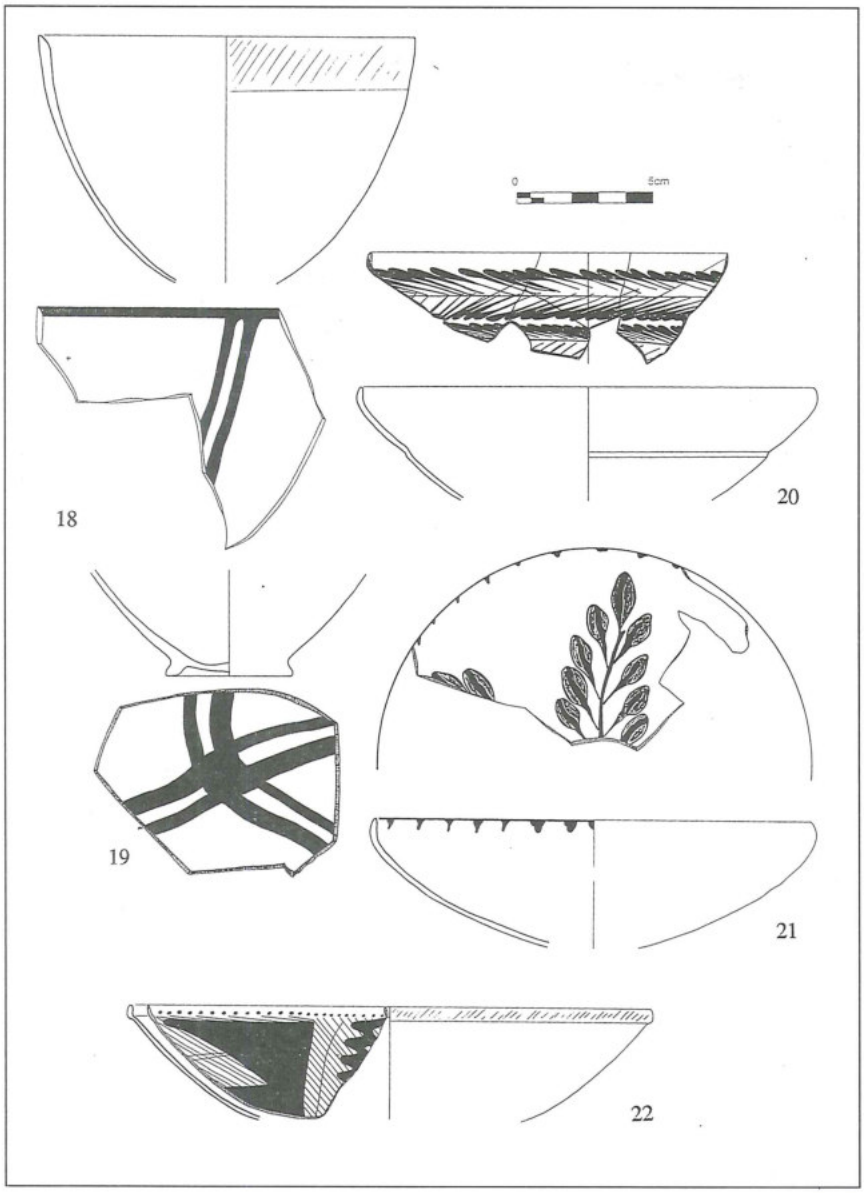
[26] Cf. *supra* and Preliminary Report 1991, 180f.

[27] This observation may be connected with some kind of prohibition of figural representation, as was suggested by J. Patrich, Prohibition of a Graven Image Among the Nabataeans: The Evidence and its Significance, *ARAM* 2, 1990, 185ff. But in recent times the quantity of figurally painted fine ware increased considerably so that this thesis should be re-examined.

[28] Cf. for example A. McNicoll, R. H. Smith and B. Hennessy, *Pella in Jordan* 1, Plates and Illustrations (1982) 137 No. 3. 7-10; 139 No. 5. 6. 10. 12; 141 No. 4. 5. 9.



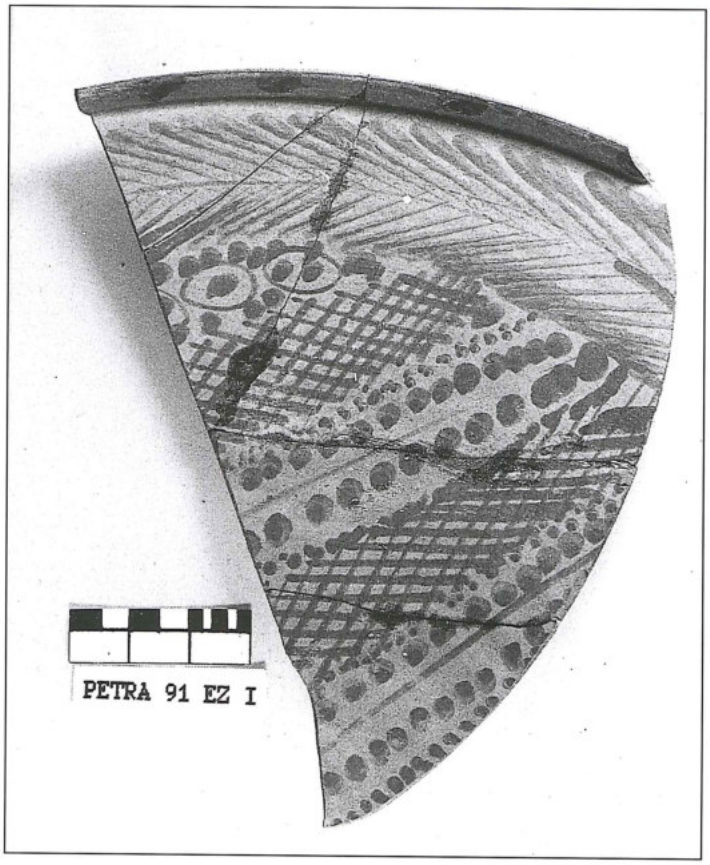

9. Typology and chronology of the Nabataean fine ware.



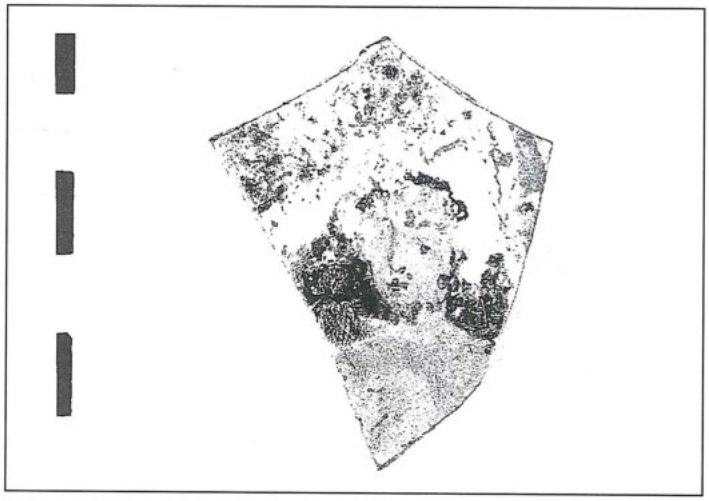

10. Painted Nabataean ware. **18**: Deep bowl with simple painting; ware, interior and exterior: 2.5YR 6/8 light red, upper part of exterior with slip 10R 5/8 red; painting: 10R 5/8 red, very thin. **19**: Bottom of a deep bowl with simple painting; ware, interior and exterior: 2.5YR 6/8 light red; painting: 10R 4/6 red. **20**: Shallow painted bowl with incurving rim and accentuated wall; ware, interior and exterior: 2.5YR 6/8 light red, upper part of exterior with slip 10R 4/6 red; painting: 10R 4/6 red. **21**: Shallow painted bowl with incurving rim; ware and interior: 2.5YR 6/8 light red; exterior and painting: 10R 4/7 red. **22**: Shallow painted bowl with a diminished rim; ware, interior and exterior: 2.5YR 5.5/8 (light) red; painting: 2.5YR 4/4 reddish brown.

steps to an independent conception of pottery; this is all the more true for the painted decoration. During the third phase the Nabataean potters freed themselves entirely from the given prototypes and even the plain fine ware shows since then completely new shapes.[29]

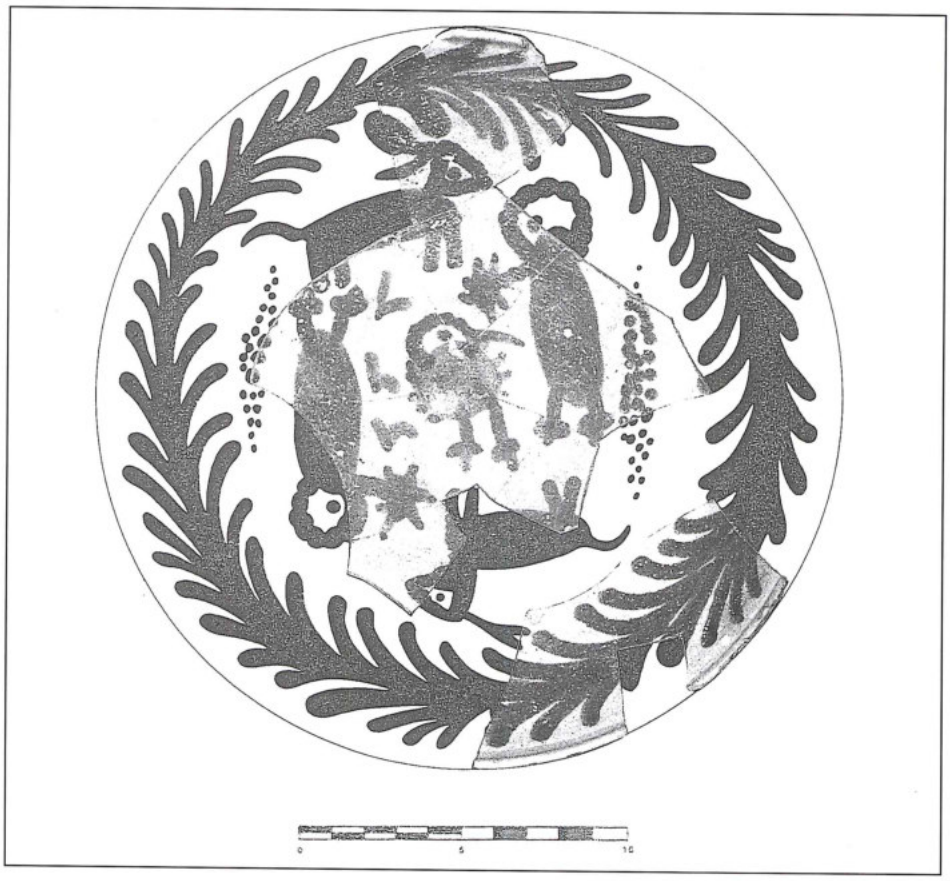
[29] Since the presentation of this paper, further results allowed a more detailed differentiation into phases and sub-phases that are described in: Preliminary Report 1993.




11. Part of a painted bowl with palmettes and geometric motives.



12. Sherd with a bearded male face painted in polychrome.



13. Nabataean painted bowl with a figural scene.

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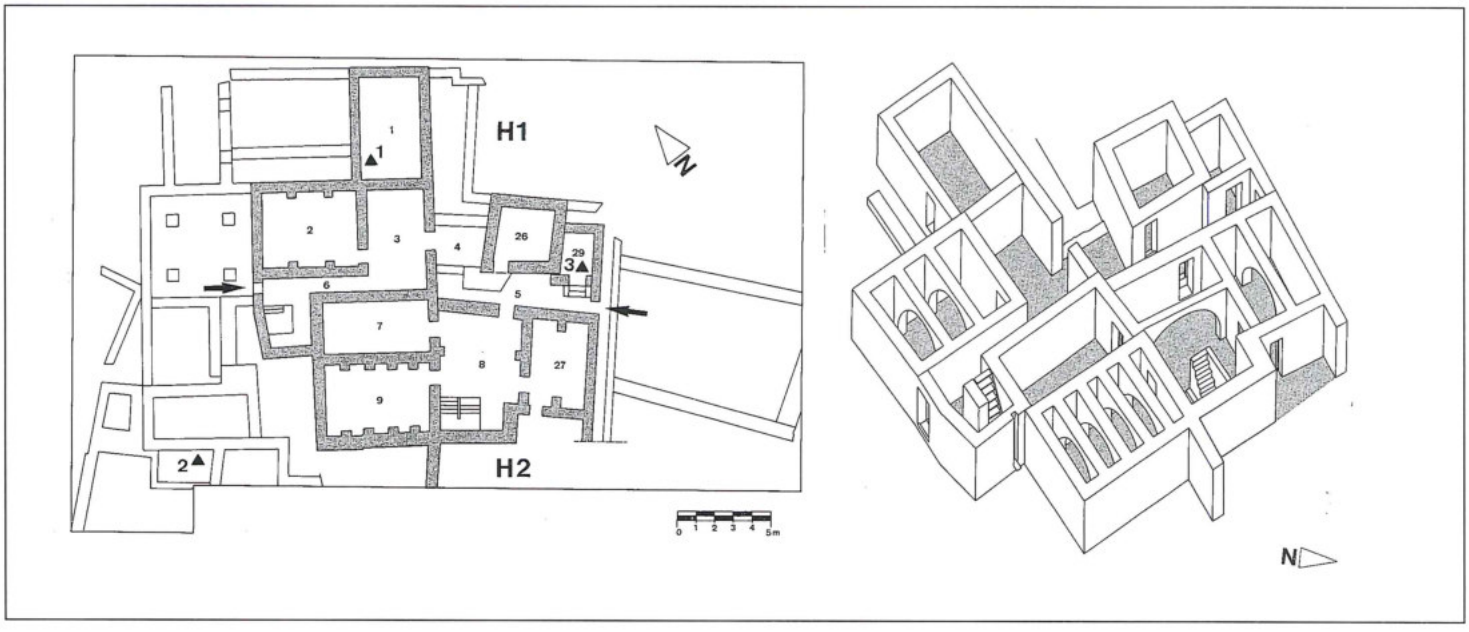
# Late Roman Pottery from az-Zanṭūr, Petra*

Since 1988, a team of archaeologists from the Archaeological Institute of the University of Basel, Switzerland, has been working under the direction of Prof. Dr. R. A. Stucky on the terrace beneath az-Zanṭūr in Petra. The main purpose of the project is to study Nabataean private architecture in the city of Petra. On our site we discovered remains of a Nabataean house that was destroyed in the early second century AD and overbuilt almost completely at the beginning of the fourth century by the two Late Roman houses H1 and H2 (FIG. 1) .

House 1 includes rooms 2, 3, 4 and 6. Room 2, which originally had an upper storey, opens onto court 3. The staircase of house 1 lies on the right of the front door, in an annexe of corridor 6 and led to the upper floor of room 2. Room 4 seems to have been some kind of a vestibule which connected house 1 to the free standing utility rooms 26 and 29. Room 26 with its two *ṭawābīn* was the bakehouse that was used as common property by the inhabitants of both houses. Northeast of court 3 lies room 1. Room 1 was not part of house 1 but a separate one-room dwelling with its doorway on its northwest side. House 2 consists of the rooms 7, 9, 27, 28 and court 8, where a well preserved staircase led to the upper floor of rooms 9 and 27 .

Within the Late Roman structures three coin hoards were recovered in association with pottery (FIG. 1): The first hoard was found in room 1, the second in room 29 and a third hoard southwest of house 2, in room 23. The coins allow us to date the associated pottery to the middle of the fourth century AD and give us a good idea of the cooking ware of that time. This is important because of the still tenuous ceramic chronology of Late Roman




1. Petra, az-Zanṭūr: Late Roman houses H1 and H2, with the locations of coin hoards 1 (1988), 2 (1989) and 3 (1991).

* In the present report we can discuss only small part of the commonware pottery found in the excavations of az-Zanṭūr, Petra. We plan to publish the Nabataean and Roman commonware pottery in the near future. See for the Late Roman pottery R. Fellmann Brogli, 'Die Keramik aus den spätrömischen häusern von Ez Zantur, Petra', in the forthcoming publication *Petra*Vol. I, of the Swiss-Liechtenstein excavations at az-Zanṭūr.

and Early Byzantine commonware pottery.

During our first campaign in 1988,[1] we discovered the skeletons of a woman and a child in room 1. Between the woman's ankles we collected 65 bronze coins, the contents of a purse that had been hanging from her belt. The analysis of the coins revealed that there were mainly two types,[2] one issued after AD 351 and the other after AD 358.

We know from a letter attributed to Bishop Cyrillus that on May 19th, AD 363 a shattering earthquake had destroyed Jerusalem and Petra as well as other cities in this area.[3] It is beyond all doubt that the finds from room 1 must be linked with the earthquake destruction of AD 363. The woman and the child must have been surprised by the violent seismic shocks and were buried together with the domestic articles stored in room 1 by the collapsing walls.

**Pottery from Room 1: A Selection of Forms (FIGS. 2–8)**

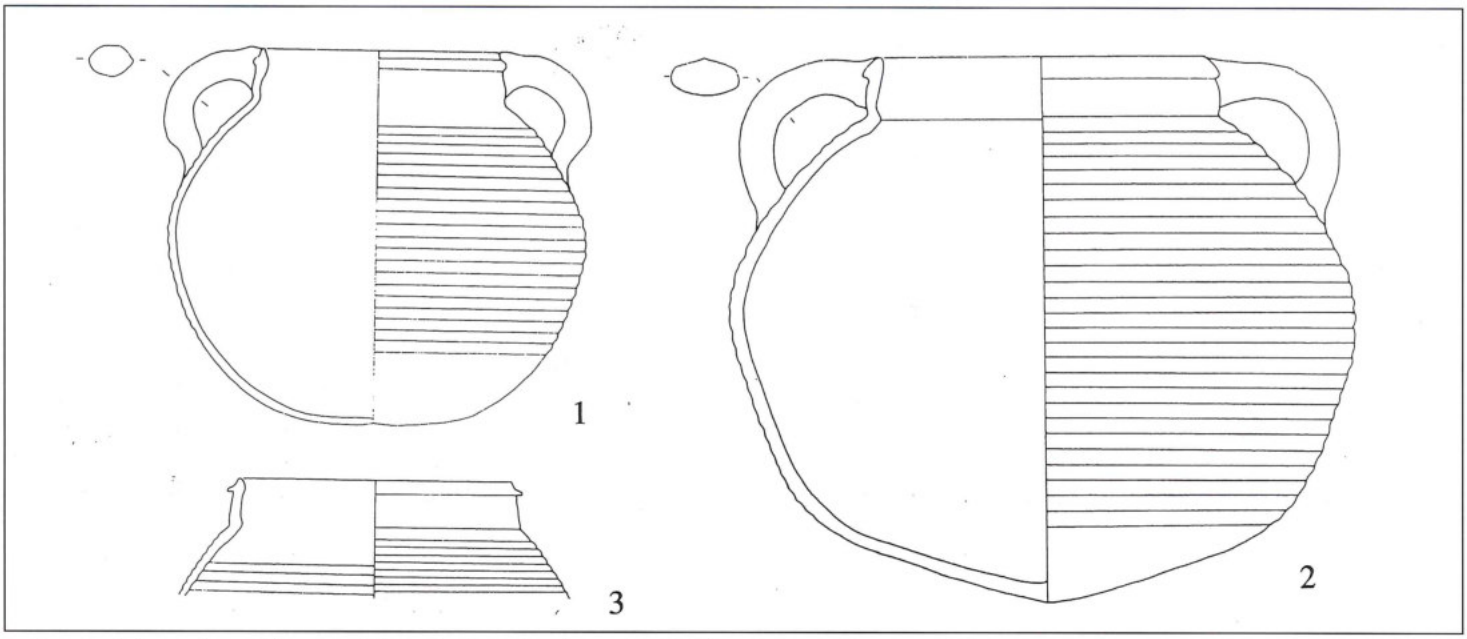
The pottery has generally rather thick walls, is of a roughly tempered ware, unpolished on the exterior, sometimes with a whitish-grey slip. Representative forms include two-handled cooking pots with almost globular bodies and vertical rims bearing a simple ridge (FIG. 2:1) or vertical rims ending in a bevelled lip (FIG. 2:2, 3). Cooking pots of the latter type were already known in Nabataean times but differ from the Late Roman examples by their thinner and finer ware. The production of cooking pots of the first type starts only in the course of the Roman ceramic manufacture.

Also characteristic are jars with large, elongated ovoid bodies and vertical rims bearing a horizontal groove (FIG. 3). At least one almost completely preserved jar of this type has only one handle. It is safe to assume that the jars were used as storage vessels.

The inventary of room 1 also included jugs with slightly flaring or vertical rims and cylindrical bodies (FIG. 4:1, 2) or with globular bodies and profiled rims (FIG. 4:3-5) as well as bottles, small jugs, lids and small bowls (FIG. 5).

Large bowls with almost horizontal moulded rims (FIG. 6:1) are only known from Late Roman commonware pottery. A small bowl with high and profiled foot (FIGS. 6:2; 7) has no parallels. It is decorated with notched moldings and an incised wavy line.

Some of the cooking pots and storage vessels are decorated as well: they show incised wavy lines on their necks and shoulders (FIG. 8:1). Incised wavy lines combined with notched mouldings embellish the neck and shoulder of a large jar (FIG. 8:2). Comparable decorations consisting of notched mouldings, at times combined with incised wavy lines, can be found in the Late Roman/Byzantine material from Mount Nebo.[4] Very similar decoration can also be found on vessels from Buṣra[5] but with the difference that the bands of notched mouldings are used there mainly as decoration of basins




2. Petra, az-Zanṭūr: 1. cooking pot with vertical rim bearing a simple ridge; 2, 3. cooking pots with vertical rims ending in a bevelled lip (scale 1:3).

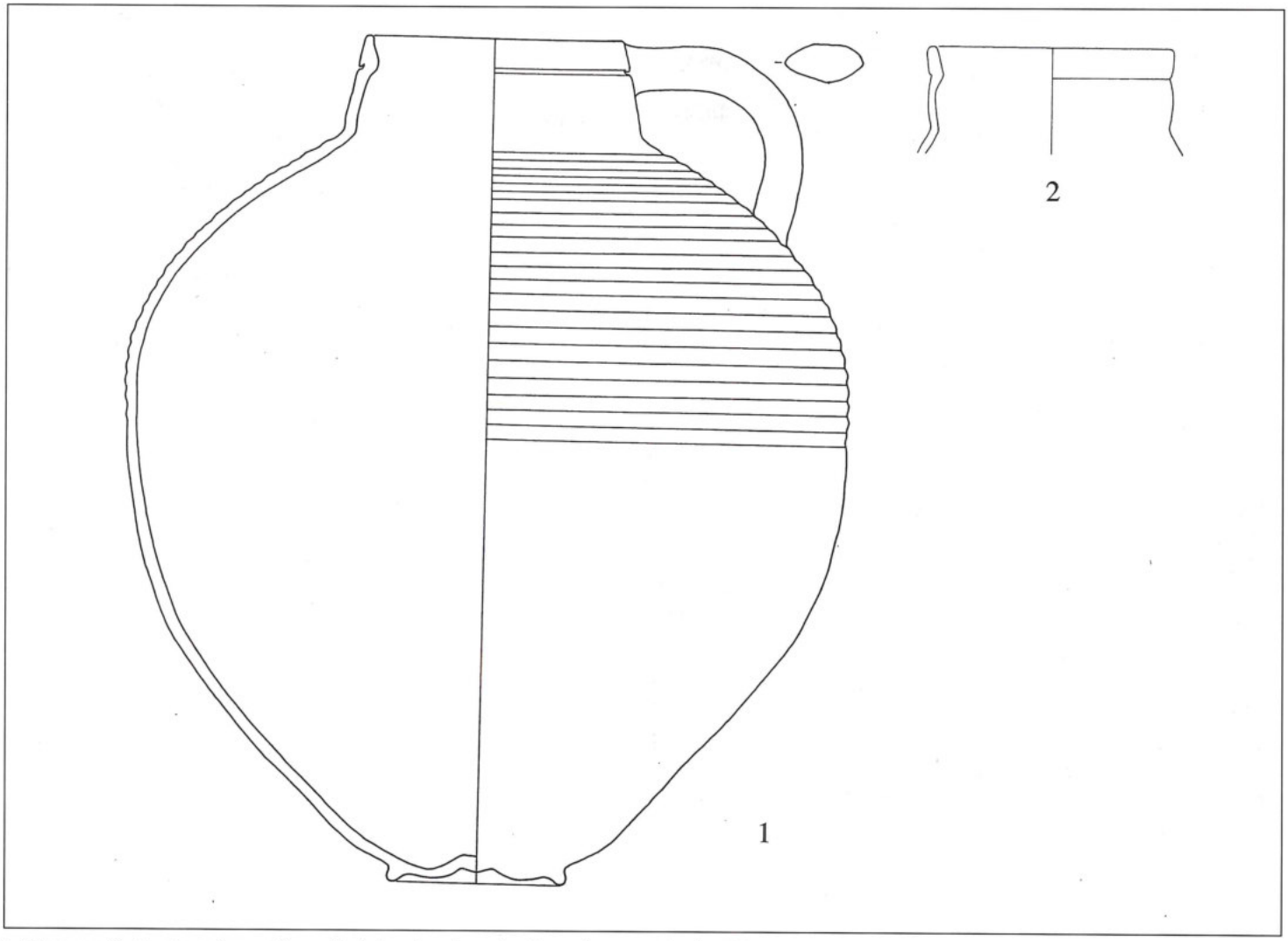
[1] See R. A. Stucky und Mitarbeiter, 'Schweizer Ausgrabungen in Ez Zantur, Petra. Vorbericht der Kampagne 1988', *ADAJ* 34 (1990), pp. 258-283.

[2] For details see R. A. Stucky und Mitarbeiter, *ADAJ* 34 (1990), pp. 270-271.

[3] For further and detailed information, refer to K. Russell, 'The Earthquake of May, 19th A.D. 363', *BASOR* 238 (1980), pp. 47-64.

[4] S. Saller, *The Memorial of Moses on Mount Nebo, Part II. The Plates*. Jerusalem, 1941, PLS. 152; 155,10.11; H; Schneider, *The Memorial of Moses on Mount Nebo, Part III. The Pottery*. Jerusalem, 1950, p. 75 FIG. 7,1.

[5] J. Wilson and M. Sa'd, 'The Domestic Material of Busra from the Nabataean to the Umayyad Periods', *Berytus* 32 (1984), pp. 69ff. FIGS. 231, 270, 271, 273, 477-485.




3. Petra, az-Zanṭūr: large jars with vertical rims bearing a horizontal groove (scale 1:3).

and rarely occur on the shoulders and necks of vessels.

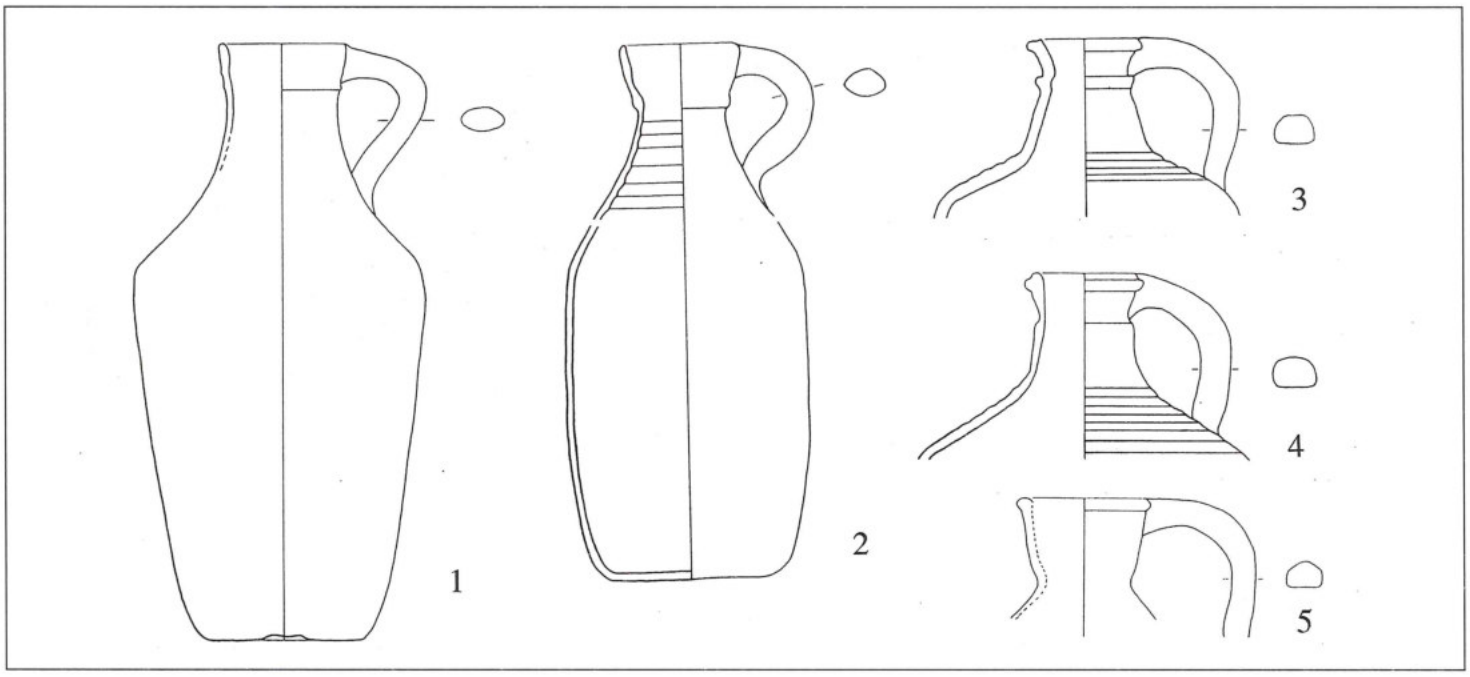
**Pottery from Rooms 23 and 29 (FIGS. 9 - 11)**

To the important pottery ensemble of room 1, we should add a few other vessels which were found associated with the coin hoards 2 and 3 in rooms 23 and 29. Northeast of the Late Roman House 1, in the eastern corner of room 23 (FIG. 1), we discovered in 1989 three large storage vessels and a mortar made of a column drum.[6] Between the storage vessels there was a small pot which was apparantly used as a deposit for saving and was not recovered after the earthquake of AD 363. It contained 180 bronze coins and — regarding their dates of issue — they corresponded perfectly with the hoard found in room 1. The same was true for the 26 coins recovered in 1991, which were associated with Late Roman pottery in room 29 (FIG. 1).[7] Consequently the pottery found together with the hoards in rooms 23 and 29 must have been in use in the seventh decade of the fourth century AD.

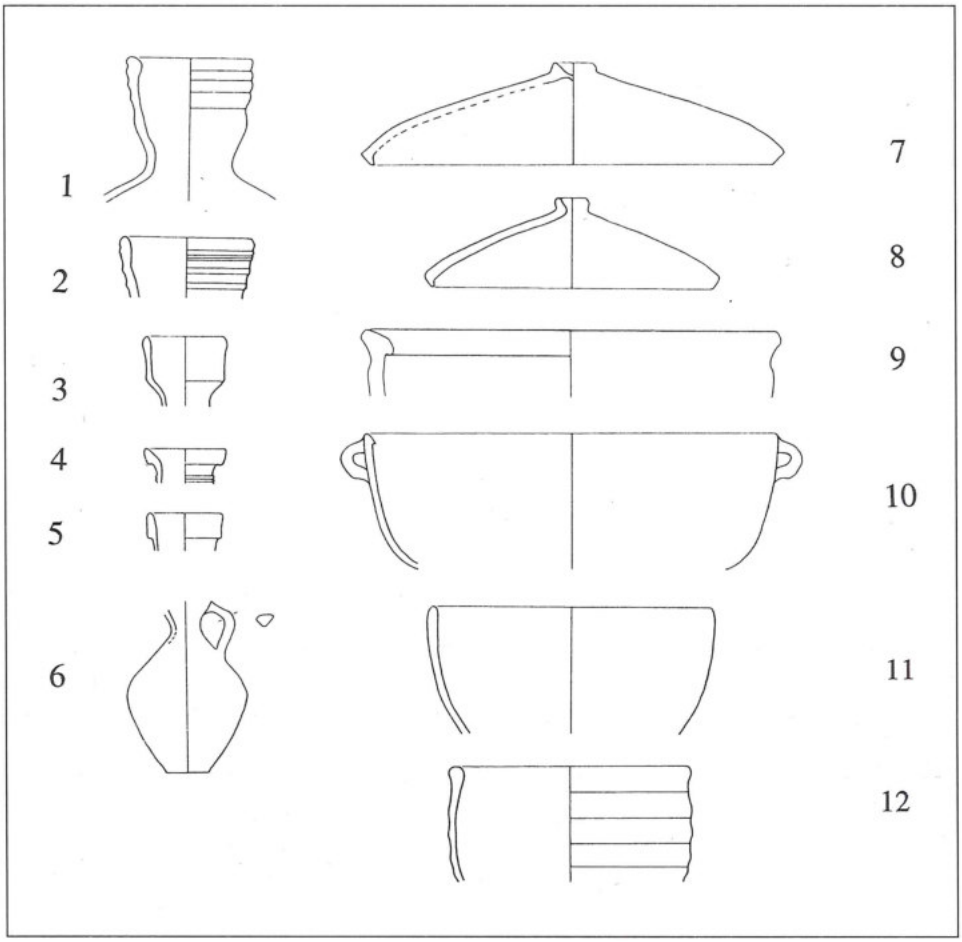
The shapes and decoration of the vessels found in room 23 are very similar to those found in room 1. This is especially true for the globular two-handled cooking pots with a vertical rim bearing a simple ridge (FIG. 9:1) as well as for the large bowl with an almost horizontal moulded rim (FIG. 9:2, 3). Already well known is the incised wavy decoration on the neck and shoulder (FIG. 9:4). The small cooking pot (FIGS. 9:5; 10) which contained the coin hoard, is, compared to other Late Roman commonware pottery, of remarkably fine ware and small size. In contrast to these specimens, two completely preserved vessels found together with the third coin hoard in room 29 are of yet unknown forms. One is a completely preserved small bottle with a globular body, a narrow neck and a profiled rim (FIG. 11:1). The other is a small one-handled pan with a small spout (FIG. 11:2). Since the vessel has no signs of having been used on fire, it may

[6] See R. A. Stucky *et al.*, 'Swiss-Liechtenstein Excavations at ez-Zantur in Petra 1989. The Second Campaign', *ADAJ* 35 (1991), pp. 251-258.

[7] See R. A. Stucky *et al.*, 'Swiss-Liechtenstein Excavations at ez-Zantur in Petra 1991. The Third Campaign', *ADAJ* 36 (1992), pp. 175-181.



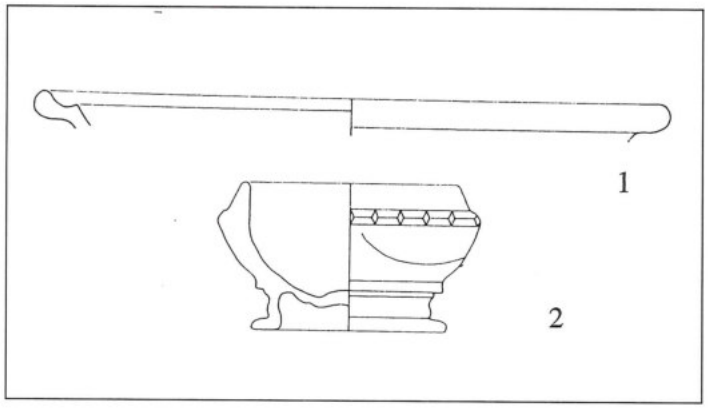

4. Petra, az-Zanṭūr: 1, 2. jugs with vertical rims and cylindrical bodies; 3-5. jugs with globular bodies and profiled rims (scale 1:3).



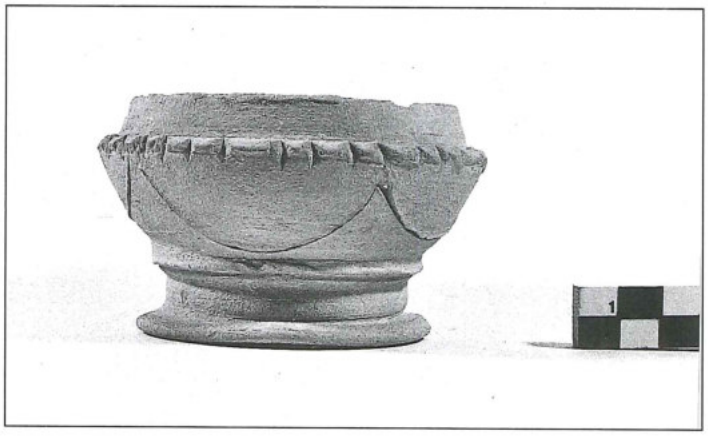

5. Petra, az-Zanṭūr: 1-6. bottles and small jugs; 7, 8. lids; 9-12. small bowls (scale 1:3).

have served as a ladle rather than as a cooking pot.

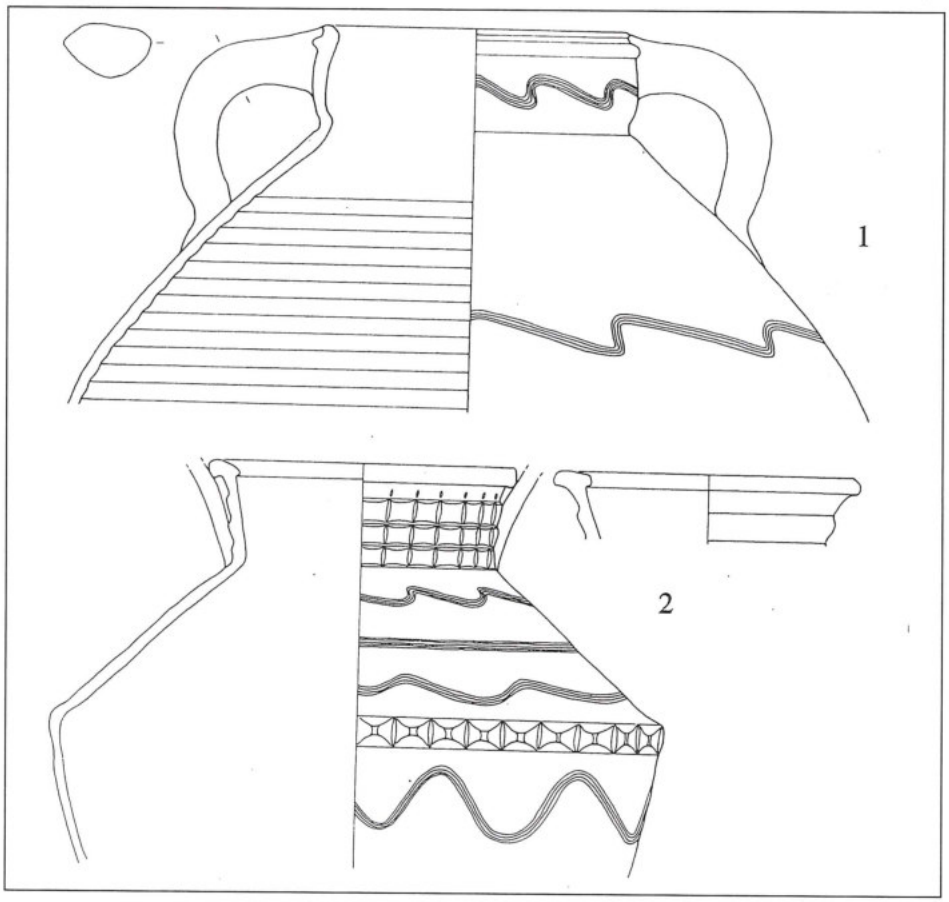
The association of the pottery with coin hoards allowed us to relate it with the *terminus ad quem* of AD 363. Proceeding on the assumption of a rather short time of use, the commonware pottery can be dated to the middle of the fourth century. On other sites in the Palestinian




6. Petra, az-Zanṭūr: 1. large bowl with an almost horizontal moulded rim; 2. small bowl with a high profiled foot (scale 1:3; see FIG. 7).



7. Petra, az-Zanṭūr: small bowl.




8. Petra, az-Zanṭūr: 1. cooking pot with incised wavy lines; 2. large jar with incised wavy lines and notched mouldings (scale 1:3).

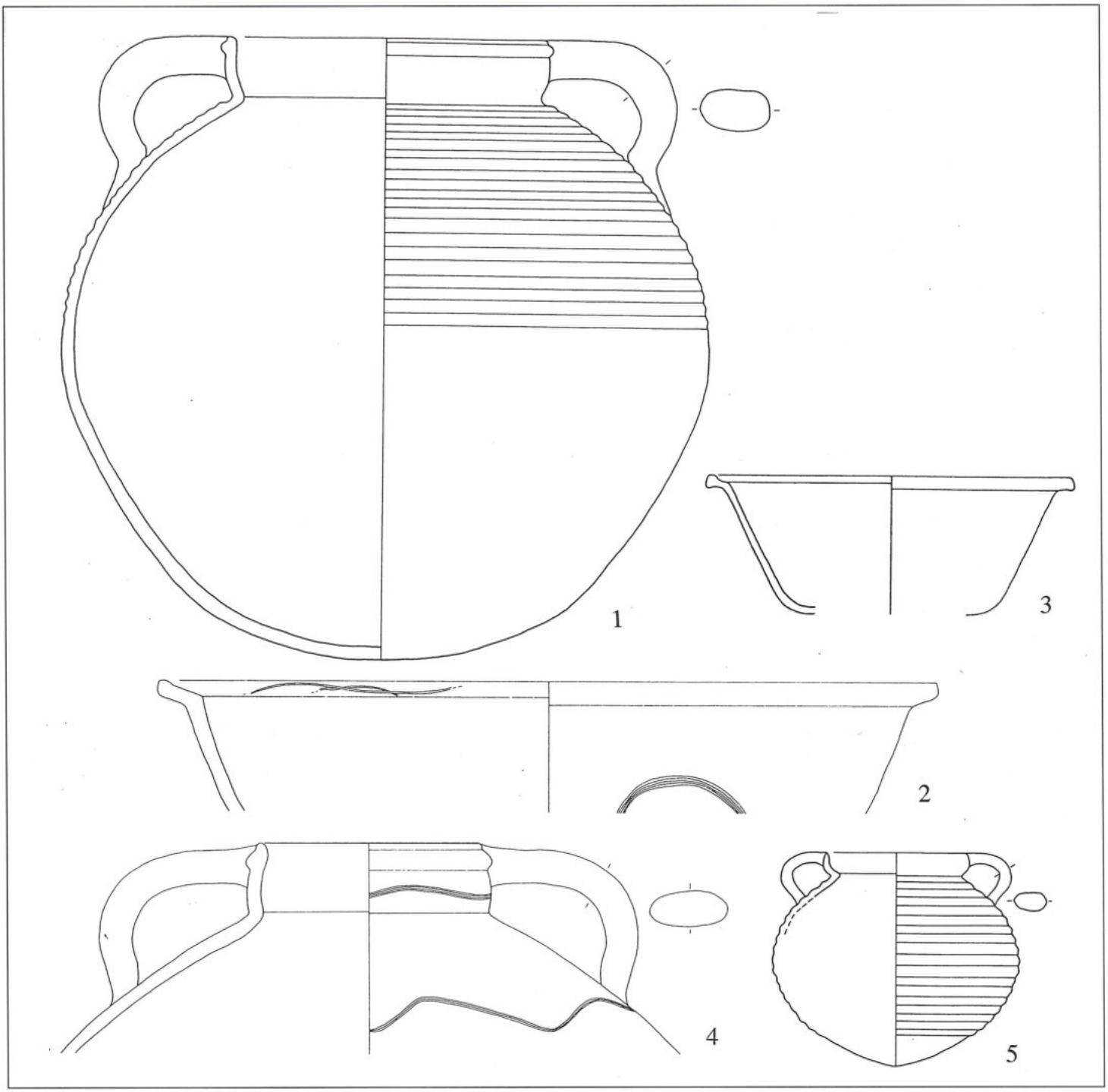
area, the dating of strata with comparable pottery is often problematic and ranges within a span of more than one hundred years, from the mid fourth to the sixth century. There are a few other sites mentioned in the letter attributed to Bishop Cyrillus which show evidence of the earthquake destruction of 363,[8] but as far as we know, the pottery from these sites cannot be dated as safely as at az-Zanṭūr. An unpleasant fact, on the other hand, is that the pottery of the relevant sites and the correlation between coins and stratigraphy are too often left unpublished.

The closest parallels come from two excavations in Petra: the first directed by F. Zayadine on the western slope of al-Khubtha[9] and the second, a trench opened some ninety metres east of the monumental gate by P. Parr.[10] Comparable material was also found in the ex-

8 K. Russell, *BASOR* 238 (1980), pp. 54-60.

9 Compare FIG. 4:1, 2 with F. Zayadine, 'Excavations at Petra (1973-1974)', *ADAJ* 19 (1974), pp. 235f. PLS. LIX FIGS. 3,10; LX FIG. 10.

10 P. Parr, 'A Sequence of Pottery from Petra', in: J. A. Sanders (ed), *Near Eastern Archaeology in the Twentieth Century. Essays in Honor of Nelson Glueck*. New York, 1970, pp. 348-381. Compare FIG. 2:1 with Parr (1970), p. 368 FIG. 7,104.105.116; and FIGS. 6:1; 9:3 with Parr (1970), p. 371 FIG. 8,127.129.




9. Petra, az-Zanṭūr: pottery from room 23. 1. Cooking pot; 2, 3. large bowls; 4. cooking pot with incised wavy line decoration; 5. small cooking pot (scale 1:3; see FIG. 10).

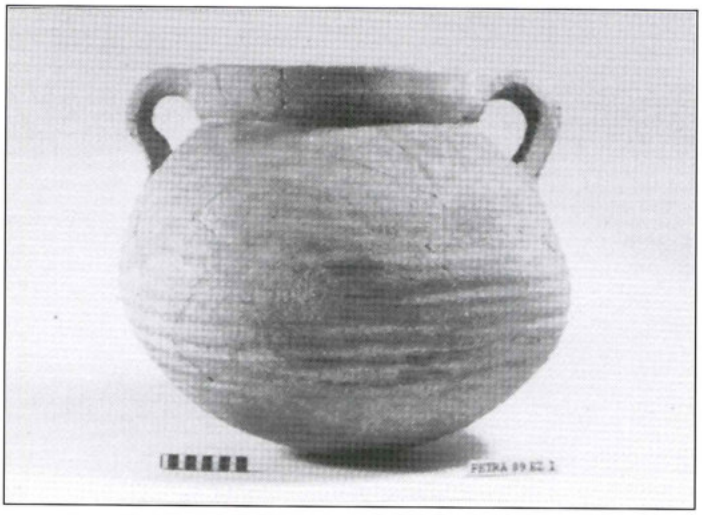
cavations of the "Temple of the Winged Lions" under the direction of P. Hammond. In Area I they unearthed pottery associated with a coin hoard from AD 363.[11]

Further comparable finds were made just outside Petra, in the potters' kilns complex of Zurrāba.[12] Some of the kilns were in use until AD 363 when they were destroyed by the earthquake.[13] Consequently it is possible that the commonware pottery found on az-Zanṭūr was

[11] Unfortunately the associated pottery has not yet been published, except for P. Hammond, 'Excavations at Petra 1975-1977', *ADAJ* 22 (1977-78), p. 232 PLS. XLVI FIG. 2.

[12] F. Zayadine, 'Recent Excavations at Petra (1979-81)', *ADAJ* 26 (1982), pp. 564ff. PLS. CXL; CXLII FIG. 3.

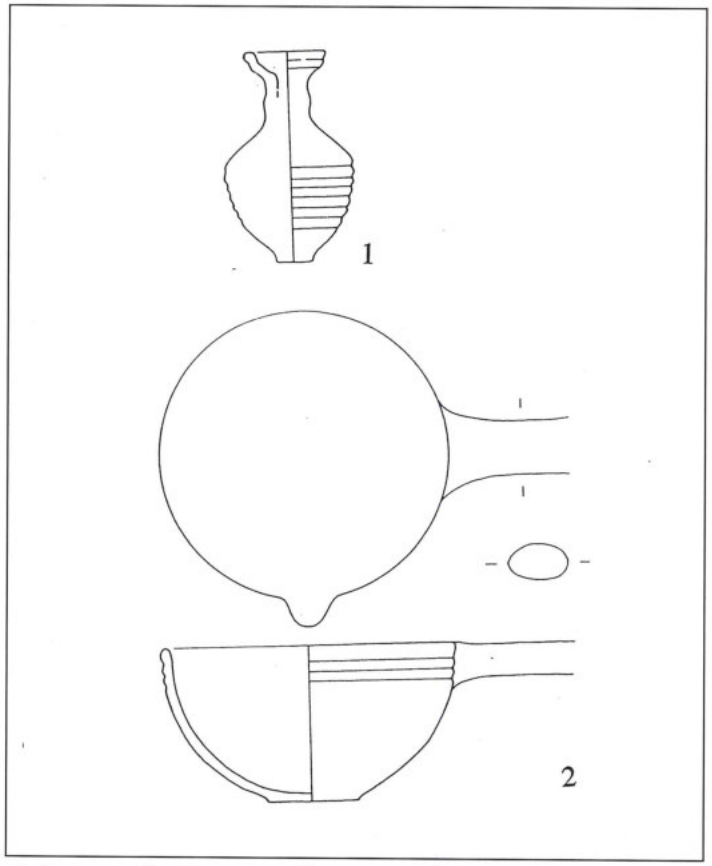
[13] F. Zayadine, *ADAJ* 26 (1982), pp. 380-393 esp. pp. 382-386; see also K. 'Amr, 'Preliminary Report on the 1991 Season at Zurrabah', *ADAJ* 35 (1991), pp. 313-323 esp. pp. 315, 320f.



10. Petra, az-Zanṭūr: the small cooking pot which contained the coin hoard.

produced locally, i.e. at Zurrāba.

Other parallels for the commonware pottery of the middle of the fourth century from Petra are known from Dhībān,[14] Ḥisbān,[15] 'Irāq al-Amīr, 'Ammān Citadel,[16] Bayt Sāḥūr, Bethany,[17] Buṣra and Khirbat Shamā'.[18] Being aware that this geographical distribution reflects the actual state of research and publication, it nevertheless shows that all the sites, except Khirbat Shamā', are situated in a rather restricted area east, north and west of the Dead Sea. If we look for parallels for the commonware pottery from Petra of the first to the third centuries, we find them spread further north in Palestine to the area around the Sea of Galilee. We may therefore suppose – with the utmost caution – that the distribution area of commonware pottery in the middle of the fourth century was reduced compared to earlier times.




11. Petra, az-Zanṭūr: pottery from room 29. 1. Small bottle; 2. small pan with one handle and a spout (scale 1:3).

14 A. D. Tushingham, 'The Excavations at Dibon (Dhiban) in Moab. The Third Campaign 1952- 53', *AASOR* 40, 1972, FIGS. 9,35.42.44; 10,35-37.

15 J. A. Sauer, *Heshbon Pottery 1971*. Andrews University Monographs VII. 1973, FIGS. 2,46.49.50.53.61.84.91.92.

16 F. Zayadine, 'Excavations on the Upper Citadel of Amman', *ADAJ* 22 (1977-78), p. 48 FIG. 17,298.305; p.49 FIG. 18; p. 51 FIG. 22,255.311.

17 S. Saller, *Excavations at Bethany (1949-1953)*. Publications of the Studium Biblicum Franciscanum 12. 1957, p. 298 FIG. 61,1787.1788A; p. 271 FIG. 53,3451.

18 E. M. Meyers, A. T. Kraabel and J. F. Strange, *Ancient Synagogue Excavations at Khirbet Shema', Upper Galilee, Israel 1970-1992. AASOR* 42, 1976, PLS. 7.14,9;7.17,15;7.22,6.,

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# Tradition, Innovation, and Imitation in the Material Culture of Islamic Jordan: The First Four Centuries

## Introduction

Excavations at Pella of the Decapolis (Ṭabaqat Faḥl) by the University of Sydney, Australia,[1] from 1979 to 1990 have produced a comprehensive corpus of early Islamic ceramics and other classes of material culture (metalwork, glass, and worked bone for instance) from a stratigraphically controlled context. The recovery of copper, silver and gold coins of the period has permitted the construction of a historical framework for this material. The aim of this paper is to provide an up-to-date classification of early Islamic ceramic forms found at Ṭabaqat Faḥl and to trace their developments from about AD 660 into the 10th century. Aspects of this work has already appeared in various journals and books,[2] but no integrated study has yet been offered which focuses on the artistic and technological evolution of pottery in Jordan during the first four centuries of Islam. Particular attention will be paid to matters of continuity and change as a reflection (however imperfect) of modifications to the social and economic structure of Jordan in the early middle ages.

## Archaeological Contexts

The source material for this paper mostly originates from two areas of the Pella excavations: Area IV on the central mound (Khirbat Faḥl) and Area XXIX in Wādī al-Khandaq (FIG. 1). A brief discussion of the progress of work in these areas and the archaeological results will assist in placing this material in its stratigraphical and chronological context.[3]

### *Area IV*

The area excavations of Area IV were undertaken between 1979 and 1983, exposing around 1700 square metres of an extensive residential/commercial quarter in continuous use from the second quarter of the sixth century until the catastrophic earthquake of AD 747/8 (FIG. 2).[4] At first the two-storied houses of stone blocks and clay bricks conformed to a grid pattern of gravelled streets, but in the later seventh century the configuration of the quarter underwent a major remodelling. The principal east–west street of Area IV was blocked off and the existing architecture converted into three sizeable houses, each facing outwards onto a large open courtyard. Ceramics from this rebuilding phase were associated with coins from the reign of the Byzantine Emperor Constans II (AD 641– 68), which strongly indicates that the earthquake of 659/60 initiated this programme of reconstruction.

The final destruction of the Area IV residential quarter resulted from the very powerful 747/8 earthquake, which caused extensive damage at Pella/Fiḥl.[5] The rich collection of artefacts from the sometimes two-metre thick destruction level is firmly coin-dated by Islamic issues as late as AH 126/AD 743-4.

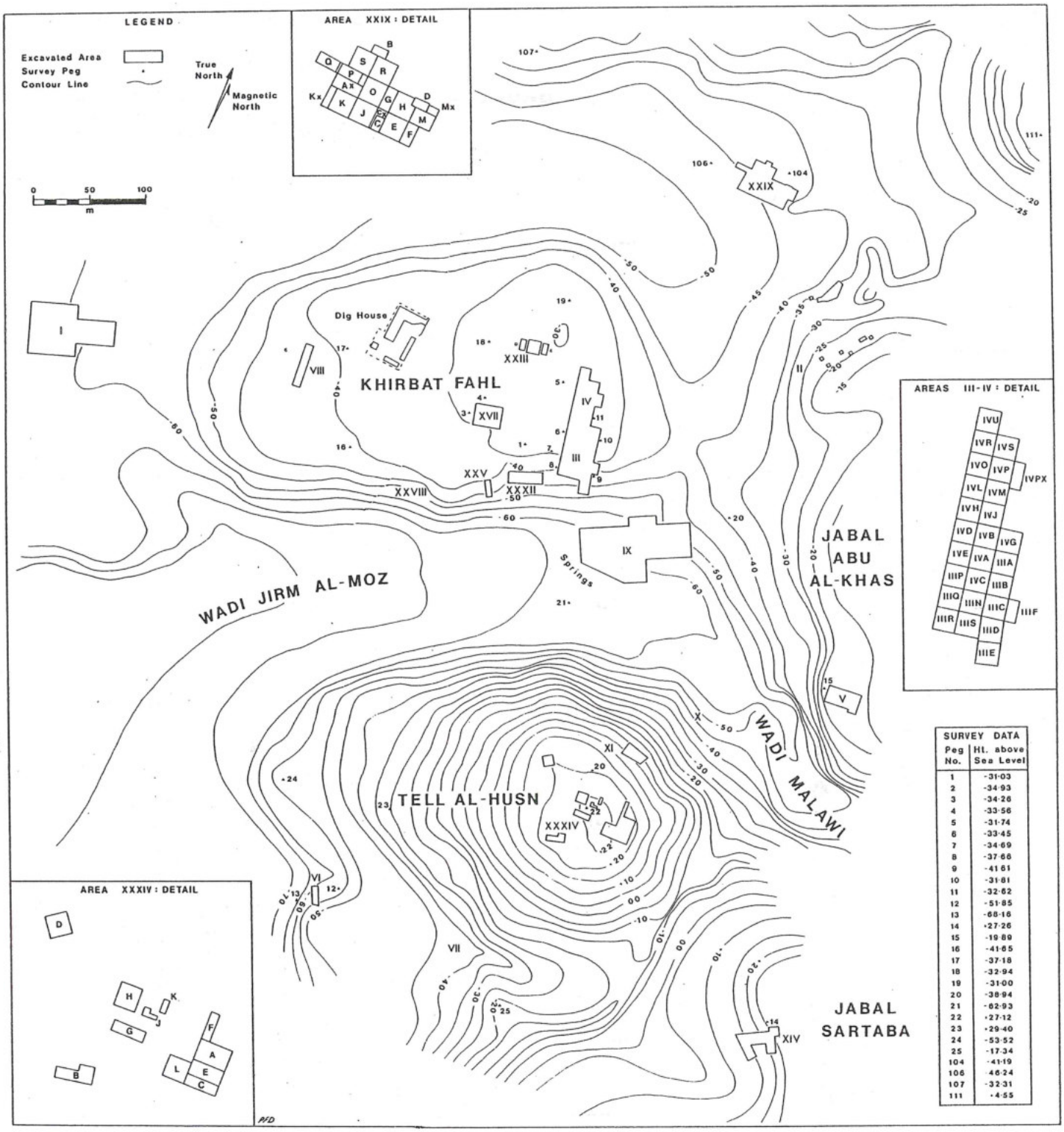
[1] The Joint Sydney-Wooster Excavations at Pella proceed only through the active support and encouragement of the Department of Antiquities of Jordan. Renewed activity in the field during 1992 after the lull of the previous year is due to the positive assistance of Professor Safwan Tell, then Director-General of the Department. The Sydney seasons were sponsored by the Australian Research Council of the Department of Education, Employment and Training, Canberra; the Australian National Gallery, Canberra; The University of Sydney; and the University of Queensland, Brisbane. The very strong support of Australia's former Ambassador to Jordan, H.E. Mr R. Bowker, is greatly appreciated.

[2] See in particular: A. G. Walmsley, 'Abbasid Fihl: Implications for the Cultural History of Jordan', in M. A. Bakhit and R. Schick (eds.), *The History of Bilad al-Sham in the 'Abbasid Period: Proceedings of the Fifth International Conference,* Amman, The Committee, 1991, pp. 135–159; *id.* 'Pella (Tabaqat Faḥl)', in D. Homès-Fredericq and J. B. Hennessy (eds.), *The Archaeology of Jordan 2: Surveys and Field Reports*, Leuven, Peeters, 1989, pp. 406–441; *id.* 'Pella/Fihl after the Islamic Conquest: A Convergence of Literary and Archaeological Evidence', *Mediterranean Archaeology* 1 (1988), pp. 142–159; *id.* 'Umayyad Pottery and its Antecedents', in A. W. McNicoll, R. H. Smith and J. B. Hennessy (eds.), *Pella in Jordan 1: First Interim Report*, Canberra, Australian National Gallery, 1982; A. W. McNicoll *et al.*, 'Preliminary Report on the University of Sydney's Seventh Season of Excavations at Pella (Tabaqat Fahl) 1985', *ADAJ* 30 (1986), pp. 155–198.

[3] For a review of the late Antique–early Islamic urban development of Pella, see: A. G. Walmsley, 'The Social and Economic Regime at Fihl (Pella) between the 7th and 9th Centuries', in P. Canivet (ed.), *Actes du Colloque "La Syrie de Byzance à l'Islam"*, Damascus, 1992, pp. 249–261.

[4] I remain thankful for the tremendous backing of the Late Anthony McNicoll in this endeavour.

[5] See: Walmsley, 'Social and Economic Regime' for a recent summary.

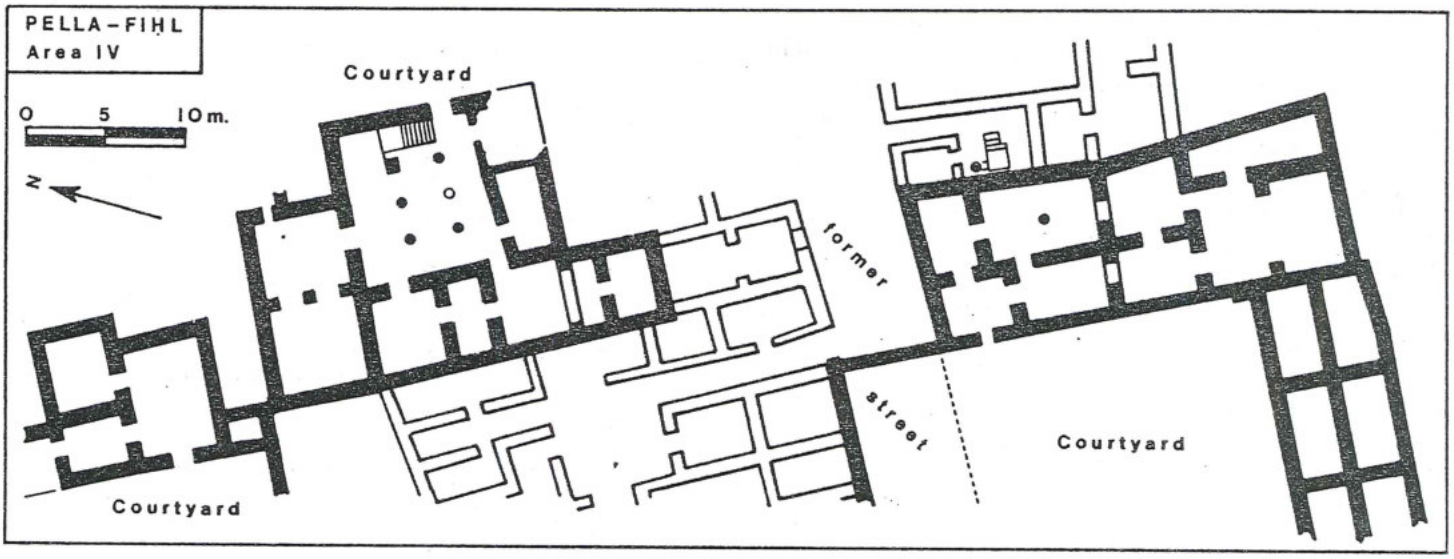



1. Map of Ṭabaqat Faḥl. Area II-IV: Domestic Quarter; Area XXIX, Abbasid Centre.

*Area XXIX*

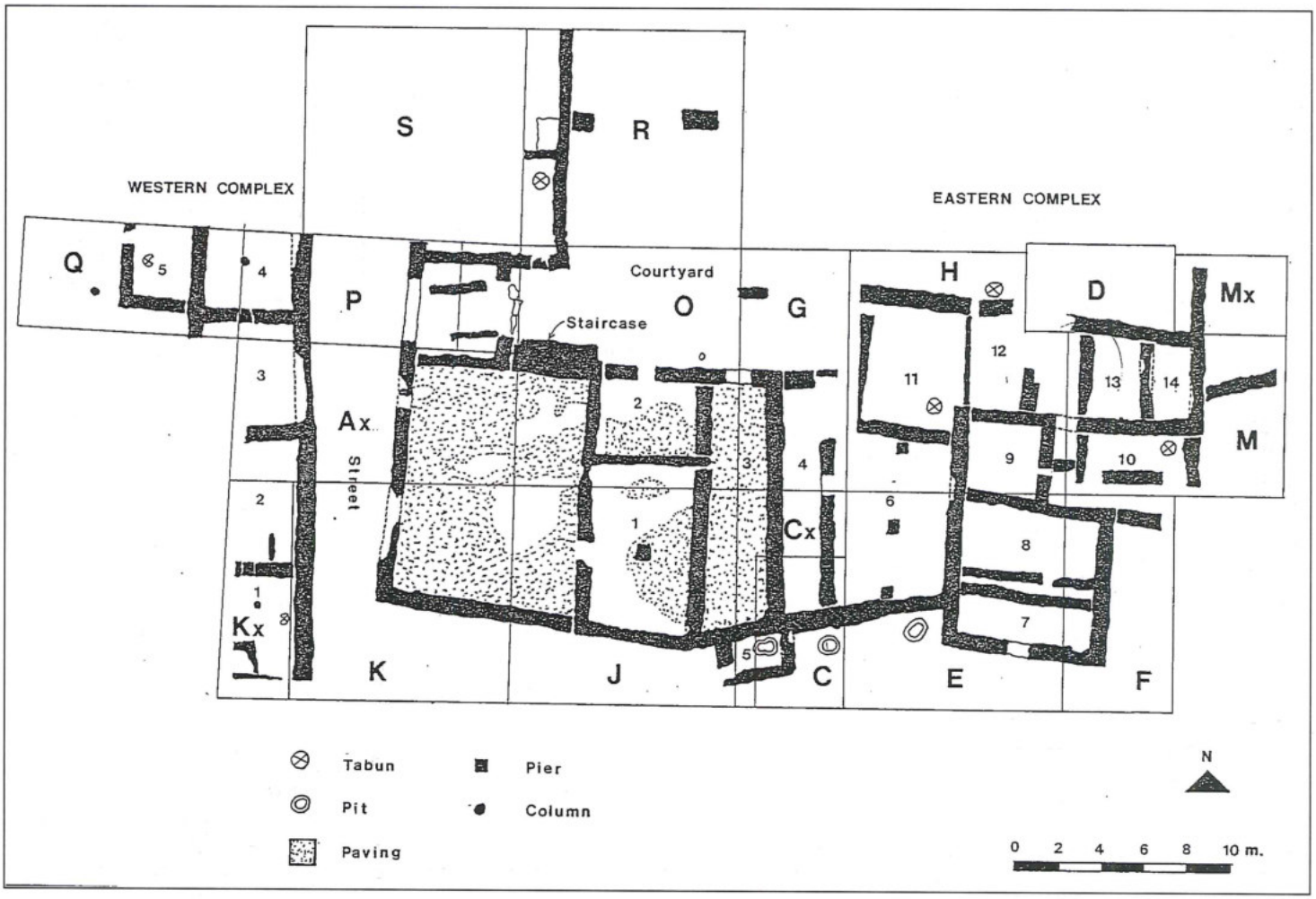
The partial exposure of two stone-built complexes in Wādī al-Khandaq, 300 m north of the central mound (FIGS. 1, 3), began with soundings in 1985 and continued with large-scale excavations in 1989 and 1990.[6] Each complex is roughly rectangular, and originally consisted

[6] A final season of excavations took place in October 1993, clarifying many issues, but the results of this work are too undigested to be included in this paper. Area XXIX is now (1994) being consolidated and preserved through a very generous grant from the Australian Department of Foreign Affairs and Trade, and the support of the Minister Mr G. Evans is most appreciated.




2. Plan of the Umayyad Domestic Quarter in Area IV. Solid lines: two-storeyed units; open lines: derelict buildings, although parts still in use.

of numerous stone-built rooms around an expansive central courtyard. The presence of two complexes of similar plan is difficult to explain, but they probably served a joint commercial/domestic function and met the economic and administrative needs of the later eighth–ninth century town.




3. General plan of the Courtyard Building and domestic units in Area XXIX.

Occupational layers, including sealed pits and refuse deposits, have produced a representative corpus of later eighth to 10th century pottery, iron work, glass, and worked bone. Coins and changes to the pottery assemblage confirms a post-747 construction date for the complexes, and as this is a single-period site the ceramic horizons are uncontaminated with earlier or later material. Two major occupational phases can be distinguished: the initial settlement of the later eighth century, and the subsequent main period of use probably from the mid-ninth to sometime in the 10th century.[7]

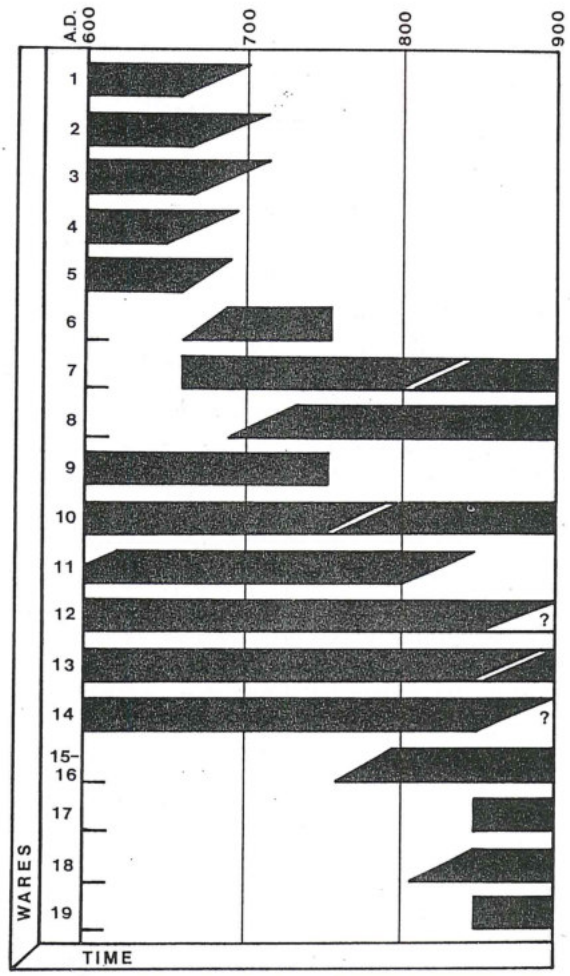
**Pottery Wares: Types, Forms, and Changes**

Analysis to date of the early Islamic pottery from Areas IV and XXIX has identified nineteen wares, not all current at the same period of time (FIG. 4).[8] Stratigraphically the AD 659/60 earthquake destruction level provides a firm starting point for the corpus. Shortly after this date the range of wares and shapes undergoes the first noticeable change in the archaeological record: five wares fade from the corpus (FIG. 4, Wares 1–5) and three new ones appear (Wares 6–8). These changes, however, do not alter the regional character of the assemblage, with local wares continuing to dominate the ceramic inventory after the AD 659/60 earthquake. Imported pottery does not reappear until towards the end of the seventh century (Ware 6). FIG. 4 demonstrates the extent to which the local potting traditions, based on technologies developed in the preceding Roman and Byzantine periods, strongly persist into the ninth century. At this time new ceramic fashions emanating from outside Palestine/Jordan demanded the adoption of quite different potting techniques, including the manufacture of glazed wares.

Wares 1–5 of FIG. 4 have been published by P. Watson,[9] and will not be repeated in detail here.

*Ware 1*
*Description:* Fine terracotta, the "Late Roman" wares of Hayes.[10]
*Forms:* Plates.
*Source:* Cyprus, Asia Minor, North Africa.
*Chronology:* Rare after AD 660; may only be rubbish survival. No obvious ceramic replacement at Ṭabaqat Faḥl.

*Ware 2*
*Description:* "Jerash Bowls"; reddish-orange fabric with pictorial red and white painted decoration.[11]
*Forms:* Plates.
*Source:* Jarash.
*Chronology:* A significant fall-off in decorative standards and production after the mid-seventh century.




4. Occurrence of pottery wares at Ṭabaqat Faḥl, c. AD 600–900. For descriptions see text.

*Ware 3*
*Description:* Solid, gritty fabric similar to Ware 14, but fired a lighter buff–brown hue.
*Forms:* Hand-made bowls and very large collared storage jars.
*Source:* Uncertain, but common around 'Ammān.
*Chronology:* Does not appear to extend beyond the end of the seventh century at Ṭabaqat Faḥl.

[7] The absence of coins makes fixing a firm date for the end of the Area XXIX structures difficult, but ceramics from the 1993 season confirm a 10th century presence.

[8] Final analysis and research of the excavations in these areas is in progress, and will probably require an elaboration of the summary of results to date given here.

[9] P. M. Watson, 'Change in Foreign and Regional Economic Links with Pella in the Seventh Century A.D.: The Ceramic Evidence', *Actes du Colloque "La Syrie de Byzance à l'Islam"*, Damascus, 1992, pp. 233–248 Wares M, L, D, E, and H respectively. Her thorough study also considers the continuation of Byzantine ware types into the eighth century.

[10] J. W. Hayes, *Late Roman Pottery*, British School at Rome, London, 1972.

[11] The definitive study is by P. M. Watson, *Jerash Bowls: Byzantine Decorated Fine Ware from Jordan,* Unpublished PhD thesis, University of Sydney, 1992.

*Ware 4*
*Description:* Soft, chaff-tempered course ware, fired light brown to red/reddish-brown.
*Forms:* Hand-made flat-based basins and plain-rimmed ring-based storage jars.
*Source:* Unknown.
*Chronology:* Uncommon after the mid-seventh century.

*Ware 5*
*Description:* Encompasses a number of different vessel types traded for their contents.
*Form:* Amphorae.
*Source:* Gaza, Antioch/Cyprus, Egypt.
*Chronology:* All these amphora types are missing from the archaeological record after AD 660.

*Ware 6*
*Description:* Gritty fabric with many white and mica inclusions. 'Sandwich' core with grey-brown centre and red-brown faces.
*Form:* Biansulate necked jars with fine ribbing on upper body and broad ribbing on lower body (FIG. 5: 1–2).
*Source:* Very possibly Gaza/Egypt delta region.
*Chronology:* Appears after c. AD 660, perhaps in place of the Gaza amphora form, but suddenly absent after about AD 750.

*Ware 7*
*Description:* Pale cream or greenish to light yellow-brown fabric, aerated, with fine white, orange and/or grey inclusions. Incised decoration if any. Related to Ware 18.
*Forms:* Medium-thin walled jars in large and medium sizes, jugs, and water flasks (FIG. 5: 3-6, 8). Larger vessels often display broad ribbing. Open, high-walled bowls with incised decoration (FIG. 5: 7). Jar stoppers.
*Source:* Some jars and flasks probably originate from Baysān.[12] The local Ṭabaqat Faḥl clays are capable of producing this ware,[13] but no evidence of a potting industry has been uncovered at Ṭabaqat Faḥl.
*Chronology:* The large ribbed water jars first appear in post-660 deposits, and are joined by the smaller jars, flasks, and occasional incised bowls by the mid-eighth century. Jars of the next century have much taller necks and steep-sloping bodies (FIG. 5: 6), and flasks have a taller, finely ribbed, filler hole and thinner body (FIG. 5: 8).

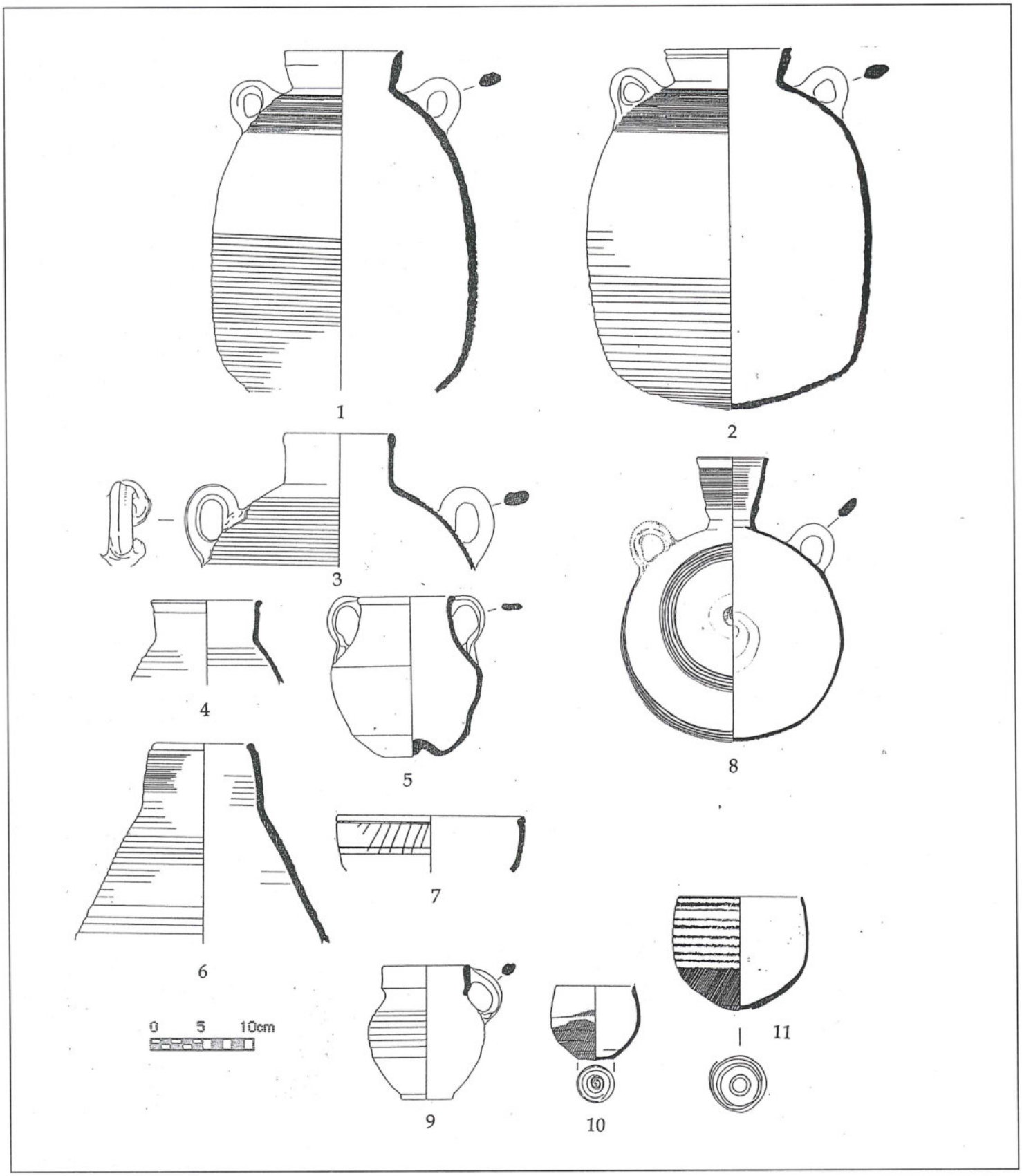
*Ware 8*
*Description:* Light orange fabric, sometimes apparently white slipped, with small and sometimes medium white and grey inclusions. Bold reddish-brown painted decoration of loops, stars, wavy lines, 'arcade' (arched) pattern (FIG. 6: 8), and crisscrossed lines.
*Forms:* Commonly smooth-bodied jars with ring bases, spouted juglets, bowls, and cups (FIG. 6).
*Source:* Unidentified,[14] but possibly north Jordan region. Cups were made at Jarash.[15]
*Chronology:* Jars in this ware appear occasionally around the turn of the eighth century, but are quite common in the 747/8 destruction level (FIG. 6: 2). They are joined by 'palace ware' bowls (FIG. 6: 9) and cups (FIG. 6: 3–4) later in the century, and continue strongly into the ninth century when decoration is restricted to loops, bisecting lines, and parallel wavy lines. The ninth century jars have steeply sloping shoulders and a bulbous lower body (FIG. 6: 5–6).

*Ware 9*
*Description:* Plain gritty ware fired an even 'biscuit' (light yellowish-brown) hue. Undecorated.
*Form:* Small one-handled juglet (FIG. 5: 9).
*Source:* Unknown, but Ṭabaqat Faḥl clays from Wādī Jirm are compatible.[16]
*Chronology:* Predominantly mid-eighth century.[17]

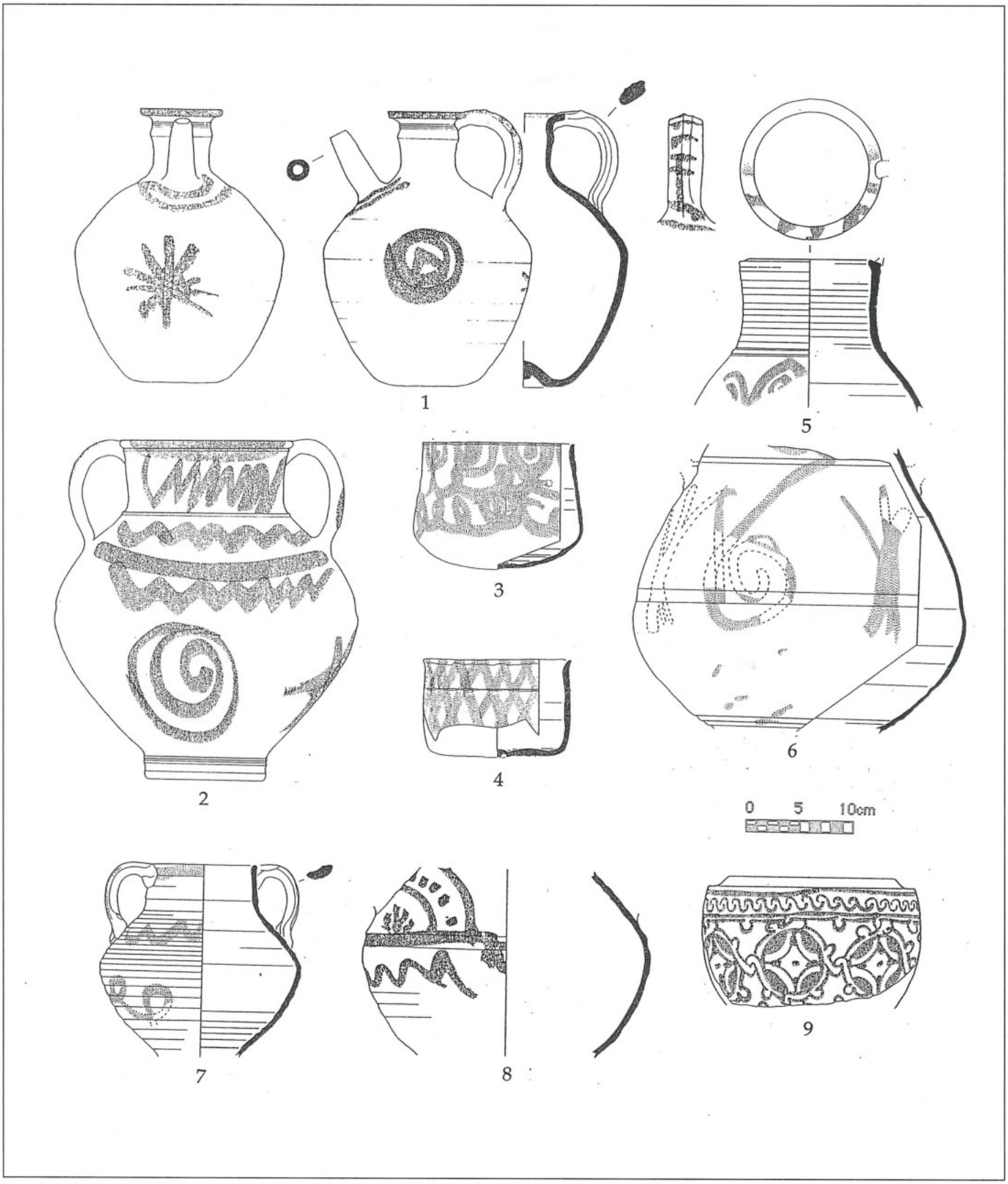
*Ware 10*
*Description:* Fine table ware ("Fine Byzantine"), compact orange fabric with small white and grey inclusions; pared base and lower body, often with grooved spiral/circle on underside.
*Form:* Cups (FIG. 5: 10–11).[18]
*Source:* Suggested from the Jerusalem region.
*Chronology:* Regularly appear in the archaeological record between AD 660–750, becoming more common in the ninth century deposits but without the ring base or incised wavy line.

*Ware 11*
*Description:* Fine 'metallic-thin' fabric, coloured patchy orange/brown/grey, slightly gritty with small to medium white and sandy inclusions. White painted decoration of banded wavy lines and strokes on rims and handles; occasional scalloped ridges on body. Handles, colour, and

[12] Watson 'Foreign and Regional Economic Links' p. 243.
[13] W. I. Edwards, 'A Progress Report on the Pella Pottery Studies', in A. W. McNicoll, P. C. Edwards *et al., Pella in Jordan 2* Appendix 10, p. 293.
[14] P. Duerden and P. M. Watson, 'PIXE/PIGME Analysis of a Series of Byzantine Painted Bowls from Northern Jordan', *Mediterranean Archaeology* 1 (1988), pp. 104–10, sample no. 21.
[15] M. Gawlikowski, 'A Residential Area by the South Decumanus', in F. Zayadine (ed.), *Jerash Archaeological Project 1981-1983*, I, Department of Antiquities, Amman, 1986, (= *JAP 1*) p. 117.
[16] Edwards 'Pottery Studies' p. 293.
[17] An exact parallel is known from Kursi on the eastern shore of Lake Tiberias; see Y. Tzaferis 'The Excavations of Kursi–Gergesa', *'Atiqot* 16 (1983), FIG. 8.4.
[18] Cf. Watson 'Foreign and Regional Economic Links' Ware K p. 242.




5. 1. CN10299, Ware 6, mid-8th c.; 2. CN154, W.6, mid-8th c.; 3. CN10061, W.7, early 8th c.; 4. CN10040, W.7, mid-8th c.; 5. CN10252, W.7, late-8th c.; 6. CN10237, W.7, early/mid-9th c.; 7. CN246, W.7, mid-8th c.; 8. CN16030, W.7, mid/late 9th c.; 9. CN2021, W.9, mid-8th c.; 10. CN16002, W.10, early 9th c.; 11. CN10246, W.10, late 8th c.




6. 1. CN1869, W.8, mid-8th c.; 2. CN2030, W.8, mid-8th c.; 3. CN16053, W.8, early 9th c.; 4. CN16055, W.8, early 9th c.; 5. CN16051, W.8, early 9th c.; 6. CN16060, W.8, early 9th c.; 7. CN16049, W.8, early 9th c.; 8. CN10245, W.8, late 8th c.; 9. CN16001, W.8, early 9th c.

decoration suggest these vessels imitate bronze originals, the white paint representing silver inlay work.
*Forms:* Small to medium-sized biansulate jars; spouted, one-handled juglets; cups (rare); small basins; and small lidded casseroles (FIG. 7: 1–7).
*Source:* Numerous kilns have been excavated at Jarash.[19]
*Chronology:* Appearing in the first half of the seventh century, this ware becomes extremely common at Ṭabaqat Faḥl by the middle of the eighth, and continues strongly until the start of the ninth century when it is quickly replaced by the jars and jugs in Ware 18. The small basins are only noted in deposits from the second half of the eighth century, and possibly began challenging the Ware 14 types.

*Ware 11A*
*Description:* Uncommon variant to Ware 11, but fabric dark grey with many small white inclusions; incised decoration.
*Form:* Cups.
*Source:* Probably Jarash
*Chronology:* A potter's folly?

*Ware 12*
*Description:* Hard, thin, grey/brown surfaced fabric, with small to medium white, grey and/or brown inclusions. Freely applied white painted decoration in broad intersecting wavy lines and loops.
*Form:* Light-weight water collection jars. Water storage was probably the function of the more porous Ware 7 jars as surface evaporation would cool the contents.
*Source:* Unidentified; possibly Baysān.
*Chronology:* The plain, uncollared, rims and tall necks of the eighth century continue into the ninth, in which longer necks and a steeply sloping upper body are common (compare FIG. 7: 8 and FIG. 7: 9–10).

*Ware 13*
*Description:* Cooking pot fabric, gritty with copious white, transparent and grey inclusions.
*Forms:* Casseroles with loop-handled lids; necked cooking pots (FIG. 8: 1–4).
*Source:* Jarash.
*Chronology:* Neither form displays significant changes between AD 660–900.

*Ware 13A*
*Description:* Late variant identified by a redder fabric and a button-handled lid.
*Forms:* Casseroles (FIG. 8: 5, 6).
*Source:* Unknown, but probably other than Jarash.
*Chronology:* Later ninth century, and a possible precursor to the reddish-fabric, clear-glazed Fatimid casseroles.

*Ware 14*
*Description:* Dark grey fabric, hand made, with small to medium grey, white and transparent inclusions. Comb-incised and chiselled decoration.
*Forms:* Large collared storage jars, large basins with plain bulbous rims, small basins/bowls with flat rims, and jar stoppers (FIG. 8: 7–10).
*Source:* Jarash
*Chronology:* The overpowering chisel and incised decoration of the later seventh century (FIG. 8: 7) gives way to a few bands of wavy comb incisions in the first half of the eighth (FIG. 8: 8), then a single line or no decoration thereafter. The large ninth century basins have a flatter rim, with a definite pointed finish to the outside edge (FIG. 8: 10).

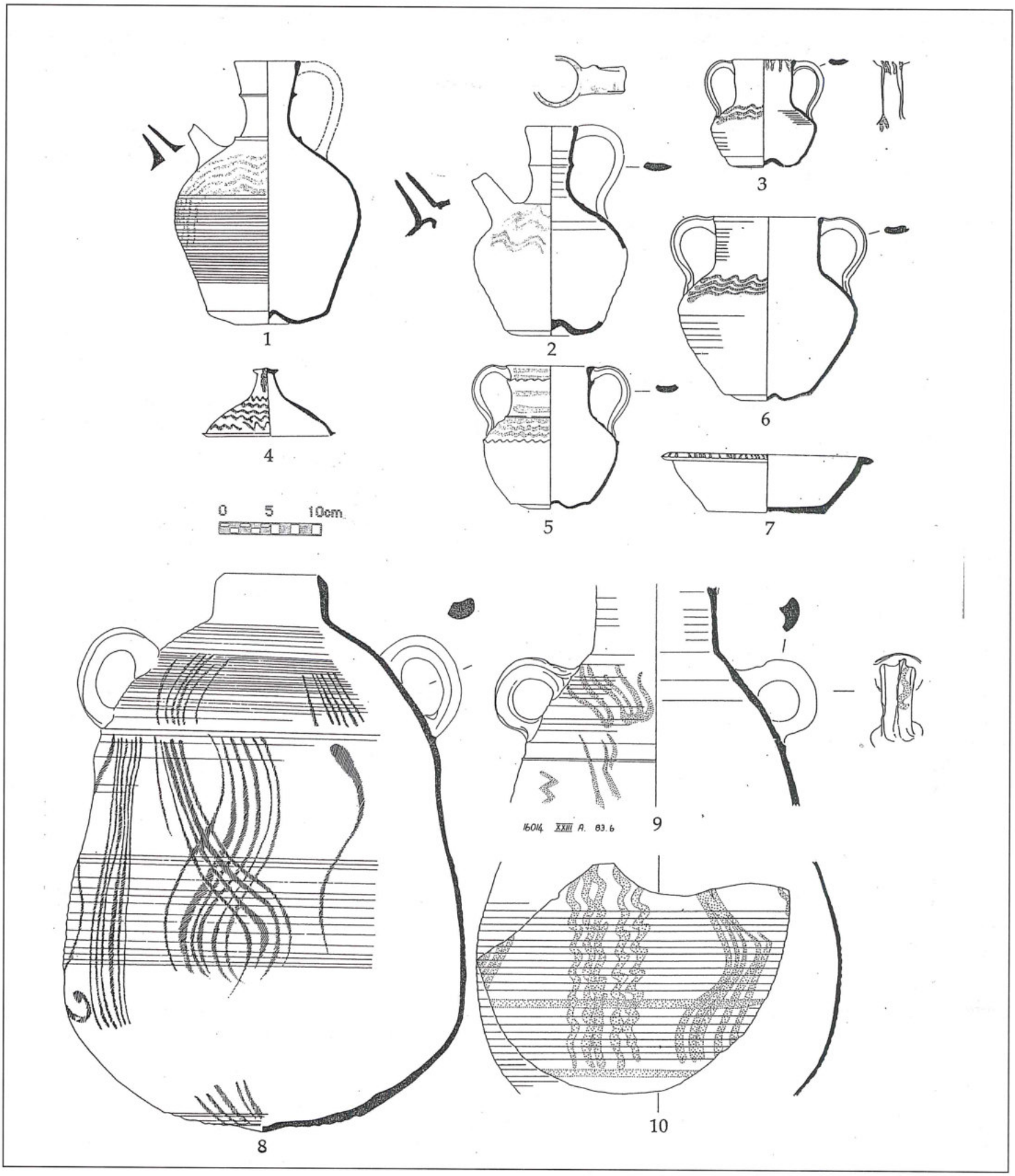
*Ware 15*
*Description:* Thick turquoise or blue glaze on greenish fabric.
*Form:* Jars.
*Source:* Unknown.
*Chronology:* May appear in the later eighth century, but predominantly ninth century. Very rare in the Ṭabaqat Faḥl deposits.

*Ware 16*
*Description:* Polychrome glazed on white slip over orange fabric.
*Form:* Bowls.
*Source:* Unknown.
*Chronology:* See Ware 15.

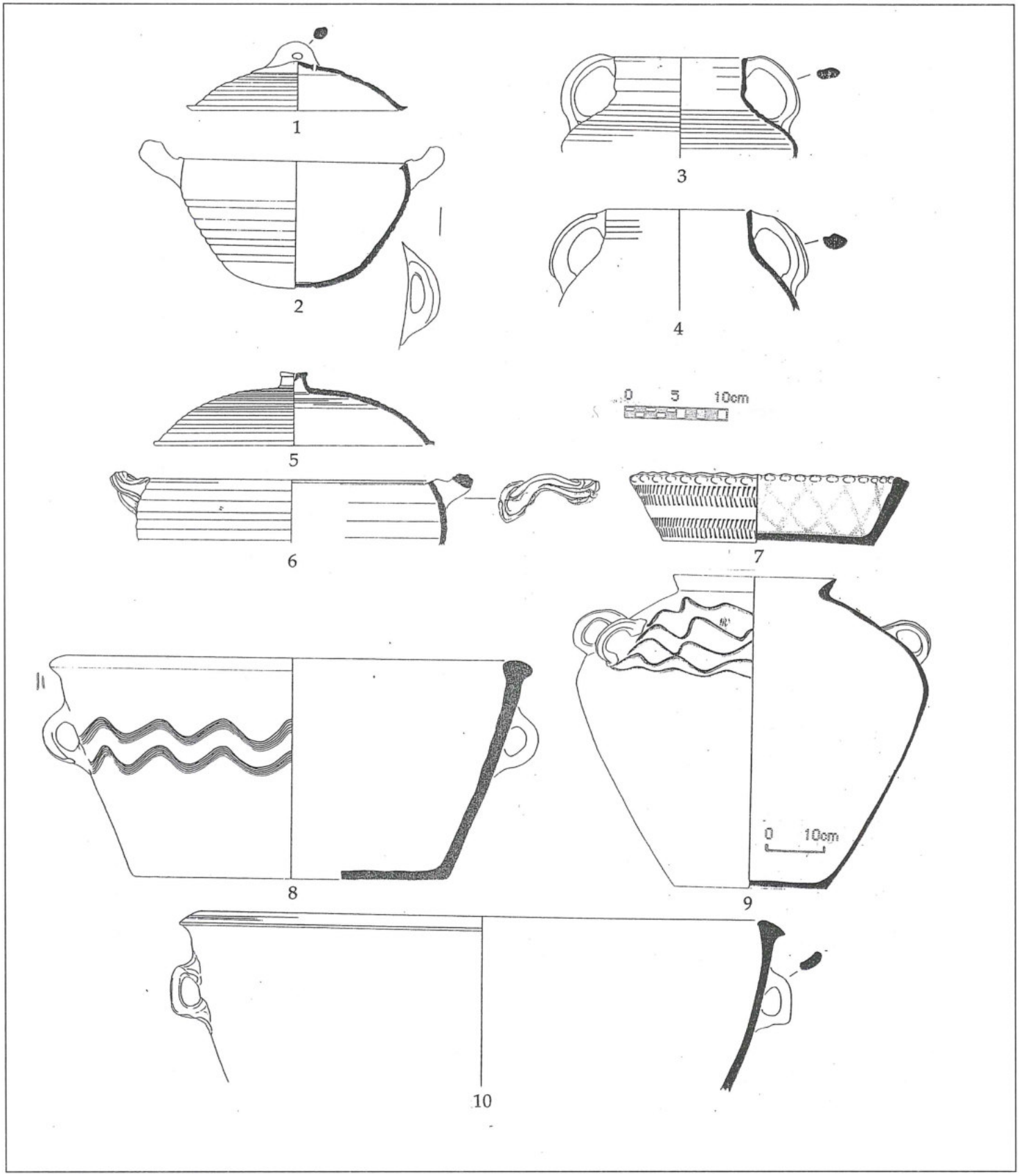
*Ware 17*
*Description:* "Coptic glazed" or variant; interior divided into zones by painted black lines with bubbly green and yellow glaze, reddish-orange fabric.
*Form:* Carinated bowls (FIG. 9: 1).
*Source:* Perhaps a local production based on Egyptian originals.
*Chronology:* Late in the Ṭabaqat Faḥl sequence, seemingly not before the mid-ninth century

*Ware 18*
*Description:* Eggshell-thin, aerated, pale cream fabric with small grey, red (grog?), and clear inclusions. The

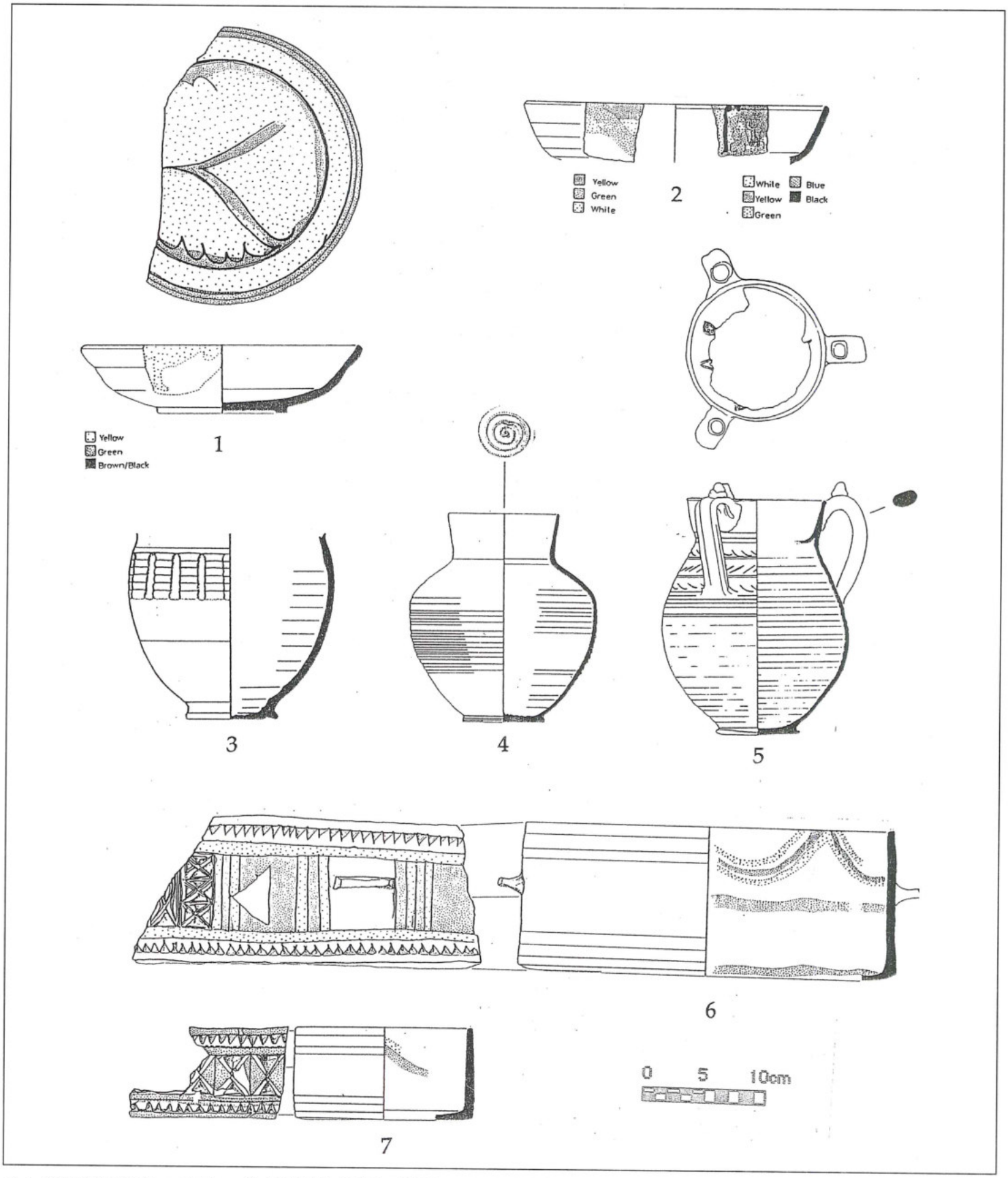
[19] R. Pierobon, 'Sanctuary of Artemis: Soundings in the Temple-Terrace, 1978–1980', in 'Gerasa 1: Report of the Italian Archaeological Expedition to Jerash, Campaigns 1977–1981'. *Mesopotamia* 18–19 (1983–84), pp. 85–111; R. Pierobon, in R. Parapetti, *et al.*, 'The Italian Activity within the Jerash Project 1982–83', *JAP 1*, pp. 184–187; J. Schaefer and R. K. Falkner, 'An Umayyad Potters' Complex in the North Theatre, Jerash', in *JAP 1*, pp. 411–35; Walmsley, in W. Ball, *et al.*, 'The North Decumanus and North Tetrapylon at Jerash: an Archaeological and Architectural Report', *JAP 1*, pp. 351–357.




7. 1. CN2022, W.11, mid-8th c.; 2. CN3264, W.11, mid-8th c.; 3. CN10251, W.11, late 8th c.; 4. CN546, W.11, ?early 8th c.; 5. CN10051, W.11, mid-8th c.; 6. CN10260, W.11, late 8th c.; 7. CN10247, W.11, late 8th c.; 8. CN8, W.12, mid-8th c.; 9. CN16014, W.12, early 9th c.; 10. CN16015, W.12, early 9th c.




8. 1. CN2052, W.13, mid-8th c.; 2. CN2051, W.13, mid-8th c.; 3. CN10255, W.13, late 8th c.; 4. CN10233, W.13, early/mid-9th c.; 5. CN16028, W.13A, mid/late 9th c.; 6. CN16029, W.13A, mid/late 9th c.; 7. CN2014, W.14, late 7th c.; 8. CN4, W.14, mid-8th c.; 9. CN140, W.14, mid-8th c.; 10. CN16009, W.14, early 9th c.




9. 1. CN16025, W.17, mid-9th c.; 2. CN16036, W.16, mid-9th c.; 3. CN10242, W.18, early/mid-9th c.; 4. CN16022, W.18, mid/late 9th c.; 5. CN16027, W.18, mid/late 9th c.; 6. CN16031, W.19, mid/late 9th c.; 7. CN16032, W.18, mid/late 9th c.

lower body is pared to leave a plain or ridged base. Applied, impressed, and incised decorative techniques are reasonably common in the manufacture of these vessels. Imitation of silver originals?
*Forms:* Jars and strainer jugs (FIG. 9: 3–5).
*Source:* The local production centre for these Samarran-style vessels is unknown. A workshop for moulded cream wares is known at ar-Ramla,[20] but a closer source is more likely.
*Chronology:* Appears suddenly in the first half of the ninth century, quickly replacing the jars and jugs of Ware 11. The eighth-century dating of the Ramla assemblage, which also includes glazed and *Kerbschnitt* pottery (Ware 19 below), is clearly erroneous; the Ṭabaqat Faḥl finds suggest an early Fatimid date for the Ramla material.

*Ware 19*
*Description:* Cut, incised and painted ware ('chip-carved' or *Kerbschnitt*), brown to orange fabric with many white, yellow, grey, red and black inclusions of various sizes; cut, incised and red and/or painted decoration in panels externally, red and white painted lines internally.
*Form:* Small basins, hand made with flat ledge handles, resembling the steatite bowls of the eighth century (FIG. 9: 6, 7).
*Source:* Unknown.
*Chronology:* Appears simultaneously with Ware 17 — the southern connection?

**Comment**
The ceramics from Islamic Fiḥl demonstrate a strong persistence of local artistic traditions in pottery making well into the first half of the ninth century AD — nearly two centuries after the Islamic Conquest of the region. The ubiquitous household Wares 10–14 spring from a long Roman/Byzantine tradition, but undergo gradual changes in ware, firing, shapes, and especially decoration during the later seventh and eighth centuries. Ware 11 particularly stands out, with a abundance of liberally applied white-painted strokes, loops, and parallel wavy lines characterising the eighth century. The simultaneous appearance of Ware 8, with an even more powerful decorative regime of red paint on a pale or white-slipped surface, marks the eighth century as an especially expressive period in the local ceramic technology of Jordan. The post-AD 660 demise of Wares 1 and 3–5, and the appearance of Wares 6–8, can be related to the changing social and economic horizons of Fiḥl. The strengthening of commercial ties with eastern centres at the expense of western contacts probably resulted from political changes at this time, notably the considerable importance of the Damascus–Makka Ḥajj route.[21] Ware 2 ("Jerash bowls") goes against this trend, but matches the end of "Late Roman" wares throughout the East Mediterranean region.

With the onset of the ninth century, a critical break with the earlier potting technologies is represented by the quite abrupt end of Ware 11 in favour of the thin-walled, Samarra-style pale cream jars and strainer jugs of Ware 18. These quickly dominated the ceramic assemblage of ninth century Fiḥl. Further evidence for change in traditional fabrics is found in Ware 13, where the old dark brown Jarashi cooking vessels are replaced by button-lidded casseroles in a more reddish fabric (Ware 13A).[22] This suggests a new source for cooking vessels at Fiḥl. By the middle of the ninth century other previously unrepresented wares make an appearance: the reasonably common *Kerbschnitt* bowls (Ware 19) and very limited quantities of three glazed wares following Iraqi or Egyptian styles (Wares 15–17). The adoption of these new "international" wares represents a major artistic and technological break with the past. It may also reflect a developing preference by the early ninth century communities in the north Jordan Valley for the dominant cultural traditions of the greater Islamic World.

[20] M. Rosen-Ayalon and A. Eitan, *Ramla Excavations, Finds from the VIIIth Century C.E.*, Jerusalem, 1969.
[21] See Walmsley, 'Social and Economic Regime' and Watson 'Foreign and Regional Economic Links' for initial thoughts on this point.
[22] The absence of cooking pots in this ware may be due to the limited sample recovered in Area XXIX.

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# Arab Lamp-Makers in Jarash, Christian and Muslim

A group of inscribed terra-cotta lamps from Jarash, some of which were described for the first time by C. Clermont-Ganneau a century ago, (1898; 1900a; 1900b) came recently back to attention as a result of the "Jerash International Project".

Almond-shaped and provided with a handle in the form of an animal head, these lamps belong to a type ubiquitous in the Early Islamic layers in Jarash itself and commonly called "*Jerash Lamps*". There is indeed no doubt that examples found elsewhere in Jordan and Palestine came from Jarash or at least imitate closely the products of this city (cf. Day 1942; Kennedy 1963; Bagatti 1970). All inscribed specimens known to me belong to Group V as defined by Scholl; they display a channel between the filling hole and the nozzle, and stand either on a ring base or on a flat almond-shaped foot. This group is dated, on the ample and cross-checked evidence from recent excavations, to the middle of the eighth century AD (Scholl 1986: 165; cf. Kennedy 1963: 87, PL. XXVII type 20, #706-711).

During the life-span of lamps of this class, a habit was developed in Jarash to mark them with inscriptions in Arabic, giving sometimes the names of the potters and, occasionally, dates according to the Hijra reckoning.

Having had the privilege to participate in the Jarash Project, I was in a position to acquire first-hand knowledge of the new lamps as they were discovered, partly in the sector I was responsible for. Comparing them with known examples, I was led in some cases to a reappraisal of readings and to a reassessment of this particular evidence in the light of the recently established facts about the Early Islamic city of Jarash (cf. Gawlikowski 1986: 120-121).

A recent paper by Nabil Khairy and Abdel-Jalil Amr, with an addendum by the latter, contains a catalogue of such inscribed lamps kept in the museums of Jordan, including some recently found in the course of the Jarash Project (Khairy and Amr 1986; Amr 1986). This publication prompted me to put my notes in order and to present my own readings and comments.

The authors have elucidated and completed several readings published earlier, and added some new inscriptions of this group. They concluded, obviously, that the potters responsible for these inscriptions as well as their customers were Arabic speakers, and seem to admit that all concerned were Muslim as well. While this last conclusion is documented by several explicit Islamic formulas, the reality seems to be somewhat more complex.

The work of Abdel-Jalil Amr provided some new potters' names, such as Ḥassān, Abū Ḥassūn, and Ibn Ḥudaij (Amr 1986: 163, FIGS. 1-2, 167, FIGS. 11-12). It is interesting to note that the lower half of a lamp dated by Khairy and Amr to the year 105 H (AD 729/730) is in fact identical (cf. FIG. 1) with a more complete example published by Ronzevalle, who restored, probably incorrectly, the date 125 H, but has read on the upper half the name of Ibn Ḥassān (Khairy and Amr 1986: 145-146, FIG. 3, PL. 38,4; Ronzevalle 1914: 168); this potter could be the son of the maker of one of the recently published lamps.

In the same way, the potter whose name is given as Ibn Ḥudaij (Amr 1986: 163, FIGS. 1-2) could be identical with 'Amr bin Kharaj mentioned on three lamps dis-



1. Lamp Pol. 211 (cf. Ronzevalle 1914; Khairy and Amr 1986: FIG. 4).



2. Lamp Pol. 41 (cf. Khairy and Amr 1986: FIG. 9).

covered in Jarash (FIGS. 2 and 3.1) (Khairy and Amr 1986: 149, FIGS. 8-9, PL. 39.9), if we adopt the reading "Ibn Khurayj", equally possible, as the letters are not dotted. In both cases, admittedly, the link is tenuous and would need some confirmation before we are able to speak of hereditary workshops.

Another lamp, published long ago by C. Clermont-Ganneau (1900a; cf. Day 1942: PL. 13.2), was made, according to his reading, by "Djayrûn bin Yûsuf in Jerash", in the year 127 or 129 H (FIG. 3.3). A fragmentary specimen from a similar mould, found in the Polish sector (FIGS. 3.2 and 4) bears clearly the same name but a different date, read by Khairy and Amr as 133 H (AD 750), while their reading of the potter's name is Jarwal (Khairy and Amr 1986: 147, FIG. 6, PL. 39.7; cf. Scholl 1986: FIGS. 1, 9). This Jarwal, or Jayrūn, b. Yūsuf was therefore active at least between AD 744 and 750.

Another potter made himself known by signed lamps of which several are on record, but the name nevertheless was not read correctly. On all known copies the date is 125 H (AD 742/3), and the potter's name was read (from a lamp brought from Jarash to Jerusalem, FIG. 3.4) as "Daud bin Barnaba" by Doumeth in 1895, corrected in 1897 by Clermont-Ganneau to "Theodore son of As...y" and changed again in 1947 to "Daud bin Muṣṭafa" by A. Battista, after another yet identical lamp (Clermont-Ganneau 1898: 342; 1900a; *apud* Bagatti 1947: 141, FIG. 34.1). A new specimen of this inscription found in Jarash by the Australian team (FIG. 3.5) attracted my attention as a parallel to the signature of the same potter on a household basin we found in the Umayyad House (FIG. 3.6). While this vessel, and the reading it provides, still awaits a comprehensive publication of pottery from the Polish sector, the new lamp was published by Khairy and Amr (1986: 146-147, FIGS. 4-5, PL. 39.5-6; cf. Kehrberg 1986: 373), together with a fragment of another one. Curiously, these authors did not recognize that they were dealing with a text presented already by Clermont-Ganneau in a paper they have used otherwise. Their reading of the inscription is "Made by Nudhûr bin Satfan in Jerash"; the date is not preserved in this case.

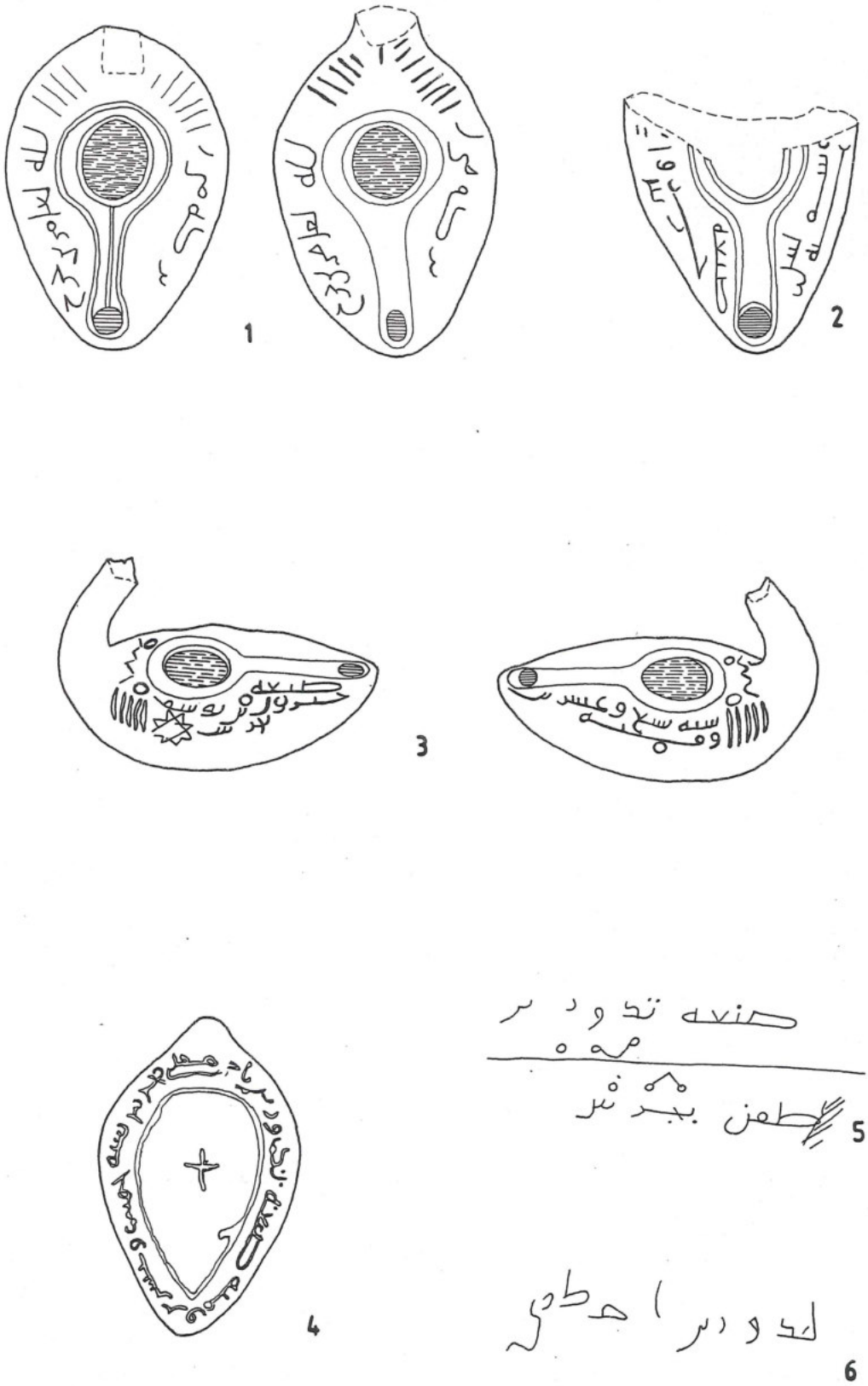
A comparison of all instances of this signature makes it quite clear that the reading of the first name by Clermont-Ganneau as Theodore (*Tôdor*) is correct. The first letter is provided with two dots on the lamp in Jerusalem and on the one from the Australian excavation, while only one dot can be seen on the other lamp published by Khairy and Amr and on the basin from the Umayyad House. The reading proposed in the first place (*li-Da'ud*) cannot be accepted because of the incongruous use of the preposition, not confirmed by other lamp inscriptions.

As to the patronym, the final *nūn* is quite clear on both lamps illustrated by Khairy and Amr, who did not see, however, the incipient *alif* on one of their specimens (broken away on the other), mistaking it for one more stroke on the shoulder of the lamp. This *alif* is distinct whenever preserved and thus excludes the reading of "Muṣṭafa" favoured by Bagatti (1970: 91), in spite of the rather uncommon form of the final letter on the Jerusalem lamp. The name is thus to be read Iṣṭifan, being a transcription of a common Christian name considered already, but finally rejected, by Clermont-Ganneau.

The potter called Tôdor bin Iṣṭifan or, putting the names back in the original Greek, *Theodoros Stephanou,* was obviously a Christian, and equally obviously Arabized, not only in his use of Arabic but also of the Hijra reckoning.

It is puzzling to find two names very similar (while apparently different) to *Iṣṭifan*, on a four-nozzled lamp published by Khairy and Amr (1986: 150-151, FIG. 11, PL. 40.12), on which they read: "Aṣṭûra and son of Aṣṭ-ân". There is no need, it seems, to consider these potters as distinct in any way from other members of their profession active in Jarash about the middle of the eighth century AD.

Finally, a lamp with a very corrupt Greek inscription around the base and a slightly better preserved Arabic text on the top half gives still another potter's name. Read as "Bishr bin Ṣâmid in Jerash", it is introduced by the Muslim *bismala* and followed by a date which, according to Khairy and Amr, is 211 H (1986: 150, FIG. 12, PL. 40.11). The same date was read on a similar lamp where the name of the potter was not preserved (Amr 1986: 163, FIG. 4). However, the published drawings do not quite confirm the date reading, which is anyway highly improbable: 211 H corresponds to AD 826, that is much too late for lamps otherwise similar in every respect to those safely dated about AD 750. Islamic lamps of the ninth century, while seemingly not represented in Jarash, are well known from other places and quite different in form. As far as I can see, the lamp of Bishr b.



3. 1: Pol. 153; 2: Pol. 159; 3: Clermont-Ganneau 1900a; 4: Clermont-Ganneau, 1900a; 5: Aus. 346/J. 393; 6: Pol. 142.



4. Lamp Pol. 159 (cf. Khairy and Amr 1986: FIG. 6).

Ṣâmid can be dated in 111 H (AD 729/30), as it was indeed dated by A. Battista already in 1947 after a copy in the Palestine Archaeological Museum (Bagatti 1947: 141).

The inscribed lamps date therefore, on the present evidence, from a short period between 105 and 133 H, i.e. AD 730-750. There is no indication as to the reason behind this short-lived habit. Some of the potters were evidently Muslim, some others Christian, and some seem to have displayed "a remarkable religious indifference" in using both Muslim and Christian inscriptions and symbols for the two halves of the same lamp moulds (cf. Day 1942: 78, PL. 14.1).

As I had the occasion to say elsewhere, partly on the evidence of these inscribed lamps, the society of the seventh and eighth centuries in Jarash went through a process of mutation, changing from Byzantine into Islamic (Gawlikowski 1992). In the course of this transformation, which concerned naturally the whole of the Syrian area as well, the *polis* of Gerasa became an Arab *madīna* called Jarash. There is no need here to remind of the enlightening remarks of Hugh Kennedy on this subject, or the recently acquired archaeological evidence supporting his views (Kennedy 1985; Piccirillo 1992; Walmsley 1992). Our lamps provide anyway the most eloquent illustration of this passage from one civilisation to another.

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# Measuring Long-Term Change in the Human Food Niche: A Levantine Example

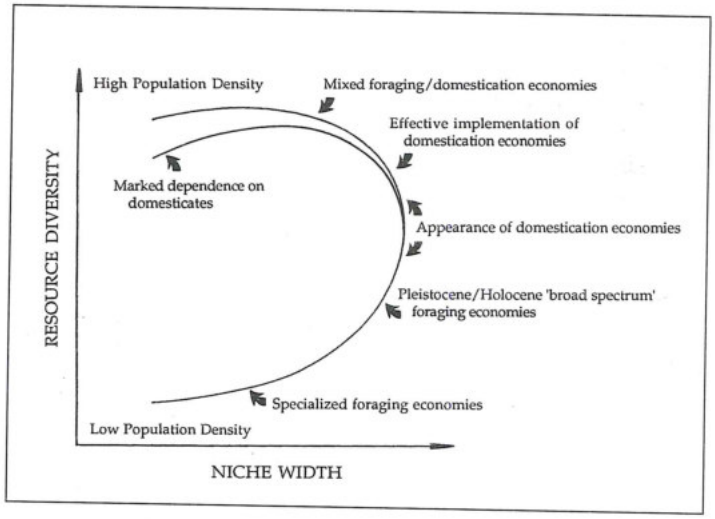
## Introduction

Archaeologists have tended to accept Flannery's (1969) broad spectrum revolution (BSR) as a general phase in an evolutionary sequence of subsistence changes leading to the appearance of domestication economies. Previous partial tests of the Flannery model in both hemispheres have tended to support it, especially those aspects that predict increasing subsistence diversity over time, and increases in the relative intensity of food procurement (e.g. Earle 1980; Christenson 1980; Clark and Yi 1983; Clark 1987). Phillip Edwards has recently claimed, however, that the BSR is not documented in Levantine archaeofaunal data, and that its generality as a phase in the domestication process in that region can thus be called into question (Edwards 1989; cf. Binford 1968; 1983). He contends that diversified archaeofaunas have been present in the Levant since the Middle Palaeolithic, and that no changes in the direction of increasing diversity are discernible in the period immediately preceding the appearance of domestication economies there. Edwards' construal of pattern is juxtaposed here with the expectations of long-term, diachronic niche width models developed by Cohen (1977), Earle (1980) and Redding (1988). Although his conclusions partly mirror our own, we think there are problems with how Edwards measures diversity and with his construal of what constitutes the BSR.

## The Broad Spectrum Revolution

In the classic formulation, the broad spectrum revolution is characterized by a series of changes in the subsistence economy beginning c. 20 kyr BP (the Epipalaeolithic in the Levant) that are manifest in a broadening of the human food niche (Flannery 1969). This increase in resource diversity was thought to continue until c. 8 kyr BP (the Neolithic) when reliance upon domestication economies is achieved in some areas of the Middle East. In the Levant, the broadening of the diet supposedly included a greater emphasis on smaller, more labor intensive, lower yield but more reliable food packages (e.g. fish, birds, shellfish) at the expense of the large and medium-sized, gregarious ungulates (e.g. deer, gazelle, equids, ovicaprines) that are the basis for Middle and Upper Palaeolithic subsistence. It is this pattern of increased diversity, attributed to a complex causal nexus involving population increase, environmental change, technological change and to changes in the organization of subsistence, that is believed to lead to the appearance of domestication economies (Flannery 1969: 79).

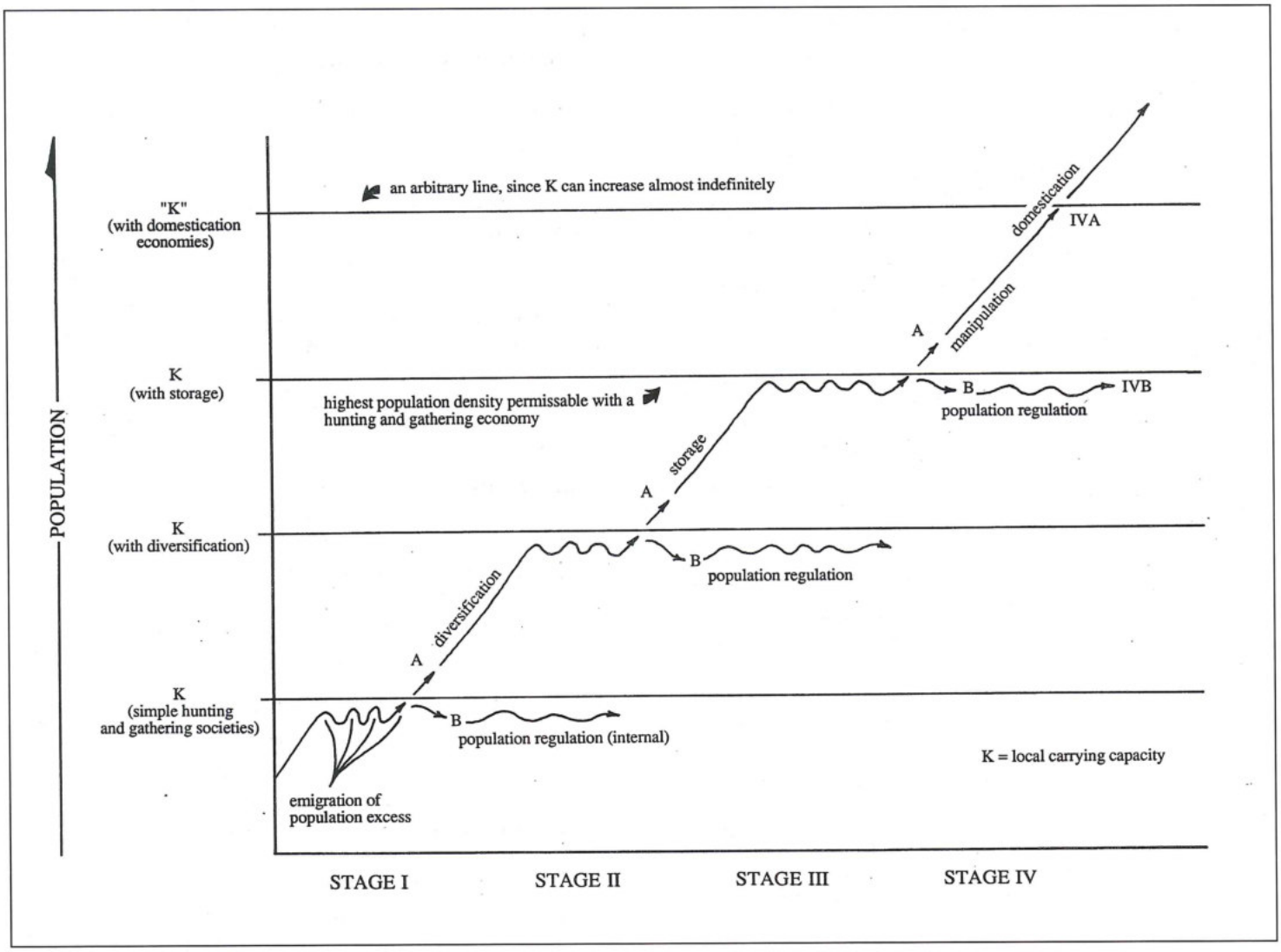
If simple diversity is plotted against niche width over time, the resulting curve is believed to have some generality, and to allow for the prediction of one variable, given a known value for the other (FIG. 1). The curve resembles a "backward C", with specialized foraging economies characterized by relatively low resource diversity occurring under conditions of low population density, followed by the BSR, where both resource diversity and niche width tend to increase, and to reach maximum values, the appearance of domestication economies and their effective implementation, marked by de-




1. Theoretical relationship between niche width and resource diversity under conditions of population growth, and with the least-cost selection assumption in effect (from Clark 1987: 296, modified from Christenson 1980: 37).

creases in diversity and niche width, and by increases in the rate of population growth. It is this sort of diversification-intensification trajectory (the "backward C"), ultimately powered by increases in population density and by regional population/resource imbalances, that has been presented in support of the BSR as a general evolutionary phase for regions outside the Middle East.

In a recent paper, Richard Redding (1988) has developed a universal generalization of the Flannery model, couched in terms of four evolutionary stages, each characterized by a prioritized hierarchy of tactics (FIG. 2). It is assumed that some local hunter-gatherer populations grew and stressed the resource base, thus forcing these groups to adopt certain tactics in order to cope with stress. Of interest to us is the role of diversification and the options associated with this subsistence tactic. In the Redding model, decisions must be made at various population and carrying capacity thresholds. These decisions are viewed in evolutionary terms and are expected to increase the overall fitness of the groups involved in the decision making process. Although the model is not intended to portray the change as unilineal, the ordering presented is believed to be the most likely general sequence of events or processes (Redding 1988: 75). Several aspects of his model are interesting for our purposes. One is the notion that the threshold of stress due to carrying capacity and population/resource imbalances does not have to be reached by all groups simultaneously. This implies that groups in relative proximity to each other might be operating on different levels in terms of the tactics or strategies employed. For our purposes it would not be unusual to see some variability in the regional data set that might be attributable to variable subsistence practices. Redding also indicates that diversity should be greatest prior to the advent of storage technology (1988: 85). This suggests that we might observe a




2. Redding's Model: Changes in local carrying capacity under conditions of population growth and with the adoption of emigration (Stage I), diversification (Stage II), storage (Stage III) and manipulation-domestication (Stage IV) strategies (after Redding 1988: 76, 79).

*decrease* in the overall diversity of site assemblages prior to the appearance of domestication economies as a result of the implementation of storage technologies.

### Edwards' Results Summarized

After examining 72 Levantine archaeofaunal assemblages distributed across eight analytical units ranging in time from the Lower Palaeolithic to the Pre-Pottery Neolithic, Edwards suggested that, by the Middle Palaeolithic, a wide range of animals were being exploited for dietary purposes throughout western Asia, and that there was no evidence to support a broadening of the diet immediately prior to the appearance of domestication economies (1989). He concluded that the BSR, which predicts an increase in diversity beginning around 20 kyr BP, is inappropriate as a general evolutionary phase in the Levant.

### Estimating Population Growth

One of the basic tenets of BSR-based models is that increases in population density over time are believed to drive the need to diversify the diet. Rather than simply reporting the number of site levels per culture-stratigraphic unit, it is clearly more appropriate to relate these numbers to a standardized measure of time. Scaling site numbers to unit time allows for comparability across culture-stratigraphic units of vastly different durations.

TABLE 1 gives the incidence of Levantine sites per millennium according to the seven analytical units most commonly used in the area. Data are derived from a variety of sources, including five regional surveys. It is apparent that the general expectation of population growth over time is met. After millennia of low values for the Middle, Upper and Epipalaeolithic, there is almost a three-fold increase when the Epipalaeolithic is compared with the Neolithic. Chalcolithic values nearly double again, and there is a substantial, although incremental, increase during the Bronze Age. Finally, in the Iron Age, scaled site numbers almost triple. While these trends are robust and are generally replicated within individual surveys, they are also influenced by the variable quality of the survey data upon which they are based.

**Table 1.** Estimate of population growth over time.[1]

| *Culture-Stratigraphic Unit* | *# of sites* | *Temporal Duration* | *# of sites per millenium* |
|---|---|---|---|
| Middle Palaeolithic | 347 | 65,000 | 5.33 |
| Upper Palaeolithic | 151 | 17,000 | 8.88 |
| Epipalaeolithic | 79 | 10,000 | 7.90 |
| Neolithic | 88 | 4,000 | 22.00 |
| Chalcolithic | 37 | 1,000 | 37.00 |
| Bronze Age | 102 | 1,800 | 56.66 |
| Iron Age | 114 | 700 | 162.85 |

[1] The data for this table represents results from 5 surveys in the Levant. They are: 1) Wādī al-Ḥasa (Clark *et al.* 1988a; MacDonald 1988a; 1988b); 2) the Southern Ghawr and Northeast 'Arabah (MacDonald *et al.* 1988; Neeley 1989); 3) an-Naqab and Sinai (Marks 1977); 4) the Ḥisma region (Henry *et al.* 1983); and 5) the Azraq Basin (Garrard *et al.* 1988a).

### The Components of Diversity

The concept of diversity, as developed and employed in ecology, has often been misapplied in archaeological research. As a general notion, diversity connotes the amount of variability present in a sample or population, but such a definition is inappropriately vague when trying to measure diversity quantitatively. In a recent volume devoted to archaeological diversity questions (Leonard and Jones 1989), the component parts of diversity are identified as richness, evenness and heterogeneity (Bobrowsky and Ball 1989: 5). *Richness* is the number of taxa in a given sample or collection. Since it can be shown statistically that richness is a function of sample size, the unqualified use of the simple number of taxa present in a collection might be an inaccurate measure of richness. To assess richness with some degree of reliability, the effects of sample size must be taken into account. *Evenness* refers to the proportional distribution of taxa in the sample. It determines whether or not all of the taxa are represented more or less equally in a sample or collection, or whether a sample is dominated by a few very abundant taxa. Evenness measures are also affected by sample size differences (Bobrowsky and Ball 1989: 7). *Heterogeneity* attempts to measure the relationship between richness and evenness, and to express it as a single index. Heterogeneity measures are very popular with archaeologists, but they suffer from the drawback that we typically do not know which aspect of diversity is most heavily influencing the index. Given such problems with heterogeneity measures, any assessment of the Levantine archaeofaunal record should probably utilize separate measures of richness and evenness. While Edwards does not use a heterogeneity index, he measured only evenness (1989: 236, 237). To ignore richness, however, could result in an inadequate assessment of subsistence change in light of expectations derived from BSR-based models.

### Kintigh's Simulation Approach

Having noted some of the problems associated with diversity indices, we sought to examine the richness component of Levantine archaeofaunas using a simulation approach developed by Keith Kintigh (1984; 1989). Kintigh has published simulation algorithms for both richness and evenness (1989) but McCartney and Glass (1990) have recently argued that the evenness measure he uses is in fact a heterogeneity statistic. His "evenness" statistic is a standardized measure which allows general

comparability between cases. We used it in conjunction with the richness statistic to identify cases of interest given the potential interpretive problems summarized above. A strength of the simulation approach is that values for expected richness and evenness are generated for given sample sizes, and are accompanied in each case by confidence intervals. Thus the sample size problem is avoided at the individual assemblage level.

## Levantine Archaeofaunal Data

The temporal span of both studies is approximately 100,000 years, but we divided ours into eight culture-stratigraphic analytical units, including three post-Neolithic periods (TABLE 2). The choice of these analytical units is partly a matter of convention, but they were also chosen on the assumption that, in order to detect possible changes in diversity associated with the BSR, bracketing periods of sufficient duration must be examined. Sixty-three assemblages are analyzed, compared with 72 (29) in Edwards' study (1989: 228, 229) (TABLE 2). Since most reports present information on all species recovered, regardless of their economic potential, we screened the data in order to isolate probable economic species. Only three publications did this consistently (Noy *et al.* 1980; Payne 1983; Saxon 1974). Building on these and other assessments of economic status, we decided to eliminate all rodents, insectivores, raptors, reptiles (except tortoises) and mollusca — the last because of inconsistent reporting and because the common ornamental use of shell, and absence of shell middens, suggested that they were not major dietary components (Edwards 1989: 231). This left 59 species of mammals, birds and fish as potential food items (TABLE 3).

**Table 2.** Faunal assemblages used for this study.

| | |
|---|---|
| *Middle Palaeolithic* | |
| Douara Cave | Payne 1983 |
| Far'ah II | Gilead and Grigson 1984 |
| Qafzeh 11 | Bouchud 1974 |
| Qafzeh 15 | Bouchud 1974 |
| Qafzeh 22 | Bouchud 1974 |
| Wadi Hasa 621 | Clark *et al.* 1988b |
| Tabun D | Bar-Yosef 1989 |
| Bezez B | Garrard 1983 |
| C-Spring | Clutton-Brock 1970 |
| *Upper Palaeolithic* | |
| Kebara D | Saxon 1974 |
| Kebara E | Saxon 1974 |
| Wadi Hasa 618 | Clark *et al.* 1988b |
| Qafzeh 9 | Bouchud 1974 |
| Jilat 9 | Garrard *et al.* 1988b |
| Azraq 17 | Garrard *et al.* 1988b |
| El Wad D | Bar-Yosef 1989 |
| *Kebaran* | |
| Ein Gev I | Davis 1974 |
| Wadi Hammeh 26 | Edwards *et al.* 1988 |
| Uweinid 18 | Garrard *et al.* 1988b |
| Wadi Hasa 784x | Clark *et al.* 1988b |
| Jilat 6 | Garrard *et al.* 1988b |
| Kebara C | Saxon 1974 |
| Nahal Hadera V | Saxon *et al.* 1978 |
| Hefsibah | Saxon *et al.* 1978 |
| Ṭawr Ḥimār (Tor Hamar) | Henry and Garrard 1988 |
| Iraq e Zigan | Heller 1978 |
| *Natufian* | |
| Bayḍa (Beidha) | Hecker 1989 |
| Wadi Hammeh 27 | Edwards *et al.* 1988 |
| Hayonim Terrace | Henry *et al.* 1981 |
| Wadi Hasa 1065 | Clark *et al.* 1988b |
| Kebara B | Saxon 1974 |
| Wādī Judayid | Henry and Turnbull 1985 |
| Rosh Horesha | Butler *et al.* 1977 |
| Jilat 8 | Garrard *et al.* 1988b |
| Jilat 10 | Garrard *et al.* 1988b |
| Azraq 18 | Garrard *et al.* 1988b |
| Jilat 6 | Garrard *et al.* 1988b |
| *Neolithic* | |
| Jericho PPNA | Clutton-Brock 1979 |
| Gilgal | Noy *et al.* 1980 |
| Abū Sālim | Butler *et al.* 1977 |
| Jericho PPNB | Clutton-Brock 1979 |
| Bayḍa | Hecker 1982 |
| 'Ayn Ghazāl PPNB | Köhler-Rollefson *et al.* 1988 |
| Wadi Tbeik | Tchernov and Bar-Yosef 1982 |
| 'Ayn Ghazāl PPNC | Köhler-Rollefson *et al.* 1988 |
| 'Ayn Ghazāl Yarmoukian | Köhler-Rollefson *et al.* 1988 |
| Ujrat | Dayan *et al.* 1986 |
| Jilat 7 | Garrard *et al.* 1988b |
| Azraq 31 | Garrard *et al.* 1988b |
| Jericho PN | Clutton-Brock 1979 |
| *Chalcolithic* | |
| Jabal Jill | Henry and Turnbull 1985 |
| Shiqmim | Grigson 1987 |
| Ṣabī Abyaḍ | Akkermans 1987 |
| *Bronze Age* | |
| Jericho EB | Clutton-Brock 1979 |
| En Shadud | Horowitz 1985 |
| Arad EB I | Lernau 1978 |
| Arad EB II | Lernau 1978 |
| Jericho MB | Clutton-Brock 1979 |
| Tel Michel MB | Hellwing and Feig 1989 |
| Tel Michel LB | Hellwing and Feig 1989 |
| *Iron Age* | |
| Jericho Iron | Clutton-Brock 1979 |
| Tel Michel Iron | Hellwing and Feig 1989 |
| Tel Michel Persian | Hellwing and Feig 1989 |

**Table 3.** Levantine archaeofaunal genera, species.

1. *Equus equus, asinus* (horse, hemione, zebra, ass)
2. *Sus scrofa* (boar, domestic pig)
3. *Dama mesopotamica* (fallow deer)
4. *Capreolus Capreolus* (roe deer)
5. *Cervus elaphus* (red deer)
6. *Bos primigenius* (auroch)
7. *Bos taurus* (domestic cattle)
8. *Alcelaphus bucelaphus* (hartebeest)
9. *Gazella gazella* (gazelle)
10. *Capra ibex* (ibex)
11. *Ovis cf. aries* (sheep)
12. *Capra/Ovis*
13. *Camelus cf. dromedarius* (camel)
14. *Dicerorhinus merki, hemitoechus* (rhino)
15. *Hippopotamus amphibius* (hippo)
16. Large ungulate
17. Small ungulate
18. *Lepus europaeus* (hare)
19. *Vulpes vulpes* (fox)
20. *Erinaceus europaeus* (hedgehog)
21. *Hemiechinus* (long eared hedgehog)
22. *Felis sp.* (cat)
23. *Canis lupus* (wolf)
24. *Panthera pardus, leo* (leopard, lion)
25. *Lynx lynx* (lynx)
26. *Martes martes* (marten)
27. *Meles taxus* (badger)
28. *Hyrax hyrax* (hyrax)
29. *Hystrix* (porcupine)
30. *Testudo* (tortoise)
31. *Clemmys* (tortoise)
32. *Teleostei* (boney fish)
33. *Sciurus* (squirrel)
34. *Struthio* (ostrich shell)
35. *Otididae* (shell)
36. *Potamon* (crab)
37. *Aves*
38. *Anas* (duck)
39. *Anser* (goose)
40. *Alectoris* (partridge)
41. *Rallus* (water bird)
42. *Phasianidae* (pheasant)
43. *Pteroclidae* (sand grouse)
44. *Fulica* (coot)
45. *Ciconia* (stork)
46. *Columba* (pigeon)
47. *Syrrhaptes* (sand grouse)
48. *Gallus* (wild chicken)
49. *Cygnus* (swan)
50. *Larus* (gull)
51. *Streptopelia* (dove)
52. *Tadorna* (shellduck)
53. *Vanellus* (harpwing)
54. *Bucephala* (duck)
55. *Ammoperdix* (partridge)
56. *Porphyrio* (gallinule)
57. *Chlamytodis* (bustard)
58. *Coturnix* (quail)
59. *Clarias* (fish)

**Dropped**

*Hyaena* (stripped hyena)
*Crocuta* (spotted hyena)
*Mustela mivalis* (polecat)
*Buteo* (buzzard)
*Bubo* (owl)
*Vormella* (polecat)
*Aquila* (eagle)
*Passeriformes* (sm. birds)
*Galerida* (lark)
*Corvus* (crow)
*Falconiformes* (falcons)
*Neophron* (vulture)
*Ketupa* (brown fish owl)
*Circus* (harrier)

## Species Diversity: Means and Frequencies

A preliminary examination of the richness and evenness statistics that ignores sample size differences indicates some interesting trends. The total number of economic species per analytical unit fluctuates between 22 and 27 from the Middle Palaeolithic through the Kebaran, and then rises sharply and attains a maximum during the Natufian and the Neolithic (TABLE 4). This peak is followed by an even steeper decline during the Chalcolithic, and by subsequent partial recovery and fluctuation in the post-Neolithic periods. Taken at face value, such a crude measure tends to support the BSR concept, but maximum diversity appears to occur in the late, rather than in the early Epipalaeolithic. The decline in richness associated with the effective implementation of domestication economies during the post-Neolithic eras also agrees with vectored subsistence change under conditions of increased population density predicted by BSR-based models (e.g. Christenson 1980; Clark 1987; cf. FIG. 1).

Inspection of maximum richness values indicates a trend toward increasing richness through time, with a peak during the Natufian and the Neolithic, followed by a rather sharp decline (TABLE 4). While again supportive of the BSR concept, this measure represents only the single "most diverse" faunal assemblage from each time period. A better indicator of general time trends is mean species richness, which peaks once again in the Natufian/Neolithic and is, again, followed by a sharp decline. The mean richness values are probably affected to some extent by sample size differences.

The summary statistics for evenness tend to support

**Table 4.** Mean values and frequencies of species richness for Levantine archaeofaunas.

| *Period* | *N* | *# of species* | *Maximum # of species* | *Mean Richness* |
|---|---|---|---|---|
| Middle Palaeolithic | 9 | 26 | 14 | 8.55 |
| Upper Palaeolithic | 7 | 22 | 17 | 8.28 |
| Kebaran | 10 | 27 | 14 | 8.40 |
| Natufian | 11 | 35 | 20 | 10.72 |
| Neolithic | 13 | 43 | 17 | 11.15 |
| Chalcolithic | 3 | 15 | 12 | 8.66 |
| Bronze Age | 7 | 23 | 13 | 9.14 |
| Iron Age | 3 | 17 | 12 | 9.00 |

Edwards' conclusion that the highest mean evenness values coincide with the Middle Palaeolithic and then decline steadily through the Neolithic (TABLE 5). In the post-Neolithic periods, mean evenness increases slightly but never to the level reached in the Middle Palaeolithic. It was this sort of trend and statistic (mean values regardless of sample size) that Edwards used to support his claim that diversity was highest early on and not in the Epipalaeolithic, as the BSR model would suggest. Aside from the sample size problem, other factors need to be considered in his interpretation. Foremost is the assumption that higher evenness is equal to greater diversity. Since evenness is a monitor of the *proportional* distribution of species, a high evenness value might indicate a relatively equal proportion of species utilization while a lower evenness statistic might correspond to more selective species utilization or an increase in the number of species utilized. In the latter instance, "traditional" resources might be utilized in the same frequencies but because of added species, their proportional representation would decline. It is possible that the decline in mean evenness over time is in response to an increase in the number of species utilized (richness), a trend which is apparent from the mean richness values.

**Species Diversity: Simulations Within Time Periods**

Plots were generated for each of the eight analytical units using Kintigh's simulation program. The results of these simulations are summarized in FIGS. 3-10. The range of expected values for the samples are represented by the three lines, and the placement of individual assemblage scores in relation to them by solid rectangles. The center line is the mean expected value, and the lines that bracket it are the upper and lower 90% confidence intervals.

*Middle Palaeolithic*

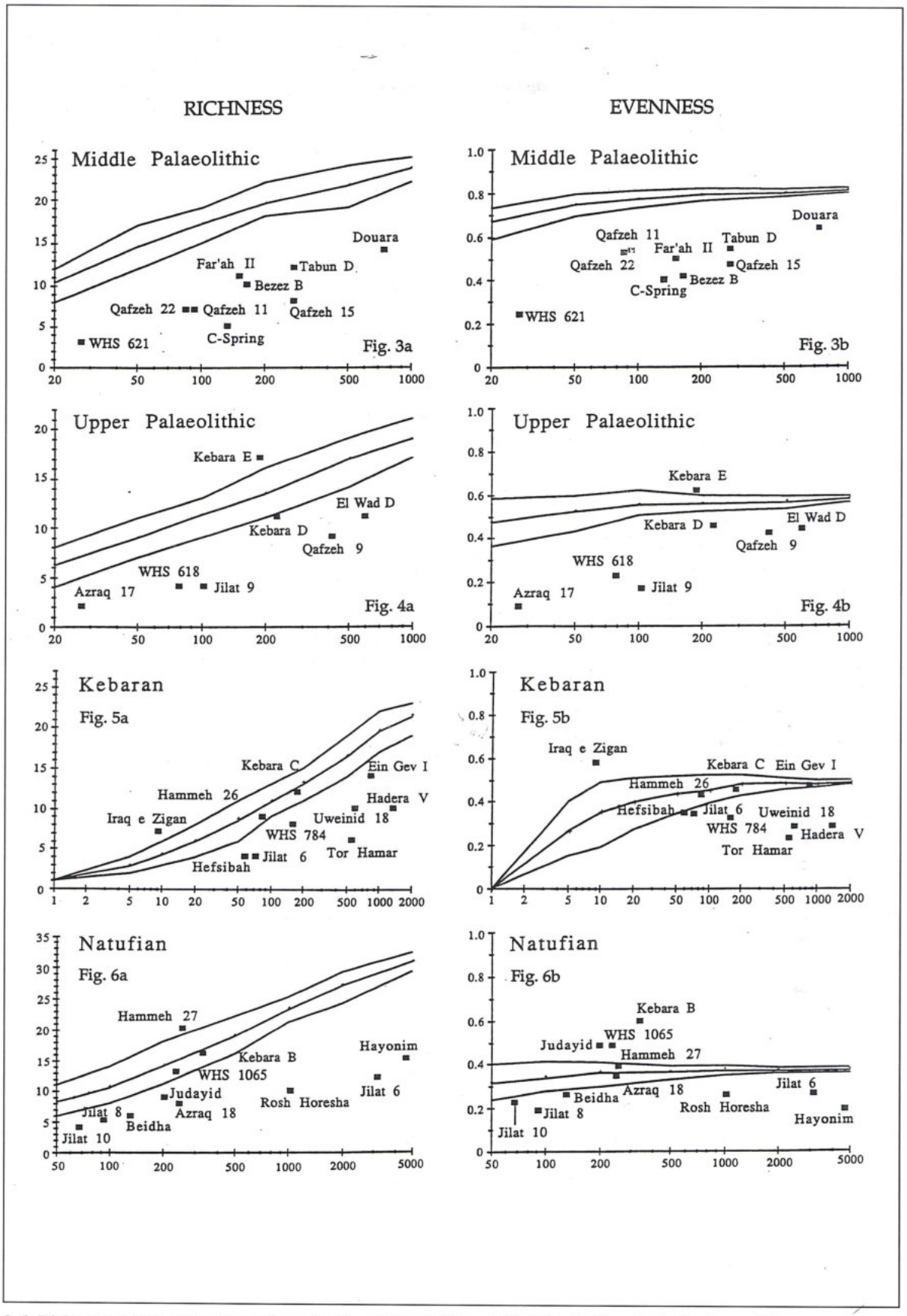
As might be expected, interpretation of the within-period simulations is not as straightforward as the mean and frequency data. This is due in part to the general tendency for all periods to exhibit levels of richness *beneath* the confidence interval. Exact fit within the bounds of the confidence interval is not expected, since the confidence intervals serve as a general model of the sample size effect to which the data are expected to conform. The Middle Palaeolithic pattern indicates that richness and evenness tend to be a result of the sample size effect (FIGS. 3a, 3b). This apparently generalized economic behavior might reflect a sort of "random" sample of species from the local environment. This is somewhat surprising since most Levantine Middle Palaeolithic samples come from rockshelter contexts that are thought to have more diverse faunas than open sites.

*Upper Paleolithic*

The Upper Paleolithic simulations indicate that most of the sites follow the linear sample size trend predicted by the simulation model (FIGS. 4a, 4b). However, one assemblage (Kebara E) is richer than expected, and another (Kebara D) falls just below the lower confidence interval. The remainder adhere to a pattern consistent with the sample size effect. While the richest Upper Palaeolithic assemblages are from Kebara, other rockshelter assemblages conform to expected trends, as do Upper Palaeolithic open sites.

**Table 5.** Summary statistics of species evenness for Levantine archaeofaunas.

| *Period* | *N* | *Max.* | *Min.* | *Mean* | *Median* |
|---|---|---|---|---|---|
| Middle Palaeo. | 9 | .6305 | .2391 | .4736 | .5000 |
| Upper Palaeo | 7 | .6159 | .0854 | .3438 | .4194 |
| Kebaran | 10 | .5732 | .2374 | .3781 | .3501 |
| Natufian | 11 | .5884 | .1859 | .3312 | .2586 |
| Neolithic | 13 | .5216 | .1262 | .3167 | .3074 |
| Chalcolithic | 3 | .5951 | .2191 | .4337 | .4871 |
| Bronze Age | 7 | .5518 | .2186 | .3878 | .3550 |
| Iron Age | 3 | .5283 | .1436 | .2857 | .1853 |




3-6. Richness and evenness simulations for four (Middle Palaeolithic-Natufian) analytical units used by convention to structure Levantine archaeological research.

*Kebaran*
In examining the richness simulation for the Kebaran, the tight, linear sample size effect noted for the Middle and Upper Palaeolithic is less apparent when the individual assemblage distribution is compared to the confidence interval (FIGS. 5a, 5b). A considerable amount of variability in the distribution of the assemblages suggests a difference in animal exploitation which is not apparent in the earlier periods.

*Natufian*
In some contrast to the Kebaran plots, the Natufian assemblages tend to conform to the expected sample size trend generated by the simulation (FIGS. 6a, 6b). Although all assemblages do not deviate from the sample size effect, the fact that some do indicates a continuation of behavioral activities that were largely absent prior to the early Epipalaeolithic.

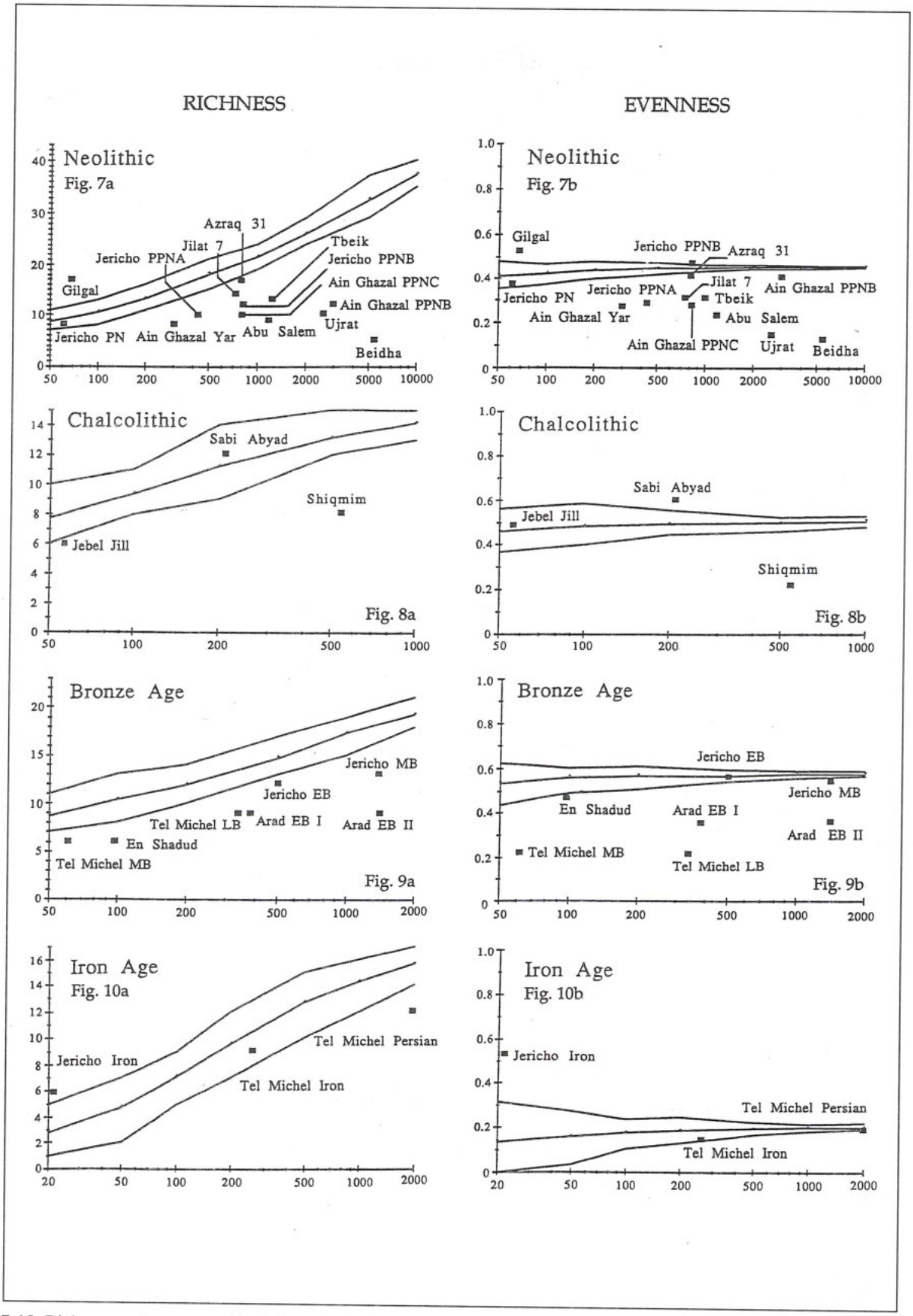
*Neolithic*
The higher richness values continue into the Neolithic where three collections fall within or above the confidence intervals (FIGS. 7a, 7b). In general a roughly linear trend due to the sample size effect can be detected for most of the other samples, though many are of a similar size and tend to cluster in the center of the diagram. Perhaps most interesting is the appearance of a very large collection with a low richness value (Bayḍa/Beidha). This is the first indication of some sort of fairly clear-cut economic specialization. It is not surprising that this signature appears for the first time in the Neolithic, when the earliest, undisputed domestication economies occur. All are open air sites, which might signal a change in richness when compared with the pre-Neolithic samples. Many of the latter were recovered from rockshelters, which tend to have better-preserved faunas and which also serve as carnivore lairs and dens, and which are frequented by raptors.

*Chalcolithic*
Interpretation of the Chalcolithic simulation is difficult because the sample size is so small (3 sites) (FIGS. 8a, 8b). While the sharp drop in the number of species exploited, as compared to the Neolithic, indicates a significant difference in resource exploitation, there is a high likelihood that the richness and evenness simulations are compromised by the small sample size. As a result, the interpretation of very small samples should be set aside until more robust data sets can be obtained.

*Bronze and Iron Ages*
No Bronze Age sample falls within the range of expected values (FIGS. 9a, 9b). This suggests that the increased diversity characteristic of the Natufian and Neolithic has begun to decline in subsequent periods, probably because of the combined effects of intensive agropastoral economies, and increasingly widespread habitat destruction. Finally, the three Iron Age assemblages suffer from the same small sample size effect as the Chalcolithic assemblages and any attempt to interpret pattern in these would be misleading (FIGS. 10a, 10b).

*Conclusions*
In summary, the patterns noted in the within-period simulations are by no means conclusive, but the overall trend is at least suggestive of some support for the BSR. Because richness and evenness generally follow a sample size trend in all analytical units, exact replication of patterns expected under BSR-based models is not achieved. While the patterns might be affected by the variables selected (unlikely, in our view), or by the fact that some units are only represented by a few collections (see Chalcolithic and Iron Age) or by some defect in the simulation algorithm itself, we cannot partition potential sources of error except impressionistically. Taking the sample size effects into account, these Levantine archaeofaunas all do in fact appear to become more rather than less diverse through time. This directly contradicts Edwards' conclusions that they are relatively diverse throughout the entire sequence (1989: 240-242).

At present, our results and those of Edwards cannot be reconciled, and we are at something of a loss to explain why. We maintain that conclusions drawn from Edwards' study are problematic because of his use of an evenness measure, and the fact that he ignored richness, his failure to consider subsistence changes more recent than a relatively early phase of the Neolithic, his failure to distinguish between economic and non-economic faunas, and his failure to take sample size effects into account. His contention that Levantine archaeofaunas were diverse from start to finish, and that no vectored change in the direction of increasing diversity was apparent during the most likely BSR interval, the Epipalaeolithic, appears to us to be unfounded. While we cannot claim to have demonstrated the existence of the BSR in these data, we submit that the weight of evidence favors our position, and we categorically reject Edwards' claim that taxonomic diversity is unrelated to trends toward food production at the end of the Pleistocene. In our opinion, BSR-based models retain considerable explanatory potential, and have developed to the point where fairly explicit test implications can be generated from them, and then compared with regional data sets like this one. We would be loath to abandon them simply because of instances where pattern searches do not neatly coincide with expectations, especially in the absence of viable alternative explanations.




7-10. Richness and evenness simulations for four (Neolithic-Iron Age) analytical units used by convention to structure Levantine archaeological research.

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# Balanophagy and the Bedrock Industries of Ancient Jordan

## Introduction

Anyone who has trod the rocky countryside of Jordan can testify that one of the most prevalent remains of human activity are the cuts, gashes, holes, and channels in the stone outcroppings that reflect the numerous bedrock industries of antiquity. The most ubiquitous of these marks is undoubtedly the simple, but multifunctional, "cup-hole." In his article on cup-marks and the ancient Palestinian wine industry, G. W. Ahlstrom (1978: 44, 45) lists the various proposals scholars have made for the function of bedrock cupholes. These include: 1. ancient fulling works (Hanauer 1900: 361); 2. mortars and querns (Dalman 1908: 23, 34); 3. receptacles for pounding grain (Glueck 1959: 88; 1968: 84); 4. jar holders (Macalister 1912: 49-50; Dalman 1908: 33, 34); 5. receptacles for soap to be used in washing wine presses and vats (Bliss and Macalister 1902: 193; Lutz 1922: 66; Orni and Efrat 1966: 304); 6. receptacles for watering cattle (Macalister 1900: 35); 7. water jug holders for workers (Kenyon 1942: 91); 8. small oil and juice presses (Macalister 1900: 35); 9. juice collectors for catching the runoff from drying grapes (Ahlstrom 1978: 45); 10. post holes for poles that held bag presses (ibid.); 11. making homes (ibid.); 12. various religious uses such as libation, funerary rites, or some service connected with a water cult (Duncan 1931: 43, 47; Hammond 1973: 48; Ussishkin 1971: 33-34). In this paper I would like to suggest an additional purpose for cupholes: processing sites for acorns.

Although it is little discussed, one of the more common consumption practices of mankind has included that of balanophagy, or acorn eating. Anyone who has ever tried a raw acorn (the nut of an oak tree) may question how this could be, since the tannic acid in most species gives the nuts a very bitter taste. However, if the tannic acid has been leached, the acorn becomes much more palatable and provides an excellent source of carbohydrates (Wolf 1945; Platt 1962 [cited in Flannery 1969: 78]; Baumhoff 1963: 162-163; Brouk 1975: 209; Johnson and King 1977: 487).

Although the better known cases of this practice are those of the California Indians (Gifford 1967) and the west Mediterranean (Lewthwaite 1982), the former abundance of oak forests throughout many of the more temperate zones of the world makes it possible, if not probable, that balanophagy has at one time or another been an important element in the subsistence strategy of many different peoples (Brouk 1975: 209). This would include the ancient Near East — an area which both modern palaeobotanical studies and the ancient historical sources indicate was once covered by extensive oak forests.

## Ethnographic Observations of Balanophagy in the Near East

Actual references to the practice of balanophagy from *ancient* Near Eastern sources appear, for the present, to be lacking.[1] However, there are several references by

[1] There are a number of ancient sources that describe acorn eating in adjacent regions, particularly from Mediterranean countries. Since the oak belt in the ancient Near East was essentially a continuation of the belt that covered the Mediterranean countries, references from the latter region are worth noting. The earliest references to the use of acorns as a food staple come, as might be expected, from various Greek and Roman writers. For example, Pliny, the Roman naturalist (79-23 BC), wrote that the oak "was the tree which first produced food for mortal man." Many varieties were known to him, some sweeter than others (in Brothwell 1969: 149). Pliny (in Gifford 1968: 93) also described the preparing of acorns for consumption: "In the absence of cereals, a flour is milled from the parched kernels (of acorns) and made into a paste to serve as bread". Pausanias, a Greek geographer of the second century AD, attributed the beginning of balanophagy to Pelasgus (in Gifford 1968: 94): "On the other hand he (Pelasgus) introduced as food the fruit of oak trees, not of all oaks, but only the acorns of the 'phegos' oak. Since his time some people have adhered so closely to this diet that even the Pythian priestess, in forbidding the Lacedaemonians to touch the land of the Arcadians, spoke the following verses, 'There are many acorn-eating men in Arcadia who will prevent you; though I do not grudge it you'." Herodotus (fifth century BC) also mentioned the Pythian prophetess' reference to the Arcadians. He quoted her as saying, "Many there are in Arcadia land, stout men, eating acorns" (ibid.). The Greek didactic poet of the eighth century BC, Hesiod, wrote (in Brothwell 1969: 149): "The earth bears them (mankind) victuals in plenty, and on the mountains the oak has acorns on top and bees in its midst". Finally, Theophrastus (c. 287 BC), the first known botanical writer, describes how acorns were ground and bread made from the flour (in Brouk 1975: 209).

The ancient Greek and Roman writers were not the only ones to document the practice of balanophagy in the Mediterranean region. The eating of acorns apparently continued to be a fairly common practice in this region up until the turn of the present century. Sources attesting to this have been conveniently compiled by Gifford (1968). For example, Hooker and Ball (1878: 268) de-

early explorers of western Palestine and Transjordan who testify that local peoples were utilizing acorns as a food source as recently as the last century. Groser (1888: 68), for example, writes, "Another abundant species (of tree) is the Valonia or prickly-cupped oak (*Quercus aegilops*), well known in the Levant, where its acorns are used in tanning, but the Arabs eat them for food". Tristram (1873: 370), writing about the Oaks of Bashan, makes a similar claim, "It (the Oak of Bashan [also *Quercus aegilops* = *Q. ithaburensis*]) bears very large acorns, and these are used as food by the Arabs, while the acorn cups are employed by dyers".[2]

Moving eastward, Sir Arnold T. Wilson (1932: 54) provides an actual description of processing acorns for food, "The nomads of the Zagros range from Baneh and Saqqiz in Kurdistan to Shiraz, have from the earliest times supplemented their meager stores of cereals with bread made from acorns, which are ground or rather pounded to pulp with the aid of a boulder rolled over a flat rock; the meal thus obtained is soaked in running water for several days, dried, and made into flat cakes. It is not appetizing, but it keeps well, and judging from the physical condition of whole families which have lived with no other cereals and no other food except the produce of their herds, it does not lack vitamins."[3]

One of the most recent documentations of balanophagy in the Near East comes from Frank Hole's study of pastoral nomadism in Western Iran. Specifically, Hole (1978) reports the use of acorns by the Baharvand, a tribe of Luri-speaking people, one-fourth of whom still pursue full-time pastoralism. Although presently the tribe derives much of its subsistence from agriculture this was not the case as recently as a few years ago. According to one of Hole's informants, an older tribesman named Atawak, the tribe had, in earlier days, been capable of subsisting entirely independent of agriculture. Instead, they relied mostly on acorns and wild grains as well as on the products of their herds and trading. Atawak recalled subsisting chiefly on meat and acorn preparations, although occasionally he would have rice (obtained at a market) and chicken (Hole 1978: 147).[4] Although balanophagy (as well as the harvesting of wild grains) was formerly very important to the Luri-speaking nomads, this activity is carried out today only during times of economic stress (Hole 1979: 208).

Hole also describes the processing of the acorns.[5] For the bulk processing of acorns it was necessary to roast them and grind them into flour. The roasters were simply rectangular stone structures about a meter and a half on a side and of similar height. Hole reports that these roof-

scribe the practice in Iberia and North Africa: "The tree was found to be the belloot oak (*Quercus ballota* of Desfontaines), a variety of the evergreen oak, which is widespread through North Africa and Spain, where the sweet acorns are commonly roasted and eaten, as chestnuts elsewhere." A further reference for this area is found in Meakin (1901: 36): "The acorns (Belloot) [of the cork oak], ... are of large size and often eaten." Another reference to balanophagy in Spain is found in Townsend (1792: 90, 91) who traveled in Spain in 1786 and 1787: "For the first two leagues we ascended gradually; then entered a forest of ilex, which, as my guide informed me, stretches east and west near forty leagues. The acorns here are of the kind described by Horace, as the origin of war among the rude inhabitants of an infant world, 'glandem atque cubilia propter.' Not austere, like those of the oak, or the common ilex, but sweet and palatable, like the chestnut, they are food, not merely for swine, but for peasants, and yield considerable profit." Ford (1851: 127) shows that the peasants were not the only Spaniards who ate acorns. Describing Estremadura he stated: "The acorns are still called bellota, the Arabic bollot-belot being the Scriptural term for the tree and the gland — which, with water, formed the original diet of the aboriginal Iberian, as well as of his pig; when dry, the acorns were ground, say the classical authors, into bread, and, when fresh, they were served up as the second course. And in our time ladies of high rank at Madrid constantly ate them at the opera and elsewhere; they were the present sent by Sancho Panza's wife to the Duchess, and formed the text on which Don Quixote preached so eloquently to the goatherds, on the joys and innocence of the golden age and pastoral happiness, in which they constituted the foundation of the kitchen." Brouk (1975: 209) notes that acorns are still used for bread-making in poor areas such as the south of Italy, where the soil will not yield cereals and where poverty prevents the purchase of flour from elsewhere; otherwise acorns are used as fodder. Gifford has also found reference for the use of acorns in Sardinia. The first comes from Altheer (1857: 93) who says that at Ogliastra, Sardinia, fat clay was mixed in a porridge of acorn meal, the compound made into cakes, baked, sprinkled with ashes or smeared with a little grease, and taken as daily food. A full account of the manufacture of acorn bread in Sardinia was given by Antonio de Cortes (1900: 76-83). He says that the acorns were first boiled until soft, pulverized in a mortar, spread on a flat stone, and mixed with ferruginous earth to counteract the tannic acid. They were then baked in an oven.

.[2] Fraser also notes how the acorns of the Oaks of Bashan are eaten by native Arabs, but he is clearly basing his observation on Tristram's earlier work (Fraser 1927: 323). Tristram's reference reminds us that acorns were not only used as food but the tannin could be extracted from the acorn and used as a dye. Although this use of acorns is beyond the scope of the present study, it is important and should be considered ethnoarchaeologically.

[3] This latter example from Persia is of particular interest because, as Gifford explains, it is the only explicit Old World example of removing tannic acid from acorns according to the California practice of pulverizing the acorns in a mortar first, then leaching with water (Gifford 1968: 95; Hole 1979: 209). The similarity of the process between two such geographically separated regions is quite interesting. Gifford suggests that at first glance any connection between the identical pulverizing-leaching practices of California and Iran would seem unlikely. However, he suggests that in view of the widespread nature of balanophagy in antiquity it is not impossible that some of the Asiatic forefathers of the American Indians were acorn eaters and that their descendants, upon reaching the oak regions of the Pacific coasts and elsewhere, revived this food habit of their ancestors. While Gifford acknowledges that this phenomenon could have easily originated independently from different centers, he suggests that one should not be closed minded to the possibility that the knowledge of removing tannin in this particular way could have spread from one center of origin (1968: 95). Throughout most of California the Indians would gather the acorns in the fall when the nuts were mature. In preparing the acorns the women would first dry and then hull the nuts. The hulled nuts were then reduced to flour by pounding them with a stone pestle in one of several types of mortars, either a portable mortar or a bedrock mortar. The acorn meal would then be spread out in a shallow, sandy depression and hot water would be poured into the basin in order to leach the bitter tannin from the flour. The dough was subsequently combined with water and cooked as mush or baked into bread (Newcomb 1974: 195). The description that Wilson provides for the Zagros is not as complete, but it can be seen to be the same basic procedure. The acorns were gathered, then crushed into pulp by a boulder on a flat rock. The meal was then soaked in running water for several days and then dried and made into flat cakes (Wilson 1932: 54). The reference to running water suggests that the nomads must have undertaken this process at or near a natural source of running water since it is unlikely that they would carry sufficient water with them for leaching. Thus, the flat rocks they used for mortars were probably bedrock outcroppings near a spring.

[4] Atawak also claimed that when he was younger the forests were much more extensive; in many places the vegetation was so dense it was difficult to walk through. Although there was less grazing land, there were more acorns and wild game (Hole 1978: 148).

[5] Hole does not mention whether he actually witnessed the procedure or was only told of it by his informants.

less buildings were found in the mountains where there were oaks. Campgrounds were not necessarily found in the vicinity. Nearby was likely to be a large rock on which another rock rested. These were "crushers", very large "manos and matates". One that Hole photographed had a boulder base and an upper stone which was so large that it was simply rocked back and forth over the acorns. The size of the "acorn smashers" that Hole saw greatly exceeded the manos and matates that are found in archaeological village sites, although Hole saw no reason why this should be the case (1978: 154).

In a separate report Hole mentions that in addition to the large boulders, the nomads would use bedrock mortars. These are often distinguished by a line of several depressions in the bedrock (Hole 1979: 209). Similar depressions, often referred to as "cupmarks" or "cupholes" are well known in the Near East. Although many functions have been suggested for these depressions, grinding acorns has not generally been one of them. The ethnographic evidence in the Zagros and California, however, suggests that some of these depressions may have, at times, been used for processing acorns.

It is interesting that, in addition to the bedrock mortars, the mano-matate are also known in both the Near East and California. In the case of California Aikens has suggested that when the mano-matate combinations predominate over mortars and pestles as a food-grinding system, seed gathering is implied. However, when a site reveals an increase in mortars and pestles it is indicative of a shift towards the use of acorns and other large nuts (Aikens 1983: 161).[6]

The mano-matate (or quern) has been found at numerous sites in western Palestine and Transjordan, including Tall al-'Umayrī and Jāwa. The mano and matate were probably the most common tools for the grinding of seeds and grains. This is not to say that seeds and grains were not ground in stone or bedrock mortars. Indeed, Glueck provides conclusive evidence that they are (1959: 88, 89). However, when large nuts such as acorns need to be ground, the mortar is more efficient, while the manos and matate are preferred for smaller seeds and grains (Aikens 1983: 161).

## Acorn Processing Sites and the Archaeological Record

These ethnographic or ethnoarchaeological studies of recent and modern Near Eastern acorn-processing sites provide a useful guide for assisting the archaeologists in identifying such sites in the archaeological record. First, the sites could be expected to be found near the ancient location of oak woodlands. The most visible physical features at the site would generally be surface boulders or bedrock outcroppings which provided a surface upon which the acorns were crushed. Depressions or "cupholes" would be expected to appear frequently in the bedrock exposures, serving as bedrock mortars. These boulders and/or bedrock mortars might often be located near sources of water, facilitating the leaching process. "Roasters", such as the type Hole mentions (1978: 154), might be found in the area.

Although no systematic surveys have been conducted to locate acorn processing sites per se, a number of sites have been reported incidentally in the literature, particularly in Palestine, which appear to meet the required parameters. In Jordan, for example, our excavations at Tall al-'Umayrī exposed an outcropping of bedrock in field C under levels of an Early Bronze Age occupation that contained numerous "cupholes" or bedrock mortars. The bedrock outcropping, itself, was just a short distance from the only spring in the area. Environmental studies (referred to above) indicated the presence of an oak forest on the surrounding hills during antiquity (Geraty *et al.* 1986: 123, 132). Numerous similar findings have been reported in western Palestine.[7]

It would be nice if acorns were more frequently found at these sites, but being organic, they do not generally survive unless they have been carbonized. Nevertheless they have been reported in Pre-Pottery Neolithic and Chalcolithic deposits at Nahal Oren and Nahal Mishmar in western Palestine (Liphschitz 1986: 2, 3). These sites may represent the camps of either early hunter-gatherers or what Gilbert calls early "herder-gatherers" (Gilbert 1983: 107). Settlements such as Arad and Jarmo have also produced acorns (ibid.; Braidwood 1960). These could possibly represent early agricultural settlements whose inhabitants were still including wild plant foods in their subsistence strategies.

Taken all together, the evidence from these sites makes it reasonable to suggest that acorns formed a part of the subsistence system of many Near Eastern peoples in antiquity, including those of Jordan. The only items

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[6] For example, at an early Indian site in the southern Sierra foothills, in an early occupation phase known as the Chowchillian (300 BC - AD 300), slab matates and manos were common. However, during the Raymond phase (AD 300 - 1500) bedrock mortars appear alongside the matates and manos, implying a shift to an emphasis on acorn-processing.

[7] The Olami Survey, conducted on the Mount Carmel range in western Palestine, revealed several sites with cupholes near wadis or springs, as well as caves. For example, at Nahal Siah cupholes were found hewn on a rocky surface on the southern bank of the wadi about 200 meters from a cave (Olami 1984: 24). Cupholes were found in the floor of the entrance to the hall of the Ornit Cave which overlooks the wadi bed of Nahal Ornit. There is evidence that there was running water in the cave in earlier times (Olami 1984: 46, 49). At Ein Qedem 1, 50 cupholes of varying size were found on a rocky surface near the center of a hill which overlooks a spring. To the north are a couple of caves (Olami 1984: 49). At Nahal Dohan four hollows or rock shelters were found on the south bank of the wadi. Cupholes were found in all four shelters (Olami 1984: 101). At H. Shoqef on Mount Carmel about 70 cupholes were scattered about on a large flat rock approximately 100 meters from a spring, although no cave is mentioned in close proximity in this case. All of these sites on Mount Carmel were in an oak forest or maquis in antiquity (Zohary 1982: 29).

missing from this brief survey are the "roasters" which would have the effect of removing the tannic acid. However, their absence may be because water was present for leaching and acorns may, therefore, have not been subjected to roasting.

**Acorns: An Alternate Food Source in Times of Stress**

As noted above, ancient references to balanophagy in the Near East are missing, in spite of the more recent ethnographic evidence for the practice in the region. This seems curious, especially in view of the fact that references to oak trees are fairly common. The answer may be, as Hole (1979: 208) points out in the case of the nomads of Luristan, that acorns were not normally the preferred food in the Near East when other foods were available. This is because most species of acorns are bitter due to the tannic acid. Even when it is removed, acorns have a bland flavor at best. Also, since the removal of tannic acid is a somewhat complicated and time consuming process, people would hardly resort to leaching acorns except in time of great need (Gifford 1968: 88).

In connection with this latter point it is interesting to note McHenry's study (1968: 4) which implicitly suggests that in California the motivation for shifting from hunting to acorn gathering was seasonal hunger. Acorns provided a buffer against starvation when other foods were not available. Eventually acorns formed such an integral part of the diet that they came to be a preferred food of many tribes. However, in regions where more intensive subsistence strategies were successfully established acorns would not likely remain an important staple.

A similar situation probably prevailed in the Old World. A reference from Pliny, the Roman naturalist, suggests that when there was an "absence of cereals" acorns were milled for bread (cited in Gifford 1968: 93). Brouk (1975: 209) makes the interesting observation that acorns were still eaten in southern Italy because these were poor areas where the soil will not yield cereals and where poverty prevents the purchase of flour from elsewhere. The only exception to the acorn's low esteem was in Spain where it came to be considered a delicacy. Thus, throughout Europe and the Mediterranean acorns were generally looked upon as poor man's food or a staple to fall back on in time of famine.

This status of acorns may help explain why and when they were used in various places of the ancient Near East. The sites where acorns have been found — such as in the kitchen middens of Jarmo (see below) — were all prehistoric. In other words, they were either pre-agricultural or were used where agriculture was just being established and other food sources were either not yet available or not as plentiful as acorns. It is interesting that most of the bedrock mortars or cupholes found in the Mount Carmel survey in western Palestine also date to this same period or earlier (also see below). Once domestication and more intensive agricultural practices were established, balanophagy ceased to be as important.

Even after the development of agriculture, however, there were times, such as during famines, warfare, or other natural catastrophes, when the normal food systems that were tied into state or social institutions failed and people were forced to fall back on alternate food sources, such as acorns. Records of the use of these alternate food sources during times of environmental or social stress would not be expected since people were just trying to survive. They were not likely to be writing down their menus!

**Historical and Anthropological Implications**

As noted above, most, if not all of the sites where acorns have been found are pre-agricultural or early agricultural camps or settlements. It is possible that some of them could be camp remains of the first pastoral nomads (see Gilbert 1983: 205). The present picture of parallel domestication of plants and animals suggests that early experimentation and husbandry of crops and herds may have proceeded together in some form of "mixed farming" (Braidwood and Howe 1960) that could include, when conditions favored, a variable dependence upon wild foods (Hole 1968; Gilbert 1983). Nevertheless, it is not impossible that a group of "herder-gatherers" emerged at the same time, who may have entered into specialized pastoralism by relying for the bulk of their plant foods on the collection of wild fruits and nuts, especially acorns in the middle elevation oak-pistachio belt (Zohary 1973: 620; Hole 1978: 159, 160; Gilbert 1983: 107).

However, what role did acorns play in subsistence strategies after agriculture became more established? As suggested above, once more desirable food sources could be obtained by pursuing some form of agriculture, acorns were utilized only in times of great need or, as Lewthwaite suggests, periods of "instability" (1982: 226).

In Syro-Palestine one of these periods may be the junction of the Early Bronze/Middle Bronze period (EB/MB) in Palestine when urban life seems to have experienced a decline. For example, Duncan (1931) dated some cupholes at Gezer to c. 2000 BC which, if correct, falls right in the middle of this period of urban decline. The presence of a spring at Gezer as well as some caves (many of which have cup-holes in their entrances) bring together several of the ingredients typical of an acorn processing site.

It is interesting that numerous scholars have suggested that this same period best provides the background to the patriarchal narratives recorded in the early chapters of Genesis. While not wishing to enter into that

debate at the present, it is interesting that one of the common motifs of these narratives is that of famine. Surveys of Palestinian sites dating to this period show that for some reason many of the sites in valleys, such as in the Galilee area, were abandoned, while other sites in the hill country were still being utilized (Gerstenblith 1980: 73).

The common explanations for urban decline during this period include climatic changes that led to a dryer period and over-exploitation of agricultural lands (e.g. Gerstenblith 1980: 73). Whatever the exact cause, the failure of urban sites would also mean the failure of the subsistence system that supported them (whether as a cause or an effect cannot be said presently). Undoubtedly, many people were forced to adopt alternate subsistence strategies, some of which included a return to hunting/gathering or herding/gathering, both of which probably included the use of acorns.[8]

Another period that possibly represents a decline of intensive subsistence systems is between the end of the Middle Bronze II-C (Dever's MB III) and the Late Bronze II periods. Gonen (1984) has shown that there was a drastic reduction of walled urban settlements after the MB IIC followed by a period of gradual re-urbanization during the LB I and II. It would seem reasonable to surmise that after such a reduction of large urban centers, for whatever reason, the regional subsistence system was drastically disrupted and people were again forced to revert to simpler systems to survive. In other words, the intensive agricultural systems that supported the MB IIC urban centers would have been replaced with either more extensive agricultural systems or by more nomadic/pastoralist systems by many of the Late Bronze Age peoples. Balanophagy would have undoubtedly been incorporated in many such food systems.

Again, as with the earlier EB/MB junction, Biblical sources may provide some background for this period, particularly the latter part. For example, the period of the Judges appears to reflect harsh conditions in which there was no centralized authority and every man did "what was right in his own eyes". The lack of an integrated food system during this period of political chaos probably forced many rural inhabitants to seek out alternate food sources.[9]

Unfortunately, archaeological excavation in the Near East has focused on urban sites so that most of the material is from urban periods when intensive subsistence strategies were pursued. The archaeological record, as well as the historical sources noted above, do, however, portray fairly extensive periods when the intensive urban systems were not functioning. Surveys do turn up numerous non-urban camp sites and settlements; closer analysis of some of these sites may turn up evidence that they were occupied during periods when wild plant and animal food-procuring strategies were being incorporated, at least partially. Future work in this area would undoubtedly be "fruitful".

## Conclusion

Taking all the evidence together — the abundance of oak forests; the value of the acorn as a food source; the ancient Greek and Roman references to balanophagy; the remains of acorns at early sites; the ethnographic evidence for balanophagy in western Palestine, Jordan, and the Zagros and the existence of archaeological sites that match the characteristics of the former — the case seems strong for the idea that balanophagy played an important role in the subsistence strategies of both pre- and early agriculturalists as well as later pastoralists and people who were experiencing food shortages. The frequent rise and fall of urban periods in Palestine (and in other places in the Near East) suggests that there were many times when people would be forced to adopt alternate, non-agricultural subsistence strategies, even if only temporarily. Recognition of the practice of balanophagy as an element in such strategies may assist the archaeologist in both locating and identifying enigmatic non-urban sites and fitting them into the historical oscillations of the region.

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[8] For a recent study on alternating periods of sedentarization and nomadization and their associated subsistence strategies see Geraty and LaBianca 1985.

[9] A good description of the times appears in the story of Gideon, which begins by telling how the Israelites were so oppressed by the Midianites that the former were forced to prepare shelters for themselves in mountain clefts, caves and strongholds. Whenever the Israelites did manage to plant crops for themselves the Midianites, and other tribes, would sweep in, stealing or destroying the crops, leaving nothing for the remaining Israelites (Judges 6: 1-6). Being forced to live in caves for security obviously disrupts the subsistence system, but the fact that the record indicates that they were deprived of the crops they had planted would indicate that the people were forced to find whatever they could for food. Situations like this were undoubtedly common in this region throughout antiquity.

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# Traditional Bedouin Agriculture at Petra: Ethnoarchaeological Insights into the Evolution of Food Production

## Introduction

This report summarizes certain preliminary results of ethnoarchaeological research on the energetics of traditional Bdūl Bedouin agriculture in the Petra region of southwestern Jordan. That research involved direct ethnographic observations to obtain quantitative labor cost and caloric benefit data on cultivated wheat and barley. These data are relevant to an evolutionary understanding of the principles affecting human subsistence behavior, and hence our understanding of the post-Pleistocene forager/food producer transition.

After many years of research directed at identifying the spatial and temporal origins of food production, modern research has increasingly focussed upon the complex environmental and behavioral processes which presumably led to the forager/food producer transition. Generally accepting that human behavior has evolved in response to changes in the physical and social environment, scholars have isolated environmental setting, climatic variations, demographic shifts and population growth as primary factors significant in the process by which food production strategies evolved. Several popular models currently exist which invoke one or more of these factors to ostensibly account for the evolution of food production.

Unfortunately, while we have identified and stressed the conditions under which the evolution of food production might have taken place, we have failed to adequately address the underlying principles affecting subsistence decisions in general. While several scholars have argued that a better understanding of the conditions under which food production became profitable relative to continued foraging is required, it seems unlikely that significant advances in this direction will occur unless human-animal-plant relationships are investigated within the context of general theories which address the underlying principles affecting subsistence behavior.

In this regard, predictive behavioral models derived from optimal foraging theory as developed by evolutionary biologists and ecologists have been particularly successful in illuminating various aspects of foraging behavior among diverse hunter-gatherer populations. These predictive models invoke decision making based upon the relative energetics (caloric yield/time invested) of exploiting alternative food resources. Unlike alternative predictive models which focus solely upon the yields or "benefits" derived from specific strategies, these particular models explicitly account for the relative labor costs of alternative strategies as well.

Using quantitative data obtained from field observations among the Bdūl Bedouin of the Petra area, the present paper will initially document the utility of such an energetic approach in better understanding the ecological parameters under which early cereal food production strategies would have been practiced. Subsequently, the interpretive insights provided by this approach will be discussed relative to the use of a common archaeological artifact, the sickle blade, in inferring the presence or absence of early agriculture. Initially, some understanding of basic energetic models is required.

## Basic Energetic Models

### *Diet Breadth*

Two predictive behavioral models developed by behavioral ecologists which invoke rates of energy capture are particularly relevant to the present study. First, the diet breadth or optimal diet model (Charnov 1976a; Charnov and Orians 1973; Emlen 1966; MacArthur and Pianka 1966; Schoener 1971) predicts which resources a forager should exploit from an array of available resources encountered at random if the rate of energy capture is being maximized. Initially, available resources may be ranked according to the ratio of energy returns each item provides (measured in calories) to the cost (or handling time) of acquiring and processing that item once it has been encountered (= its postencounter return rate). If a forager is maximizing the rate of energy capture, a resource item randomly encountered should be taken if and only if its ranking (return rate) is equal to or greater than the returns to be gained for searching for,

finding, and handling an item of higher rank during the same period of time. Resources which fail to meet this criterion should not be taken.

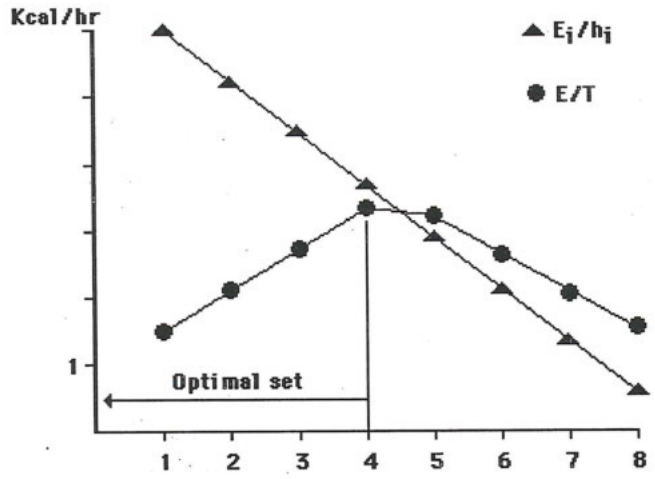
In a more formal statement, for all items to be included in the diet:

$$\frac{E_i}{h_i} \geq E_p$$

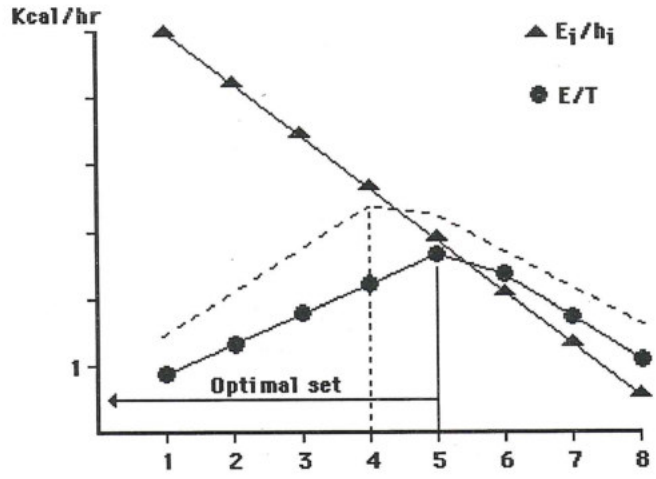
Where $E_i$ = total energy (kcal) of each resource i
$h_i$ = collecting and processing time ($g_i+p_i$) for each resource i
$E_p$ = $E/(T_s+T_g+T_p)$
$E$ = total energy in resources gathered per collector
$T_s$ = total search time in the resource patch
$T_g$ = total gathering time per collector for all resources gathered
$T_p$ = total processing time per collector for all resources gathered

An optimal diet should include all potential resources with post-encounter return rates equal to or higher than the average returns for foraging in general, and should exclude all potential resources with postencounter return rates lower than average foraging returns. Significantly, whether or not a potential resource is in the optimal diet does not depend upon its own abundance, but rather on the abundance (or more precisely the encounter rate) of higher ranking resources. High-ranked resources should remain in the diet regardless of how rare they become. However, if the encounter rate for high-ranked resources falls, average foraging return rates would also fall and lower ranked resources would enter the diet. These expectations are summarized in FIG. 1.

The diet breadth or optimal diet model is specifically useful for conceptualizing the changes in human diet which apparently occurred in the post-Pleistocene period. As noted by Hawkes *et al.* (1982: 395) and Hill *et al.* (1986), the coincidence between the apparent decline or extinction of large mammal populations and other fauna at or near the end of the Pleistocene and the emergence of "broad spectrum" subsistence economies (Flannery 1969) is consistent with expectations derived from the diet breadth or optimal diet model.




A. Triangles indicate prey types arranged by rank, based on returns once encountered. Circles mark returns gained from searching for and handling progressively lower ranked prey.




B. If the encounter rate for high-ranked prey decreases, returns from foraging for those prey items should also decrease. As average returns from searching for and handling these resources fall below those gained from handling lower-ranked prey, the latter should enter the diet.

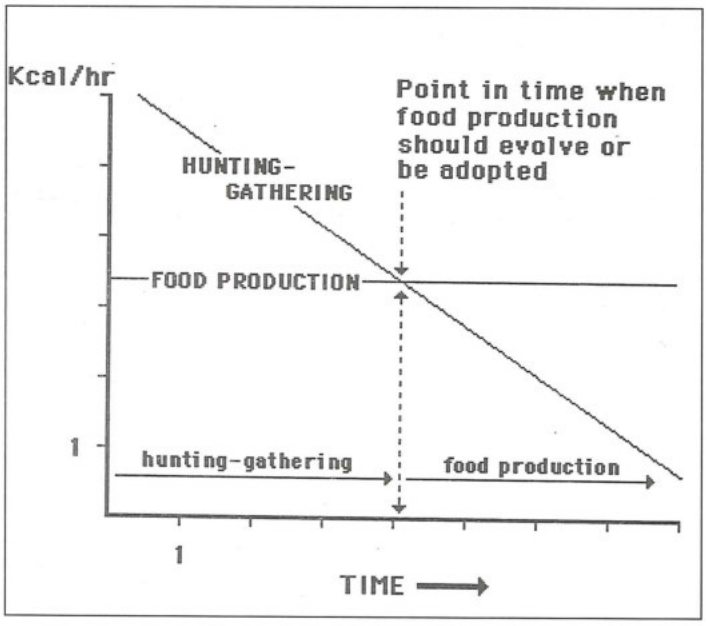
1. Diet breadth model (after Russell 1988: 11, FIG. 1)

*Patch Choice*

While the diet breadth or optimal diet model specifically deals with the exploitation of resources randomly encountered in a "fine grained" environment, patch-choice models deal with the expected spatial and temporal exploitation of patchy environments where resources are clumped, again assuming that the goal of foraging behavior is to maximize the rate of energy capture (Charnov 1976b; Charnov and Orians 1973; MacArthur and Pianka 1966; Pyke *et al.* 1977; Schoener 1971). Here, it is expected that a forager would operate in that patch or set of patches that produce the best energy returns relative to the time costs of traveling to the patch, searching it, and gathering and processing the resources encountered there. A further expectation of such models concerns movement between patches. Assuming that the foraging process depletes the resource level in any patch through time, it is expected that a forager will only re-

main in that patch until the rate of energy capture to time invested falls equal to the mean energy return per unit time (including travel time) of all available patches (Charnov 1976b).

This model portends to be particularly useful in addressing issues concerning the forager/food producer transition and the ecological conditions under which food production would have occurred. For example, it has been proposed that under declining foraging return rates at the end of the Pleistocene, food production strategies should have been adopted when mean foraging return rates fell equal to or below the mean return rate for available food production options (Russell 1988: 12). This expected relationship is depicted in FIG. 2.




2. Subsistence strategy return rates and the evolution or adoption of food production options (after Russell 1988:12, FIG. 2). Under declining foraging return rates, food production strategies should have been adopted when mean return rates for hunting-gathering fell equal to or below the mean return rate for available food production options.

Further, it is expected that available food production options should have been adopted according to their ranking by relative return rates. Hence, it has been suggested that cereals which did not exhibit relatively high postencounter return rates for their exploitation in natural stands would have been unlikely candidates for early food production strategies, since the additional labor required for their cultivation would further diminish their rates of energy return to labor expended (Russell 1988: 129-130). Ostensibly, this simple energetic relationship between cereal species would largely account for why so few cereals (29 known or suspected cultivars) became the focus of human food production relative to the vast number of cereal species (roughly 7500) which were, and still are, available for exploitation world-wide.

However, in order to further develop and test this particular proposition in North Africa and the Near East, energetic cost and benefit data is required on the wild progenitors of the relevant cultivated species, the numerous wild cereals and seed resources which various food producing populations continue to exploit, but do not cultivate (Clark 1976: 77-78; 1980: 576; Carruthers 1910: 343; Irvine 1952; Musil 1926: 15-16; 1927: 122-124; 1928: 15-16; Nicolaisen 1963: 179-181, 206-207; Smith 1980: 470-472; Williams and Farias 1972), and any wild cereals and seed resources which are also available to these populations, but are not exploited. Unfortunately, while Harlan's (1967) well-known experimental data on wild einkorn harvesting are widely cited in the archaeological literature, comparable research has not been conducted on the wild progenitors of other cereal domesticates in the Near East and North Africa, let alone on other wild cereal resources. Some initial steps in obtaining such quantitative data in the Petra region have now been made, but those data are still being processed.

The data which are presented here concern a further expectation derived from patch choice models. Specifically, it would be expected that variations in the spatial and temporal exploitation of habitats or habitat types suitable for food production should have been a function of the energy returns for food production effort which could be obtained in specific locations or regions. Quantitative data relevant to this issue as applied to wheat and barley cultivation were obtained by field observations in the area of Petra. These data serve to clarify issues of field selection in early agricultural strategies and associated harvesting techniques.

## Locations and Nature of Bdūl Agricultural Fields

The principal areas in which Bdūl agricultural fields were historically located included the ruins of the ancient city to the north and south of the Wādī Mūsā drainage, the southern half of the Petra Valley through Jabal Farasa, the lower Wādī Bayḍa drainage and its surrounding plateau, the low terraces along the Wādī Ṣabra drainage northeast of the ancient site of Ṣabra, and the low terraces of the lower Wādī Mūsā drainage near the site of Ṭūr Imdaī. The Bdūl also cultivated pockets of arable land on the sandstone massifs surrounding the Petra Valley, including fields along the lower slopes of Jibāl ash-Sharāh on the plateau east of Jabal Farasa, the top of al-Khubtha, the plateau on Jabal ad-Dayr, and the broad plateau just below the summit of Jabal an-Nabī Hārūn. Similarly, the Bdūl also cultivated pockets of arable land around the heads of drainages such as Wādī Marwān and Wādī al-Mu'ayṣra to the north-northeast of the Petra Valley, and the southern end of the Wādī ad-Diliyya west of Jabal an-Nabī Hārūn. Although not generally exploited for cereal cultivation, the Bdūl have long tended informal

gardens along the bottom of Wādī aṣ-Ṣiyyagh.

Within the ruins of the city of Petra and on the plateau of Jabal ad-Dayr, fields were created by moving structural rubble to the edges of plots in order to cultivate the sandy soils which now bury ancient structures. Ancient walls of ashlar block construction which were not completely buried by sand frequently determined the limits of potential fields, and now lie buried beneath the rubble moved to the margins of the resulting agricultural plots. An early dating of such activities on some fields in the ruins of the city north of the Wādī Mūsā drainage may be reflected by the presence along their margins of coarse, straw-tempered gray-ware sherds, generally dated to the Middle Islamic, Mamluk, or "Medieval" period of roughly the twelfth or thirteenth centuries AD. None of these fields are cultivated today as a result of legislation prohibiting such activities within or near the ruins of Petra.

Many of the outlying Bdūl fields consist of ancient Nabataean rainfall runoff terrace systems along the bottoms of shallow drainages and their more sloped feeder channels. This is particularly true in the southern section of the Petra Valley and on the plateau surrounding the lower end of the Wādī Bayḍa drainage. While some of these ancient terrace systems were intact, others have been partially or totally rebuilt by the Bdūl, often using stones tilled from the fields. At some locations, the Bdūl have created entirely new terrace systems based upon Nabataean runoff principals. Under these conditions, traditional Bdūl agriculture replicated ancient Nabataean, Roman and Byzantine practices in the Petra area. In many instances, however, the Bdūl simply exploit natural pockets of arable land where the topography results in concentrated rainfall runoff from the surrounding terrain. In these instances, Bdūl cereal cultivation is achieved under what are expected to have been prehistoric agricultural conditions.

## Wheat and Barley Yields

*Seed Stock*

Among cultivated, predominantly self-pollinating cereals such as wheat (Frankel and Galun 1977: 18) and barley (Allard *et al.* 1968: 117; Jain 1976: 479), occasional natural hybridization with weed races on the margins of fields occurs, although seldom, if ever, on a massive scale (Harlan 1965: 174; Harlan and Zohary 1966: 1076; Zohary *et al.* 1969). The typical pattern is one involving a localized eruption of a hybrid swarm. Such cases are intermittent in time and space, erupting locally for a generation or two, and then quickly subsiding. Through this process, the locally adaptive traits of weed races are introduced into the cultivated crop. Annual directional selection by humans for seed size and weight in order to isolate the most desirable seed stock for next year's planting has resulted in the creation of ecogeographic landraces of such cereals (see Allard *et al.* 1968: 99-103, 111-113; Russell 1988: 50-53).

In Jordan, several local wheat and barley varieties have resulted from such broadly based mass selection processes, although scientific efforts at improving cereal crops have been formally pursued for several years (Salim 1961). For wheat, where most efforts at cereal improvement have concentrated, only two introduced and developed varieties were in common use in 1988 (El-Hurani 1988: 41). The first is known as F.8, a durum wheat originally introduced to Jordan in 1935 from the 'Akka Agricultural Experiment Station in Palestine. The second is known as *Ḥawrānī Nawaḥī* , another durum wheat, originally introduced to Jordan from the Ḥawrān plains of Syria in 1954. However, these varieties are primarily used in the agriculturally more developed central and northern sections of Jordan, particularly from 'Ammān through Irbid. In southern Jordan, only 12% of the farmers surveyed in 1988 were using them, preferring instead a local variety (or varieties) known broadly as *Qaṭma Ṣafra* (El-Hurani 1988: 41, 42, TABLE 52). This hard wheat landrace, which is cultivated by the Bdūl, is considered relatively low in gluten quality and content, but is high in protein (Salim 1961: 12, 14, TABLE VII).

*1986 Yields*

In May, 1986, quantitative data on wheat and barley yields were obtained from fields on the plateau south of the lower Wādī Bayḍa drainage, the head of Wādī al-Mu'ayṣra, and the southern Petra Valley. For each field tested, a representative 1 $m^2$ of the crop was totally harvested, and both seed and straw/chaff yield were measured using hand-held scientific scales. In three instances, two samples each were taken in order to quantify obvious yield differences in the same field as a result of micro-environmental variations. The results for wheat fields are presented in TABLE 1, while those for barley fields are presented in TABLE 2.

For comparative purposes, TABLE 3 presents the wheat and barley yields expected by Bedouin farmers in the an-Naqab desert in the late 1950s as reported by Mayerson (1960: 18), while TABLE 4 presents the average wheat and barley yields on Arab farms in Palestine according to a British Committee Report of 1930 (Simpson 1930) and TABLE 5 presents expected wheat yields in Jordan according to rainfall regions (Steitieh and Smadi 1974: 19, TABLE 4). As can be seen, the wheat and barley yields observed at Petra in 1986 fall within the "satisfactory" through "exceptional" ranges of yields expected by Bedouin in an-Naqab, and compare favorably with the yields reported for Arab farms in Palestine in 1930 and expected wheat yields in Jordan.

**Table 1.** Grain and straw/chaff yields (kg) for wheat fields at Petra in May, 1986.

| Sample # | Location | PLANT Height (m) | YIELD/M² | | YIELD/DUNUM | |
|---|---|---|---|---|---|---|
| | | | Grain | Straw/Chaff | Grain | Straw/Chaff |
| W1 | L. Wādī Bayḍa | 0.72 | 0.09 | 0.201 | 90 | 201 |
| W2 | L. Wādī Bayḍa | 0.88 | 0.158 | 0.343 | 158 | 343 |
| | (same as W1) | | | | | |
| W3 | L. Wādī Bayḍa | - | 0.066 | 0.117 | 66 | 117 |
| W4 | L. Wādī Bayḍa | - | 0.04 | 0.094 | 40 | 94 |
| W5 | L. Wādī Bayḍa | 0.65 | 0.033 | 0.04 | 33 | 40 |
| W6 | L. Wādī Bayḍa | 0.94 | 0.248 | 0.422 | 248 | 422 |
| | (same as W5) | | | | | |
| W7 | S. Petra Valley | - | 0.095 | 0.174 | 95 | 174 |
| W8 | S. Petra Valley | - | 0.064 | 0.079 | 64 | 79 |

**Table 2.** Grain and straw/chaff yields (kg) for barley fields at Petra in May, 1986.

| Sample # | Location | YIELD/M² | | YIELD/DUNUM | |
|---|---|---|---|---|---|
| | | Grain | Straw/Chaff | Grain | Straw/Chaff |
| B1 | Rās Wādī al-Mu'ayṣra | 0.072 | 0.108 | 72 | 108 |
| B2 | Rās Wādī al-Mu'ayṣra | 0.06 | 0.095 | 60 | 95 |
| B3 | S. Petra Valley | 0.044 | 0.049 | 44 | 49 |
| B4 | S. Petra Valley | 0.135 | 0.110 | 135 | 110 |
| | (same as B3) | | | | |
| B5 | S. Petra Valley | 0.67 | 0.098 | 67 | 98 |
| B6 | S. Petra Valley | 0.05 | 0.058 | 50 | 58 |

**Table 3.** Wheat and barley yield expectations of Bedouin farmers in an-Naqab.

| INFORMANT YIELD EVALUATION | WHEAT (kg/du) | | BARLEY (kg/du) | |
|---|---|---|---|---|
| | Sowing Rate | Yield | Sowing rate | Yield |
| Exceptional | | 100 | | 200 |
| Good | All | 50-70 | All | 70-80 |
| Satisfactory | 5-7 | 30-50 | 6-7 | 40-60 |
| Poor | | 0-20 | | 0-20 |

Adapted from Mayerson (1960:18), after Russell (1988:112, TABLE 15).

**Table 4.** Average wheat and barley yields (kg/du) on Arab farms in Palestine according to a British committee report dated July 13, 1930.

| Crop | As Declared in 104 Villages | "Selected Evidence" | "Official Estimate" |
|---|---|---|---|
| Wheat | 48 | 57 | 67 |
| Barley | 63 | 54 | 74 |

Adapted from Simpson (1930: 185, APPENDIX 24), after Russell (1988: 112, TABLE 16).

The Bdūl considered 1986 to be an "average" to "good" year for cereal crops, noting for contrast that 1983 had been "exceptional." Consistent with the findings of agricultural studies in Jordan (Salim 1961: 4, 6, 7-8), the Bdūl maintain that the most critical variables in crop yields are the distribution, timing and amount of rainfall. A related phenomenon involving concentrated runoff and associated depositional processes seemingly underlies observed spatial variations in crop yield within individual fields.

*Yield Variations by Microenvironments Within Fields*

Two wheat fields in the Wādī Bayḍa drainage and one barley field in the southern Petra Valley exemplified this correlation. In all three cases, field topography involved

**Table 5.** Estimated production of wheat and area cultivated in Jordan by rainfall regions.

| ENVIRONMENT | | SOWING RATES AND YIELDS (kg/du) | | | ARABLE AREA IN AN "AVERAGE" YEAR | |
|---|---|---|---|---|---|---|
| Region | Rainfall (mm) | Sowing Rate | Average Yield | Range of Yields "Bad" – "Good" | Dunums | % of Total Arable |
| Desert | 150-250 | 4-5 | 40 | 10-70 | 416,000 | 21.3 |
| Eastern Plain | 250-300 | 5-7 | 64 | 35-90 | 693,000 | 35.6 |
| Western Plain | 300-400 | 8-15 | 81 | 50-117 | 610,000 | 31.3 |
| Upland | 400+ | 15 | 105 | 75-146 | 180,000 | 9.2 |
| Ghawr | irrigated | 10-15 | 147 | 112-191 | 50,000 | 2.6 |

Adapted from Steitieh and Smadi (1974: 19, TABLE 4), after Russell (1988: 71, TABLE 3).

relatively gentle slopes which concentrated rainfall runoff from larger catchments towards the central and lower portions of fields. As a result, these portions of the fields received greater effective moisture for plant growth, both in quantity of water available and in greater potential permeation of soil. In two of these cases, low, informal rock walls at the lower ends of the fields heightened this process, diminishing soil erosion while simultaneously breaking runoff flow and thus promoting greater water percolation into the soil. In all three cases, the effects of these microenvironmental variations were readily apparent in both the density and height of the resulting crops.

The first example involved a field cultivated in the broad, sandy bottom of a wash with a fairly extensive rainfall catchment. The bottom of this wash had a very gentle slope of around 1-2°, and the runoff pattern along its bottom was highly braided, reflecting the equivalent of "sheet-wash." The sides of this wash were also gently sloping at about 2-3°, but did not receive the same concentrated runoff as the wash bottom.

Wheat growing on the sloped sides of this field was yielding the equivalent of 90 kg/du (sample W1), a respectable yield in light of the comparative data previously presented. However, yields in the central and lower portions of the field where runoff was concentrated were the equivalent of 158 kg/du (sample W2), representing a 76% increase in actual grain yield.

The second example in the Wādī Bayḍa drainage involved a sloped field off the side of the main drainage channel. Here, rainfall runoff was concentrated into the lower central portion of the field, although the total catchment area was relatively small. The lower central portion of the field had a very gentle slope of around 1-2°, while the sides and upper portion of the field had a slightly greater slope of around 2-3°. A low, informal rock wall across the lower end of this field inhibited soil erosion and increased effective moisture immediately behind it in the lower central area. One further result of this constriction of runoff water flow has been the accumulation of silty, clayey loam at this location, a factor which affected both the growth of the wheat itself and the harvesting labor it required. The significance of this observed variation will be further discussed below.

Wheat growing on the sloped sides of this field was yielding the equivalent of only 33 kg/du (sample W5), not a very respectable yield in light of the comparative data previously presented. However, yields in the lower central portion of the field where runoff was concentrated were the equivalent of an astounding 248 kg/du (sample W6), representing a 651% increase in actual grain yield.

That these same relationships between runoff conditions and yields apply to barley is demonstrated by the third example, involving a barley field in the southern Petra Valley. Here, field conditions were somewhat similar to those extant in the second wheat example. The field consisted of gently sloping sandy terrain where rainfall from a relatively small catchment were concentrated towards its central and lower portions. Here again, the central and lower portion of the field had a very gentle slope of around 1-2°, while the sides and upper portion of the field had a slightly greater slope of around 2-3°. Further, a low, informal rock wall across the lower end of the field again inhibited soil erosion and increased effective moisture immediately behind it.

Barley growing on the sloped sides of this field was yielding the equivalent of only 44 kg/du (sample B3), not a very respectable yield in light of the comparative data previously presented. However, yields in the central and lower portions of the field where runoff was concentrated were the equivalent of 135 kg/du (sample W6), a very respectable yield representing a 207% increase.

*Yield Variations and the Choice of Cultivation Sites*

While the effects which microenvironmental variations within fields have on actual crop yields is readily apparent, it must be noted that such variations occur without any equally dramatic genetic variation within the crops

**Table 6.** Standard analyses and caloric variations of wheat and barley samples from the same fields but different ecological conditions.

| SAMPLE # | ENERGY KCAL/KG | COMPOSITION (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Protein | Carbohydrates | Fat | Ash | Fiber | Moisture |
| W5 | 3545 | 11.74 | 73.34 | 1.57 | 0.93 | 4.80 | 7.62 |
| W6 | 3477 | 9.30 | 73.90 | 1.65 | 2.05 | 4.67 | 8.43 |
| B3 | 3314 | 10.67 | 67.94 | 1.88 | 1.66 | 11.73 | 6.12 |
| B4 | 3313 | 13.46 | 64.84 | 2.01 | 1.84 | 11.42 | 6.43 |

themselves. Each of the fields examined were sown with the same general stock of seeds, and the variations observed were solely the result of the microenvironmental conditions documented. Standard analyses of the harvested wheat and barley further indicate that while compositional variations in total protein, carbohydrate and fat content between samples from the same fields do occur, significant caloric variations do not (TABLE 6).

Annual grasses in general have evolved to achieve mass representation and seed production in temporally favorable environments (Cohen 1971; Paltridge and Denholm 1974). A significant aspect of this adaptive strategy is enormous phenotypic plasticity in their potential for seed production (Allard 1965: 76). For wheats and barleys, as with wild grasses and rangelands in general, water and soil nutrients represent the primary limiting factors to plant growth and productivity (Breman and de Wit 1983; Guise 1969; Hall *et al.* 1979; Hillman 1973: 230; Simpson 1981; Webley 1972: 173). Under conditions of seasonally restricted rainfall, water stress is particularly significant in reducing crop yields and rangeland productivity. It is therefore hardly surprising that the yield from the same seed on different parts of the same field would exhibit extremes according to microenvironmental variations involving water concentration.

It has been previously demonstrated that the yields of mass selected landraces of wheat grown under dry-farming conditions fall within the upper range of yield variability exhibited by natural stands of wild wheat (Harlan and Zohary 1966: 1078; Russell 1988: 48-50; Zohary 1969: 56). Further, it has been documented that, prior to the development of the first wheat hybrids in AD 1795, wheat yields cannot be demonstrated to have significantly increased since at least the first century AD (Russell 1988: 43, 48-53).

Hence, while it is reasonable to posit that annual selection by humans for seed size and weight among predominant self-pollinating cereals served to stabilize mean productivity within the upper range of variability exhibited by their wild progenitors, the present data support the contention (Russell 1988: 66-67) that it was the selection of favorable cultivation sites which would have dramatically increased overall cereal productivity.

## Hand Harvesting

*Introduction*

The Bdūl harvest their cereal crops by hand rather than by sickle. The harvesting of cereals by hand represents the oldest and most long-lived reaping method, and is widely practiced, not only in the Petra area, but throughout the Old World (Bohrer 1972). This ethnographic observation is significant in addressing the evolution of early food production strategies, since the presence or absence of sickle blades in the archaeological record has often served as the principle criteria for inferring the presence or absence of cereal cultivation.

In May and June, 1986, quantitative data on the labor costs of harvesting wheat and barley by this method were recorded in fields on the plateau south of the lower Wādī Bayḍa drainage and in the southern Petra Valley. During this period, fields were being harvested by the Bdūl in groups ranging in size from the few members of a single household through 10-20 individuals from related families and their friends.

The hand harvesting of wheat and barley grown on the typical sandy soils which characterize most fields in the Petra area proceeds in a squatting position, with both hands employed. The tillers of grain in an area the size of an extended hand are grasped between the thumb and forefingers just above soil level, with the tillers pressed against the palm by the forefingers. A short jerk backwards with the hand, accompanied by a slight downward tilt of the wrist, snaps the stalks from their roots. Both dry and slightly green stalks will snap as a result of this hand action.

Work proceeds in this fashion until both hands are filled with small bundles of grain, at which point the bundles are laid together on the ground and work again proceeds with empty hands. The small piles of reaped grain are later gathered for transport to a threshing floor. The gathering is often performed by an adolescent or teenager. The only exception to this reaping procedure was observed when the patch of tall wheat where sample W6 was obtained was harvested. This patch of wheat, growing in silty, clayey loam, would not snap off at its base, and stalks were literally jerked from the hard soil a few tillers at a time. Penetrometer readings across this

**Table 7.** Penetrometer readings in the wheat field in the lower Wādī Bayḍa where samples W5 and W6 were obtained.

| Sample # | Location | PENETROMETER READING (KG/CM²) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | RANGE |
| W5 | Slope of Field | 1.00 | 0.75 | 1.00 | 0.75 | 1.25 | 0.75-1.25 |
| W6 | Center of Field | 3.75 | 3.85 | > 5.00 | > 5.00 | 4.00 | 3.75- > 5.0 |

**Table 8.** Efficiency of Bdūl males hand harvesting wheat and barley near Petra in May and June, 1986.

| DATA | SUBJECT | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| SUBJECT'S AGE | 45-48 | 45 | 20 | 30 |
| CEREAL | Barley | Wheat | Wheat | Wheat |
| FIELD LOCATION | S. Petra Valley | L. Wādī Bayḍa | S. Petra Valley | L. Wādī Bayḍa |
| SAMPLE # | B5 | W4 | W8 | W6 |
| KG/DU | 67 | 40 | 64 | 248 |
| NO. OF M² TIMED | 20 | 4 | 12 | 4 |
| MINUTES/M² | | | | |
| Mean | 1.1 | 0.64 | 0.65 | 2.68 |
| Median | 1.1 | - | 0.63 | - |
| St. Dev. | 0.22 | - | 0.2 | - |
| Min. | 0.83 | 0.6 | 0.4 | 1.6 |
| Max. | 1.5 | 0.8 | 1.0 | 3.7 |
| KG GRAIN/HR | 3.66 | 3.74 | 5.94 | 5.58 |
| KCAL/HR * | 12,078 | 13,090 | 20,790 | 19,530 |
| MEAN HRS/DU | 18.3 | 10.7 | 10.8 | 44.7 |

* Calculated for barley at 3300 Kcal and wheat at 3500 Kcal. This excludes all prior tillage and sowing labor costs, and all subsequent processing labor costs.

field dramatically document this observed variation in soils (TABLE 7).

*Quantitative Labor Data*

To obtain quantitative hand reaping labor data, a representative focal person was chosen and timed by stop watch, recording the time elapsed for each m² of crop harvested. The purpose and nature of the recording were not revealed to the focal person, and in two cases, the recorder pretended to be observing a harvester other than the focal person. In four cases, harvesting labor was determined in fields for which grain yields had been previously established. The results of these four cases are presented in TABLE 8.

Initially, the opportunity only arose to repeatedly time one individual who was hand harvesting barley (subject 1), with the results suggesting a mean efficiency of 18.3 hours per dunum on sandy soils. The only comparable data was obtained for a 25-28 year old male who was hand harvesting barley in a field with similar soils just east of the head of Wādī al-Mu'ayṣra, but only his labors on a 2 m² area were timed, and the yield of the field involved was not determined. Even so, he harvested the first m² in 1.35 minutes, and the second in 1.57 minutes (mean of 1.46 min/m²). This would equate with an efficiency of 24.3 hours per dunum, although it should be noted that timing was terminated because the subject was more interested in having a conversation with the recorder than in harvesting his barley crop. A labor expenditure of 18.3 hours per dunum for the hand harvesting of barley grown on sandy soils with very little clay or silt therefore seems reasonable.

Three separate determinations were made for the labor expended in the hand harvesting of wheat. Two of these (involving subjects 2 and 3) were in fields possessing sandy soils with very little clay or silt, while the third (involving subject 4) was in the tall wheat plot (W6) growing in silty, clayey loam. As mentioned above, the standard method used to hand harvest cereals growing elsewhere on sandy soils did not work here, and the stalks were actually jerked from the hard soil a few tillers at a time. The resulting differences in the labor required are readily apparent. Subjects 2 and 3 worked at relatively comparable paces, resulting in the close ex-

penditures of 10.7 and 10.8 hours of labor time per dunum, even though the density of crops being harvested were 40 and 64 kg/du respectively. By contrast, subject 4 expended tremendous labor in harvesting the tall wheat plot growing in silty, clayey loam, suggesting a labor requirement of 44.7 hours per dunum of wheat growing in these conditions. In addition to occasional expletives, subject 4 repeatedly mentioned that he wished he had a sickle.

*Efficiency of Hand vs. Sickle Harvesting*

The possibility of a correlation between hand vs. sickle harvesting as related to cereals grown on sandy vs. dense soils was suggested by Bohrer (1972). Apparently, cereals grown in loose sandy soils tend to develop shorter, weaker stalks and a more clumped root base, while cereals grown in denser, clay soils tend to develop taller, stronger stalks and a more diffused root base. These aspects of the phenotypic flexibility of cereals would directly affect human harvesting strategies as a function of the environments in which they are grown. The hand harvesting labor data presented in TABLE 8 appear to support this relationship.

Comparative labor data on the reaping efficiency of various prehistoric sickles with lithic blades are given in the replication studies of Steensberg (1943), where plots sown with two-rowed barley and a small percentage of oats were harvested, and in the studies of Korobkova (1981), where plots of wheat were harvested. These studies primarily involved reaping experiments with replicate sickles, using both ancient and modern lithic blade inserts. TABLE 9 summarizes their efficiency data on various forms of early sickles, including additional efficiency data for replicas of early metal sickles, and ethnographic and historic data on the use of modern iron sickles.

For the earliest cereal strategies, a sickle reaping efficiency of approximately 24-33 hrs/du seems appropriate. By later periods, refinements in sickles with lithic blades had seemingly reduced reaping labor to approximately 15-20 hrs/du. Apparently, the labor efficiency of early forms of metal sickles (18-23 hrs/du) was not necessarily greater than developed forms of sickles with lithic inserts, although later iron sickles had a reaping efficiency of approximately 8-11 hrs/du, and modern forms between 2-5 hrs/du.

As can be seen, the reaping efficiency documented for a Bdūl hand harvesting barley in the sandy soils which characterize the Petra and Bayḍa areas falls within the lower range of labor recorded for reaping with advanced lithic and early metal sickles. Even the Bdūl who was less concerned with his barley reaping than conversing with the researcher was operating at an efficiency within the lower range of labor recorded for reaping with early lithic sickles, and close to the upper range of labor recorded for reaping with early metal sickles.

This relationship is even more pronounced when comparisons are made with the labor recorded in hand harvesting wheat grown on sandy soils. The reaping efficiencies documented for Bdūl hand harvesting wheat in the sandy soils which characterize the Petra and Bayḍa areas indicate that they spend less labor time than that documented for harvesting with all lithic and early metal sickles. Their efficiency actually falls within the upper range of labor recorded for reaping with early and traditional iron sickles. By contrast, the Bdūl harvesting the tall wheat plot growing in silty, clayey loam was operating at an efficiency less than using either an unhafted piece of obsidian without secondary flaking, or a primitive straight sickle with two flint inserts.

These data indicate that in both prehistoric and historic contexts, there has been less reason for wheat or barley grown on sandy soils to be harvested with sickles than wheat or barley grown on denser clay soils. Significantly, the primary focus of early cereal cultivation in the Near East, North Africa, Central Asia and Europe was on light soils (Russell 1988: 66-67; Sherrat 1980: 315; 1983: 98), such as those in the vicinity of Bayḍa and Petra.

## Archaeological Implications

The phenotypic plasticity of unimproved, mass-selected land races of wheat and barleys is such that extremely high yields are possible under favorable ecological conditions. Given their predominant self-pollinating reproductive strategies, productivity in early wheat and barley cultivation would have been manipulated by choice of cultivation site, not by selective plant breeding. Attempts to explain the evolution of cereal production strategies on the basis of complex feedback mechanisms involving increased productivity as a result of human selective breeding (e.g. Rindos 1980; 1984) do not appear to be tenable for predominant self-pollinating cereals.

These data therefore provide a quantitative basis for the expectation that environments with suitable soils and natural concentrations of runoff would have been the focus of early cultivation strategies (Russell 1988: 66-67). Actually, the primary focus of early cereal cultivation in the Near East, North Africa, Central Asia and Europe does appear to have been on light soils with low water-retaining capacities (Clark 1968: 97; Sherrat 1980: 315; 1983: 98; Simpson 1981: 27; Webley 1972: 171, 173). However, the locations where such light soils were exploited for early cereal cultivation were almost universally associated with localized surface water or high groundwater, resulting from perennial spring flows, spate runoff on alluvial fans, concentrated runoff in catch-

**Table 9.** Relative reaping efficiencies of prehistoric through modern hand sickles.

| DESCRIPTION/TYPE OF SICKLE | HRS/DU | SOURCE |
|---|---|---|
| Obsidian piece without secondary flaking | 41.6-33.3 | Korobkova 1981: 340 |
| Flint, curved blade with secondary flaking | 31.6 | Steensberg 1943: 23 |
| Flint, straight blade with secondary flaking | 24.6 | Steensberg 1943: 23 |
| Early Djeitun sickle with 2 flints | 41.6-33.3 | |
| Early Djeitun sickle with 3 flints | 33.3 | |
| Sickle with 3 obsidian inserts | 33.3 | all Korobkova 1981: 340 |
| Sickle with 2 flints with secondary flaking | 27.8 | |
| Sickle with 5 obsidian inserts | 27.8 | |
| Stenild sickle with ancient flake | 26.7 | Steensberg 1943: 23 |
| Stenild sickle with modern flake | 36.5 | Steensberg 1943: 23 |
| First Yalangach-depe/Stenild sickle | 23.8 | Korobkova 1981: 340 |
| Second Yalangach-depe/Stenild sickle | 23.8 | Korobkova 1981: 340 |
| Crescent-shaped, 1 flint sickle | 20.0 | |
| Crescent-shaped, 1 flint sickle | 25.6 | all Steensberg 1943: 23 |
| As above, with straight toothed edge | 27.0 | |
| Late Djeitun, 2 inserts with denticulation | 18.5 | Korobkova 1981: 340 |
| Late Djeitun, 3 inserts with denticulation | 18.5 | Korobkova 1981: 340 |
| Early Tripolye with 4 flint inserts | 18.5 | |
| Early Tripolye with 5 flint inserts | 18.5 | all Korobkova 1981: 340 |
| Shomu-tepe with obsidian inserts | 16.7-18.5 | |
| Curved horn sickle with flint inserts | 16.7-18.5 | |
| As above but with longer blade | 16.7-18.5 | all Korobkova 1981: 340 |
| Late Tripolye with sawtooth flaking | 15.2 | |
| Bronze crescentric, serrated edge | 19.3-22.8 | Steensberg 1943: 23 |
| Bronze knob-sickle, smooth edge | 20.0-23.0 | Steensberg 1943: 23 |
| Copper, cold-forged, half-moon sickle | 18.5 | Korobkova 1981: 340 |
| Iron, smooth-edged Slovakian sickle | 10.7 | Steensberg 1943: 23 |
| Iron, serrated Galician sickle | 8.7 | Steensberg 1943: 23 |
| Iron, serrated edge | 8.8 | Korobkova 1981: 340 |
| Iron, smooth-edged, small size sickle | 8.0-16.0 | Avitsur 1966: iv |
| Iron, smooth-edged, medium size sickle | 8.0 | Avitsur 1966: iv |
| Iron, smooth-edged, large size sickle | 2.7-4.0 | Avitsur 1966: v |
| Iron, 1829-1830 sickles, barley->wheat | 4.1->4.9 | U.S. Dept. of Labor 1899 |
| Iron, smooth-edged, very thin wheat stand | 1.6 | Lerche 1968: 37 |

Adapted from Russell (1988: 116, TABLE 20).

ments, and flood-recession environments around ponds, marshes, lakes and streams (Moore 1985: 15-16; Russell 1988: 66-67; Sherrat 1980).

Significantly, such favorable locations are, in general, geographically circumscribed. It is therefore suggested that, coupled with the attributes of sessile and stored resources, such locations would have been (or would have become) a focus of competition between human populations. Consistent with evolutionary models of territoriality invoking economic defendability (Dyson-Hudson

and Smith 1978; Krebs and Davies 1985: 86-88), it seems reasonable to expect that the high return rates which could be obtained by cultivating cereals in circumscribed environments with rich soils and natural or easily obtained irrigation would have provided a situation in which the benefits derived from permanently occupying and exploiting them outweighed the social costs of their exclusive use and defense.

Finally, from the data presented above, it seems unreasonable to infer that an absence or low frequency of sickle blades in archaeological contexts involving sandy environments necessarily indicates that cereal cultivation was not practiced. The hand-harvesting of cereals on loose, sandy soils is energetically as efficient, if not more so, than sickle harvesting under similar conditions. Only on denser, clay soils is sickle harvesting necessarily more efficient than hand harvesting. Hence, while the presence of sickle blades in archaeological contexts set in clayey environments may indeed be an excellent marker for the expansion of early cereal cultivation into these regions, their absence at sites in sandy environments has little to do with the presence or absence of cultivation.

It has been previously suggested that the early aversion to heavier clay soils may be partially understood by reference to early tillage technology and the labor required for seedbed preparation, since light soils would be inherently easier to cultivate with hand tools than the denser clay soils (Sherrat 1980: 321; 1981: 293; Simpson 1981: 27; Webley 1972: 171, 173). It has also been noted that the frequent association of clay soils with forest growth would presumably have made the exploitation of such lands less attractive than those with lighter soils under conditions of lithic technology due to the higher labor costs expected for initially clearing (Iversen 1956; Kaplan 1985: 12) and subsequently breaking dense virgin clay soils. It now appears that a further cost associated with the exploitation of such soils was increased harvesting labor.

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# The Origins and Design of Nabataean Water-Supply Systems

In the late first century BC, Diodorus of Sicily, probably quoting the third-century historian Hieronymos of Kardia, described the Nabataeans in this romantic fashion:

> They live in the open air, claiming as native land a wilderness that has neither rivers nor abundant springs from which it is possible for a hostile army to obtain water. It is their custom neither to plant grain, set out any fruit-bearing tree, use wine, nor construct any house; and if anyone is found acting contrary to this, death is his penalty. They follow this custom because they believe that those who possess these things are, in order to retain the use of them, easily compelled by the powerful to do their bidding. Some of them raise camels, others sheep, pasturing them in the desert. While there are many Arabian tribes that use the desert as pasture, the Nabataeans far surpass the others in wealth although they are not much more than ten thousand in number, for not a few of them are accustomed to bring down to the sea frankincense and myrrh and the most valuable kinds of spices, which they procure from those who convey them from what is called Arabia Eudaemon. They are exceptionally fond of freedom, and whenever a strong force of enemies comes near, they take refuge in the desert, using this as a fortress; for it lacks water and cannot be crossed by others, but to them alone it furnishes safety, since they have prepared subterranean reservoirs lined with plaster... After filling these cisterns with rain water, they close the openings, making them even with the rest of the ground, and they leave signs that are known to themselves but are unrecognizable to others... They use as food flesh and milk and those plants that are suitable for this purpose. (19.94.2-10)[1]

This valuable passage, along with related sections not quoted here, probably reflects fairly accurately the character of early Nabataean society and the resources upon which it depended.[2] The early Nabataeans were wandering pastoralists who lived largely off the land and shifted their flocks of sheep, goats and camels from place to place depending on season and the conditions of the pasturage. The water that sustained them in the desert was for the most part runoff from the meager precipitation that fell in the winter months and was stored in plastered cisterns cut in the bedrock. There were no rivers in Edom, always the Nabataean heartland, and the infrequent springs seldom flowed in significant volume; often they were no more than seepages. Except for a few small areas around the peaks of the mountains towering over the eastern slope of Wādī 'Arabah, precipitation is less than 100 mm per year, and for most of Edom it ranges between 25 and 75 mm. Because of the strong, constant sunshine and the low humidity, pan evaporation–the rate of evaporation of exposed bodies of water– ranges between 3000 and 4000 mm per year.[3]

Nevertheless, this dramatic, isolated desert landscape carried–according to Diodorus' source–a very significant population. We do not have to accept the figure of ten thousand literally to understand that the Nabataeans were making the best of their resources. Although seemingly barren to North American eyes, the desert of what is now southern Jordan and northern Saudi Arabia had other resources for its ancient inhabitants besides precipitation. There were edible flora and fauna, clay for ceramics, and bitumen from the Dead Sea–much sought after by the Egyptians for embalming.[4] But even more important was

[1] Quoted from R. M. Geer, *Diodorus of Sicily*, vol. 10. Cambridge, MA: Harvard Universiry Press, 1954, pp. 87-91.

[2] On early Nabataean history, see P. C. Hammond, *The Nabataeans: Their History and Culture*. Gothenburg: P. Åström, 1973; M. Lindner, ed., *Petra und das Königreich der Nabataer*, 4th ed. Munich: Delp, 1983; A. Negev, 'The Early Beginnings of the Nabataean Realm.' *PEQ* 108 (1976) 125-133; *idem, Nabataean Archaeology Today*. New York: New York University Press, 1986.

[3] Rainfall and evaporation statistics can be found in *National Water Master Plan of Jordan*. Amman: Natural Resources Authority, 1977.

[4] For trade goods see P. C. Hammond, 'The Nabataean Bitumen Industry at the Dead Sea.' *BA* 22 (1959) 40-48; D. J. Johnson, *Nabataean Trade: Intensification and Culture Change*. Ph.D. diss. University of Utah, 1987. There is a good discussion of native flora in M. Evenari, L. Shanon and N. H. Tadmor, *The Negev. The Challenge of a Desert*. 2nd ed. Cambridge, MA: Harvard, 1982, pp. 229-323

the location of Edom on the land bridge that linked the Red Sea and the Arabian peninsula on the south with the Ḥawrān and the Decapolis on the north, the Persian Arabian Gulf on the east with the Levantine coast of the Mediterranean on the west. Even in the 1990s the modern Hashemite Kingdom of Jordan both profits and suffers from its location at the crossroads of the Middle East. Already in the early centuries of the Nabataean presence in Edom, Nabataean merchants were bringing spices and aromatic resins to Mediterranean ports by caravan, and Nabataean camel drivers and guides were conducting and–one suspects–fleecing caravans that crossed their lands carrying goods to the hungry markets of the Mediterranean world.[5]

What does all this have to do with Nabataean hydraulic technology? Consideration of the information provided by Diodorus allows reconstruction of at least the basic outlines of the early Nabataean society and economy, and, in hostile environments, the interaction between technology and society is particularly keen and often easier to document than in less marginal areas of the world. Before examining the technology of water supply in the Nabataean culture, one more ancient literary source must be considered, the historian Strabo, writing in the late first century BC or the early first AD.

> The Nabataeans are a sensible people, and they are so much inclined to acquire possessions that they publicly fine anyone who has diminished his possessions and also confer honours on anyone who has increased them. Since they have but few slaves, they are served by their kinsfolk for the most part, or by one another..., or even by their kings. They prepare common meals together in groups of thirteen persons, and they have two girl-singers for each banquet. The king holds many drinking-bouts in magnificent style, but no one drinks more than eleven cups of wine, each time using a different golden cup. The king...often renders an account of his kingship in the popular assembly; and sometimes his mode of life is examined. Their homes, through the use of stone, are costly; but on account of peace, the cities are not walled. Most of the country is well supplied with fruits except the olive; they use sesame oil instead. The sheep are white-fleeced and the oxen are large, but the country produces no horses. Camels afford the service they require instead of horses... Some items are imported completely from other countries, but others only in part, especially in the case of native products, such as gold and silver and most of the aromatics, whereas copper and iron, purple garments, styrax, crocus, costaria, embossed metalwork, paintings, and moulded images are not produced locally. (16.4.26)[6]

The contrast between the hedonistic, settled Nabataeans described by Strabo and the lean, foxy nomads described by Diodorus has provoked frequent comment.[7] What we see, of course, is a neat summary of the changes that overtook Nabataean society between the third and the first century BC: monarchy (although remarkably populist in tone), a sort of settled urbanism with elaborate stone houses, agriculture (including fruit trees and vineyards), herds of animals–including carefully bred and well-fed cattle, and luxurious possessions associated with sophisticated manufacture and long-distance trade. The technology of water supply, unfortunately, is not mentioned, but implicit in the overall picture are more sophisticated structures and techniques than the rock-cut cisterns mentioned by Diodorus. How were these materialistic wine-bibbers and flute girls, their homes, flocks and fields supplied with water in an environment just as arid in the first century BC as it had been in the third and as it is today?[8] In part, the increased production of water resulted from the adaptation or more intensive application of water-harvesting techniques that went back at least to the Iron Age Edomite culture. But, in part, the higher standard of living also resulted from the introduction of new techniques from the Hellenistic world. We can only touch here on the contentious topic of why the Nabataeans so enthusiastically embraced a settled life at all. It is likely that sedentarization in this case evolved or was intentionally fostered to provide an alternative economic system to the caravan trade, which seems to have been increasingly diverted from Nabataean to Egyptian or Syrian routes in the first century BC.[9]

Although meager in amount and very localized in occurrence, precipitation does fall reliably in the desert

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[5] For the Red Sea trade and Nabataean caravan activity, see J. W. Eadie, 'Strategies of Economic Development in the Roman East.' Pp. 113-120 in D. H. French and C. S. Lightfoot, eds., *The Eastern Frontier of the Roman Empire*. Oxford: BAR, 1989; L. Casson, *The Periplus Maris Erythraei*. Princeton: Princeton University Press, 1989, pp. 9, 61-63, 143-144.

[6] H. L. Jones, *Geography of Strabo*, vol. 7. Cambridge, MA: Harvard, 1930, pp. 367-369.

[7] A. Negev, 'The Nabataeans and the Provincia Arabia.' Pp. 520-686 in H. Temporini and W. Haase, *ANRW* II.8 (1977) 523 ff.; G. Bowersock, *Roman Arabia*. Cambridge, MA: Harvard, 1983, p. 12.

[8] For the general lack of climatic change since the Neolithic or Early Bronze Age, see N. Shehadeh, 'The Climate of Jordan in the Past and Present.' Pp. 25-37 in A. Hadidi, ed., *Studies in the History and Archaeology of Jordan*, II. Amman: Department of Antiquities, 1985; R. Rubin, 'The Debate over Climatic Changes in the Negev, Fourth-Seventh Centuries C.E.' *PEQ* 121 (1989) 71-78; also, W. C. Lowdermilk, 'The Use of Flood-Waters by the Nabataeans and Byzantines.' *IEJ* 4 (1954) 50-51.

[9] Sedentarization is discussed in Bowersock (above, n. 7) 64; *idem*, 'Nabataeans and Romans in the Wadi Sirhan.' Pp. 133-136 in A. M. Abdalla, *et al.*, eds., *Studies in the History of Arabia*, 2. Riyad: King Saud Press, 1984; S. Hart, 'Some Preliminary Thoughts on Settlement in Southern Jordan,' *Levant* 18 (1986) 51-58; D. Graf, 'Nabataean Settlements and Roman Occupation in Arabia Petraea'. Pp. 253-260 in *Studies in the History and Archaeology of Jordan*, IV. Amman: Derpartment of Antiquities, 1992; O. S. LaBianca, *Hesban I: Sedentarization and Nomadization*. Berrien Springs, MI: Andrews University, 1991; S. T. Parker, 'Peasants, Pastoralists, and *Pax Romana:* A Different View.' *BASOR* 265 (1987) 35-51.

every year when averaged out over the large catchment areas individual Nabataean tribal groups and settlements controlled. The secret of survival was the knowledge of how to harvest this precipitation. The most obvious techniques had been discovered by the Iron Age and put to work in many of the arid areas of the ancient Near East.[10] The terracing of hillsides is perhaps the most spectacular and visible of these early methods: heavy stone walls built across the slope of a hill captured both runoff water and the particles of earth it carried. The reservoir of soil gathered and protected in this fashion served in turn as a sponge to hold moisture to sustain the crops planted on the level surface created. In a variation on this technique, walls were built across wadis, dry stream beds that carried the concentrated runoff from a catchment area. Although vulnerable to damage, walls and fields in such a location were more likely to receive significant runoff and alluvial soil than the terraces on the slopes above. Because the principle involved was so obvious, the construction techniques relatively simple, and the need for maintenance constant, ancient terraces and wadi barriers in the Near East have often remained in use for long periods of time and lost their original appearance. But occasionally, single period sites provide a glimpse of their use in the Bronze or Iron Age, for example at the Early Bronze Age site of Tall al-Ḥandaqūq.[11]

A variation on the wadi barrier, the containment dam designed to trap and hold a pool of water, was attemped in the Near East as early as the Early Bronze Age, but seldom with much success. The barrier wall had to be capable all at once of withstanding the shock of the water's sudden arrival, its erosive action as it poured over the spillway, and the weight of the standing pool. The barrier and reservoir walls also had to be impermeable or at least highly resistant to the percolation of the water they retained. In antiquity, as today, there have been spectacular failures of containment dams, as at the Old Kingdom Wādī Garawi dam.[12] Even when structurally successful, containment dams provided a pool of water that was subject to the enormous evaporation typical of the desert regions, and the quality of the water would have been low because of pollution by bird and animal droppings and by plant, insect and animal life in the pool itself. Nevertheless, erosion of the soft sandstone typical of Edom has produced natural pools that have been used with little or no human alteration from antiquity to the present.[13]

From the Early Bronze Age on, cisterns have been the preferred method for capturing and storing water to be used for drinking. The entry of water was controlled, and the captured water was protected from evaporation and pollution. Hand in hand with advances in cistern design, the archaeological record shows progress in the creation of plasters resistant to the percolation and erosive effect of the water. By the Iron Age, the Edomites had settled on the rock-cut bottle cistern as appropriate to their needs, well illustrated by examples at the Edomite settlement on Umm al-Biyara at Petra (FIG. 1).[14] This type of cistern remained in use among the early Nabataeans and is described by Diodorus' source:

> They have prepared subterranean cisterns lined with plaster... As the earth in some places is...of soft stone, they make great excavations in it, the mouths of which they make very small, but by constantly increasing the width as they dig deeper, they finally make them of such a size that they can be one plethron [27 metres! ed.] wide. (19.94.7)[15]

Although the Edomite cisterns are much smaller in size, usually shaped like a bottle with small neck and three to four metres in greatest diameter, they served



1. Umm al-Biyāra, Petra: Rock-cut bottle cistern (Photo: Oleson).

10 Studies of Nabataean water-supply technology can be found in Evenari *et al.* (above n. 4); J. P. Oleson and J. W. Eadie, 'The Water-Supply Systems of Nabataean and Roman Ḥumayma.' *BASOR* 262 (1986) 49-76; M. Lindner, 'Die Wasserversorgung einer antiker Stadt—Petra.' Pp. 196-201 in G. Garbrecht, *Der Wasserversorgung antiker Städte.* Mainz: von Zabern, 1987; Z. al-Muheisen, *L'alimentation en eau de Petra.* Diss. Sorbonne. Paris: 1983.

11 J. Mabry, 'Investigations at Tell el-Handaquq, Jordan (1987-88).' *ADAJ* 33 (1989) 59-95. For terraces, see also Z. Ron, 'Agricultural Terraces in the Judean Mountains.' *IEJ* 16 (1966) 33-49; T. E. Levy and D. Alon, 'Settlement Patterns along the Nahal Beersheva-Lower Nahal Besor. Models of Subsistence in the Northern Negev.' Pp. 45-138 in T. E. Levy, *Shiqmim*, I. Oxford: BAR, 1987, esp. pp. 55-59.

12 For the Wadi Garawi dam, see G. Garbrecht, 'Geschichtliche Talsperren im östlichen Mittelmeerraum,' *Leichtweiss-Institut für Wasserbau, Mitteilungen* 82 (1984) 1-23; R. L. Bowen, Jr. and F. P. Albright, eds., Archaeological Discoveries in South Arabia. Baltimore: The Johns Hopkins University Press, 1958, pp. 62-81; M. Lindner, 'Nabatäische Talsperren.' Pp. 147-174 in G. Garbrecht, *Historische Talsperren.* Stuttgart: Wittwer, 1987; R. Rubin, 'Water Conservation Methods in Israel's Negev Desert in Late Antiquity.' *Journal of Historical Geography* 14 (1988) 229-244.

13 There is a spectacular series of natural and adapted pools at Muqawwar, east of Ḥumayma; see W. Jobling, 'Aqaba-Ma'an Archaeological and Epigraphical Survey.' Pp. 16-24 in D. Homès-Fredericq and J. B. Hennessy, *Archaeology of Jordan,* II: *Field Reports, Surveys, and Sites.* Akkadica, Supp. 7. Leuven: Peeters, 1989.

14 For early cisterns, see I. Browning, *Petra.* rev. ed. London: Chatto & Windus, 1982, p. 176; G. and A. Horsfield, 'Sela-Petra, The rock of Edom and Nabatene.' *QDAP* 7 (1938) 1-42.

15 Geer (above, n. 1) 88-89.

their intended purpose well. They were cut in the rock close to the focus of a natural catchment and provided with small feeder channels to lead the water into the draw-hole or a special intake hole. Their interiors were lined with a hard, sandy white plaster.

The infrequent, and thus all the more welcome, springs and seepages of Edom, for the most part found among the strata exposed by the ash-Sharāh escarpment or the Dead Sea rift, must always have been a focus of human activity. Because of the constant use of these sites from the Palaeolithic to the present, their original appearance, and the earliest methods of enhancing or capturing their flow cannot be documented. The most appropriate methods, however, are obvious, and probably were in use by at least the Early Bronze Age. The original muddy pools would have been cleared out, and eventually lined with stone, and conduits provided to carry the overflow to adjacent artificial pools or fields. The *qaṭṭār*, or site where water seeps from an exposed aquifer, is exploited by trimming back the original face and by cutting runnels and basins to concentrate and collect the water (FIG. 2).[16]

These were the techniques available to the early Nabataeans as they moved into the southern desert and Edom–possibly from northwestern Arabia and possibly around the fifth century BC.[17] Judging from the rapidity with which they occupied their new territory, they undoubtedly already knew or quickly learned the appropriate methods of harvesting the scanty desert precipitation. But in the course of the second and first centuries BC new techniques appeared, probably first in response to a growing population and more frequent transit through the desert, then in response to the shift to a more settled, agricultural economy. Since many of these techniques remained in use through the Byzantine period throughout the area occupied by Nabataean communities–from the Ḥawrān on the north to the Ḥijāz on the south, and west across an-Naqab (the Negeb) to the Mediterranean coast, it is very difficult to document the precise time and place of their introduction (FIG. 3). Nevertheless, recent excavations at Ḥumayma, ancient Auara, a Nabataean settlement in southern Jordan, suggest that the first century BC was a period of particularly rapid innovation and that Nabataean needs governed the process.[18]



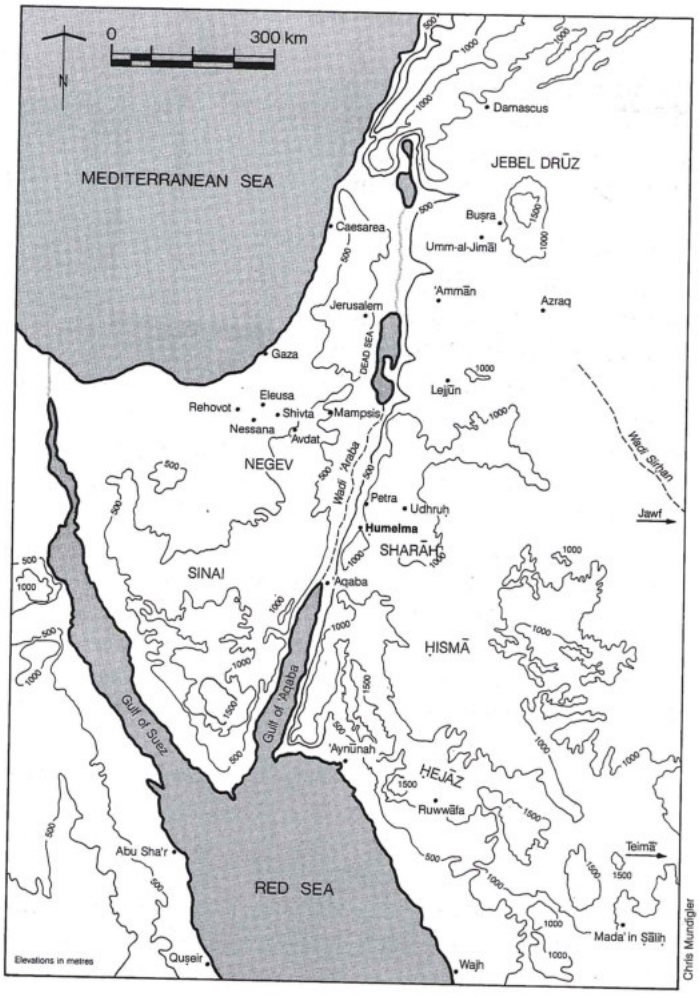
2. Qaṭṭār in Wādī Qaṭṭār ad-Dayr, Petra (Photo: Oleson).

These new and revised techniques of water management can be grouped under the three headings of collection, transport and storage. For most of the desert areas of the Nabataean kingdom, collection of water was the most critical consideration, and–although simple in principle–required careful consideration. One characteristic of a desert landscape is the absence of a heavy ground cover of plants and the humus on which they feed and to which they contribute. Except where it falls on pure drift sand, much of the precipitation in a desert runs off the surface unimpeded and quickly collects in short-lived torrents that fill the wadis and grow in force until they empty into mud flats or cross absorbent geological deposits. The runoff resulting from even minor rain showers is even more impressive in the sandstone mountains of the Petra region, for example. In collecting runoff water, it was important to strike a balance between too large a catchment, which might yield a torrent very difficult to control, and one too small, which might be missed altogether by localized desert rain storms. The potential for excess flow was less important in situations where the water was to be conducted across sturdy wadi barriers to moisten agricultural soil than where it was

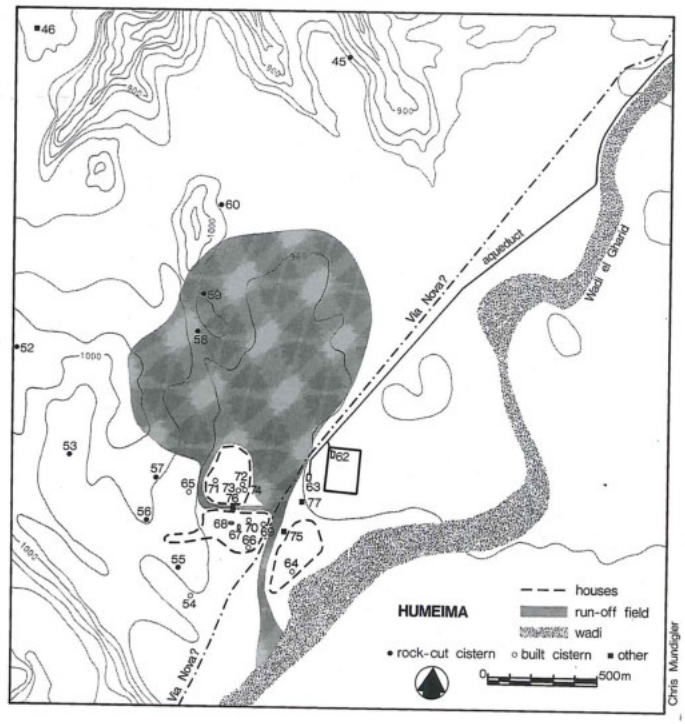
16 There is a *qaṭṭār* at Muqawwar; see Jobling (above n. 13). There is another well preserved example at Petra, in Wādī Qaṭṭār ad-Dayr (here, FIG. 2).

17 On the origins of the Nabataeans, see F. Altheim and R. Stiehl, *Die Araber in der Alten Welt,* 1: *Bis zum Beginn der Kaiserzeit.* Berlin: Walter De Gruyter, 1963, pp. 31-39; A. Negev, 'The Early Beginnings of the Nabataean Realm.' *PEQ* 108 (1976) 125-133; H. P. Roschinski, 'Geschichte der Nabatäer.' *Bonner Jarhbücher* 180 (1980) 129-154; and now the interesting sythesis presented by D. Graf, 'Arabia during Achaemenid Times.' Pp. 131-48 in H. Sancisi-Weerdenburg and A. Kuhrt, eds. *Achaemenid History,* IV: *Centre and Periphery.* Leiden: Nederlands Instituut voor het Nabije Oosten, 1990.

18 The author has been directing survey and excavation at Ḥumayma since 1986. Selected publications include J. P. Oleson, 'The Ḥumayma Hydraulic Survey: Preliminary Report of the 1986 Season.' *ADAJ* 30 (1986) 253-260; *idem*, 'Technology and Society in Ancient Edom.' *Transactions of the Royal Society of Canada* ser. 5, vol. 2: (1987) 163-174; *idem*, 'The Ḥumayma Hydraulic Survey: Preliminary Report of the 1987 Season.' *ADAJ* 32 (1988) 157-169; *idem*, 'The Ḥumeima Hydraulic Survey: Preliminary Report of the 1989 Season.' *ADAJ* 34 (1990) 285-311; *idem*, 'Aqueducts, Cisterns, and the Strategy of Water Supply at Nabataean and Roman Auara (Jordan).' Pp. 45-62 in A. Trevor Hodge ed., *Future Currents in Aqueduct Studies.* Leeds: Francis Cairns, 1991; *idem*, 'The Water-Supply System of Ancient Auara: Preliminary Results of the Ḥumeima Hydraulic Survey.' Pp. 269-75 in *Studies in the History and Archaeology of Jordan*, IV. Amman: Department of Antiquities, 1992; J. P. Oleson, K. 'Amr and R. Schick. 'The Ḥumeima Excavation Project: Preliminary Report of the 1991 Season.' *Echos du Monde Classique* 11 (1992) 137-169; J. P. Oleson, D. Graf and J. Eadie, 'Ḥumayma.' Pp. 270-274 in D. Homès-Fredericq and J. B. Hennessy, eds., *Archaeology of Jordan,* II: *Field Reports.* Akkadica, Supp. 7. Leuven: Peeters, 1989; J. P. Oleson, K. 'Amr, R. Schick, R. M. Foote and J. Somogyi-Csizmazia, 'The Ḥumeima Excavation Project: Preliminary Report of the 1991-1992 Seasons.' *ADAJ* 37 (1993) 461-502; *idem*, 'The Ḥumeima Excavation Project, Jordan: Preliminary Report of the 1992 Season.' *Echos du Monde Classique* 12 (1993) 123-158.




3. Location of Ḥumayma in Nabataea.




4. Plan of Ḥumayma.

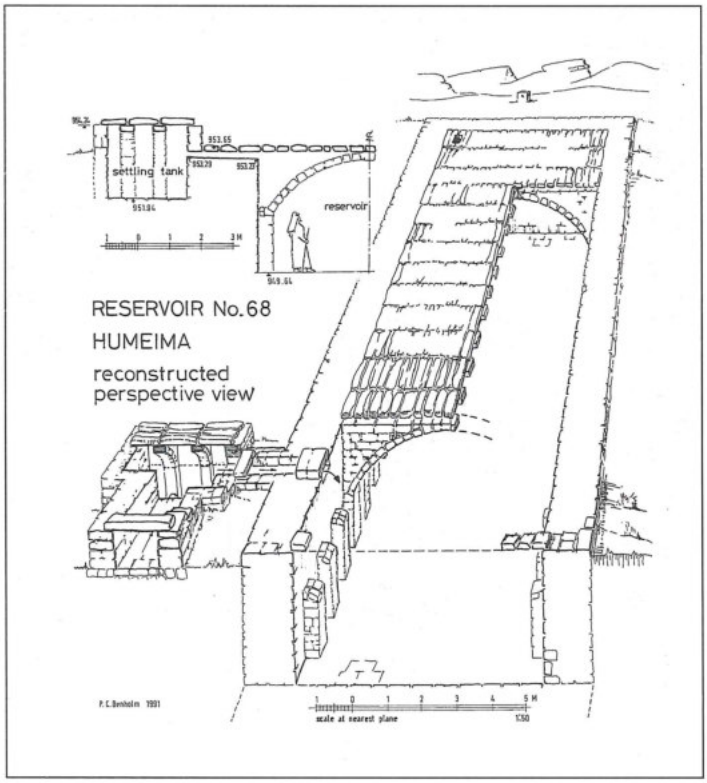
meant to fill cisterns close to habitation areas, particularly where the cisterns were built of blocks rather than cut in the bedrock.[19]

The settlement of Ḥumayma, ancient Auara, is interesting in this regard. According to the first-century (or possibly fourth-century) historian Euranios, Auara was founded in the 80s BC by King Aretas III (87-62 BC, possibly before his accession to the throne) on the caravan route that later became the *Via Nova Traiana*, in what is now Jordan's southern desert.[20] The king probably wanted both to facilitate the caravan trade and to foster exploitation of the fertile loessal soils on the adjacent plain, but there is no obvious reason for the precise location of the settlement other than the presence of an excellent water-catchment field to supply the cisterns on which Auara was to depend (shaded in on FIG. 4). This field, approximately one square kilometer in area, slopes gently (at approximately two percent) from north to south towards a natural outlet approximately 50 metres across, framed by low rises. If the whole field received the 80 mm of rain which the region averages through the year, and even it as much as fifty percent of it were absorbed, 40,000 cubic metres would still run through this gap–enough water to sustain a population of 11,000 for a year, if it could be stored.[21] In fact, King Aretas intended the settlement to depend on two large public cisterns built as a pair 50 m west of the gap–close enough to be filled through collection channels, but out of harm's way. Each cistern had a capacity of approximately 460 cubic metres and together they held more than enough water to sustain, for example, a population of 250 humans, or 100 humans and 1100 goats (FIG. 4, no. 67 and 68; FIG. 5). Of course the runoff field might well not yield 40,000 cubic metres of water every year, but the subsequent history of Auara shows that the safety margin was sufficient. During the 800 years of the settlement's existence, more than 30 houses were built on the low slopes surrounding these public cisterns. For

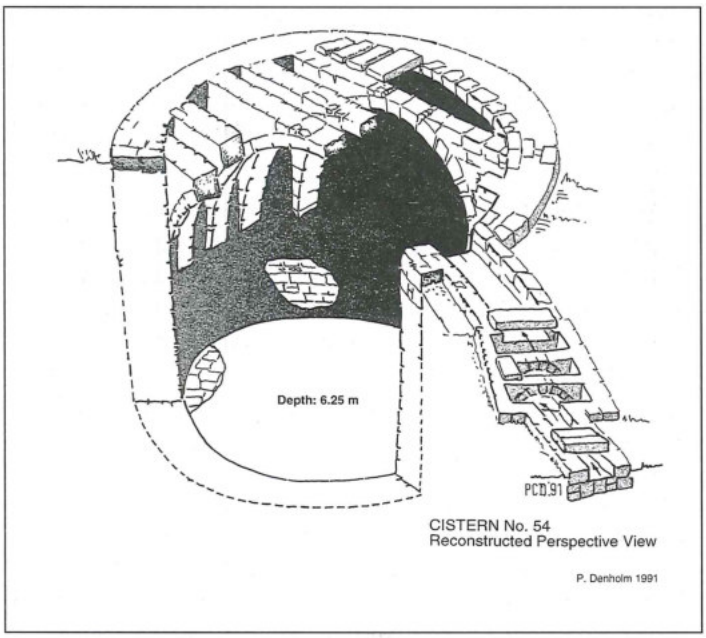
19 Evenari *et al.* (above, n. 4) 99-119, 179-189.

20 The fragments of Uranius are assembled in F. Jacoby, *Die Fragmente der griechischen Historiker,* III C. Leiden: Brill, 1958, pp. 339-344; on this enigmatic author, see J. M. I. West, 'Uranius.' *HSCP* 78 (1974) 282-284. The best treatments of the Nabataean history of the region around Ḥumayma are D. Graf, 'The Nabataeans and the Hisma: In the Steps of Glueck and Beyond.' Pp. 647-664 in C. L. Meyers and M. O'Connor, eds., *The Word of the Lord Shall Go Forth: Essays in Honor of David Noel Freedman.* Winona Lake: Eisenbrauns, 1983; *idem*, 'Qura 'Arabiyya and Provincia Arabia.' Pp. 171-203 in *Géographie historique au Proche-Orient, Notes et monographes techniques,* no. 23. Paris: CNRS, 1988.

21 For statistics on human consumption see S. Helms, 'Paleo-Bedouin and Transmigrant Urbanism.' Pp. 97-113 in A. Hadidi, ed., *Studies in the History and Archaeology of Jordan,* I. Amman: Department of Antiquities, 1982; *idem, Jawa. Lost City of the Black Desert.* Ithaca: Cornell, 1981, p. 189.

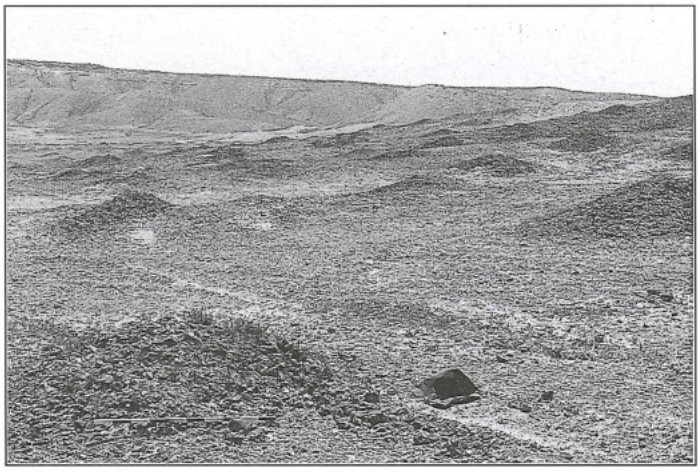



5. Reconstruction of public cistern no. 68, Ḥumayma.




6. Reconstruction of Private Cistern no. 54, Ḥumayma.

the sake of convenience, some of them tapped the same runoff course to fill smaller, circular cisterns below their private courtyards (FIG. 6). Many of these cisterns are still in use today, filled by the sparse but predictable desert rainfall even though maintenance of the catchment channels seems haphazard. As far as we can tell, the adjacent wadi bed, which drains approximately 200 square kilometres of the Auara catchment, was left almost completely alone, probably because its flow was too violent to allow easy diversion.

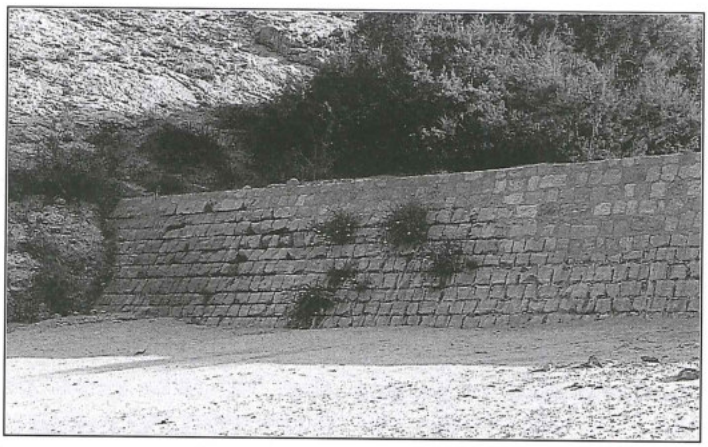


7. Stone mounds facilitating runoff, Shivta (Photo: Oleson).

Catchment areas could be adapted to human needs by building containment walls or cutting channels at the edges of a slope to salvage water or to divert it towards a small cistern opening. Features of this type were relatively easy to arrange on bedrock slopes, and throughout the Ḥisma, particularly around Ḥumayma, many of them still function today as they were designed originally. The enhancement of runoff on earth slopes, however, required more planning and greater maintenance. Earth conduits have survived at some sites, such as Shivta in an-Naqab.[22] Everywhere around the late Nabataean cities of an-Naqab, the gravelly slopes are covered with man-made patterns formed by piling field stones in regular heaps or lines (FIG. 7).[23] These laborously-constructed heaps probably were intended to serve two purposes. Removal of the surface stones allowed the soil to crust over almost immediately after it was moistened by rain and thus fostered unimpeded runoff from the slopes, increasing the yield of water. The absence of small stones probably also fostered the gradual transport of fresh soil particles to terraced fields on the slopes or in the wadis below. Erosion and deflation of the exposed soil meant that continued clearing of the gaps was essential, and today in most cases the exposed surface soil has disappeared. So far it has not been possible to date these features precisely, but they may well have appeared around the Nabataean cities of an-Naqab in the first cen-

22 For Shivta, see Y. Kedar, 'Ancient Agriculture at Shivtah in the Negev.' *IEJ* 7 (1957) 178-189; A. Segal, 'Shivta—A Byzantine Town in the Negev Desert.' *JSAH* 44 (1985) 317-28; Evenari *et al.* (above, n. 4) 103, FIG. 69.

23 These mounds used to be called *tulailat al-'inab* ("grape mounds") on the assumption that they were heaped up to protect vines, an idea debunked—in my opinion—by Evenari *et al.* (above, n. 4) 126-147. See also K. C. Gutwein, *Third Palestine: A Regional Study in Byzantine Urbanization*. Washington D.C., Univesity Press of America, 1981, 77.

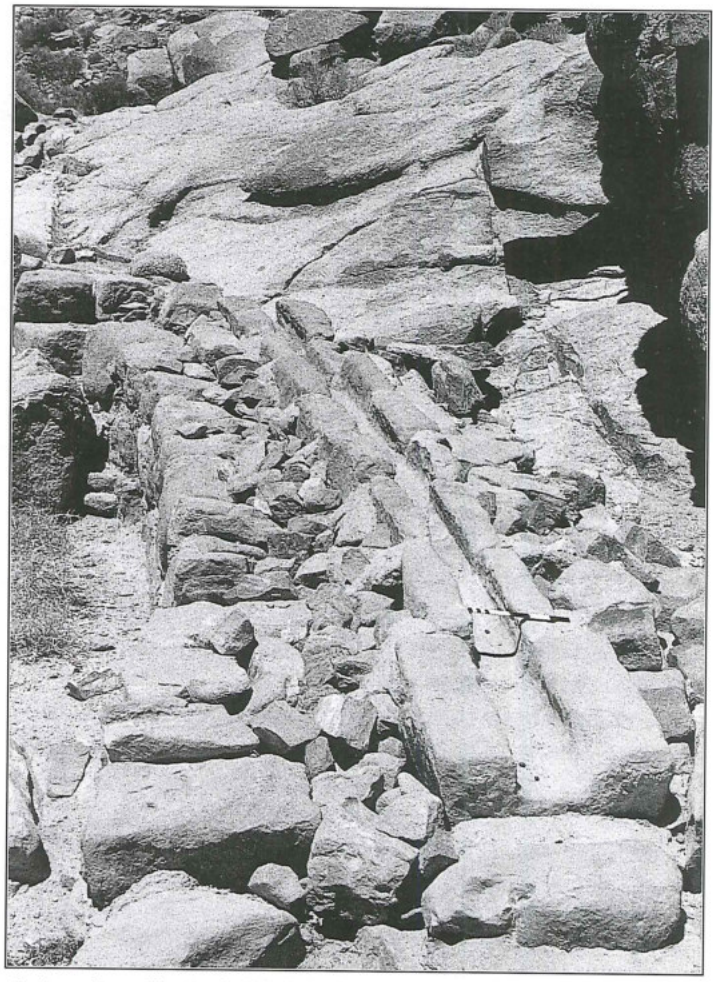


8. Nabataean dam, Mampsis (Photo: Oleson).

tury BC or AD, the time of their initial flowering, and remained in use through the Byzantine period. Catchment fields enhanced in this manner are very rare in southern Jordan, probably because of differences in local geology and topography. At most sites in this region large areas of exposed bedrock form excellent natural runoff areas, and there are extensive deposits of loess in the plains, formed during the Pleistocene period.[24]

Another hydraulic management technique typical of Nabataean settlements is the application of wadi barriers to divert excess water flow into channels that carried it to fields above the wadi bed proper. This arrangement both expanded the area of watered fields and avoided the loss of soil and moisture that resulted when a wadi in spate breached a barrier wall. The technique may have been borrowed from the Nile Valley, where it had been in use for millennia as a technique for irrigating fields above the level of the Nile flood.[25]

Containment dams represent a different approach altogether. Small ones built across steep-walled gullies to form a type of cistern are common in the sandstone topography of Petra and other Nabataean settlements in southern Jordan, but these dams–really a type of free-standing cistern wall–do not entail the same engineering problems as larger containment dams. Perhaps best known of these large dams are three at Mampsis/Kurnub in an-Naqab which barred the main wadi and created pools holding 10,000 cubic metres of water. Their date is still not certain, but an origin in the first or second century has been proposed on historical grounds.[26] The con-



9. Aqueduct, 'Ayn ash-Shallālah, Wādī Ramm (Photo: Oleson).

tainment walls, built of mortared blocks, had vertical faces upstream and sloping walls downstream for buttressing (FIG. 8). Recent rebuilding has concealed the original spillway arrangement. A smaller dam (10.7 m long, 4.4 m thick) at Ḥumayma/Auara had a narrow enough span and was thick enough that buttressing was not necessary.[27] In this case, the spillway, always the most vulnerable point on a containment dam, was cut in the bedrock to one side of the mortared masonry wall. It contained a reservoir of approximately 1400 cubic metres, made accessible by steps cut in the steep rock wall of the canyon at one side. The pools behind the dams at both Kurnub and Auara are filled to the brim with silt and sand, reminding us that constant maintenance would

[24] There is one clear example at Ḥumayma; see Oleson (above, n. 18) 1986, PL. 46.2.

[25] There are excellent discussions of the wadi barriers used in an-Naqab, in M. Evenari and D. Koller, 'Ancient Masters of the Desert.' *Scientific American* 194.4 (1956) 39-45; also in Evenari *et al.* (above, n. 4) 95-120, 179-190. On Egyptian technique, see R. J. Forbes, *Studies in Ancient Technology,* vol. 2. Leiden: Brill, 1965, pp. 25-32.

[26] See A. Negev, *The Architecture of Mampsis, Final Report, I: The Middle and Late Nabataean Periods.* Jerusalem: Hebrew Univesity, 1988, pp. 6-7, 17-18 and the references cited there. For Nabataean and later dams in general, see the citations in note 12 above, along with B. De Vries, 'The el-Lejjun Water System.' Pp. 399-428 in S. T. Parker, ed., *The Roman Frontier in Central Jordan,* pt. i. Oxford: BAR, 1987; P. Parr, 'La date du barrage du Siq à Petra.' *RB* 74 (1967) 45-49. W. Jobling, 'Prospection archéologique et épigraphique dans la région d''Aqaba-Ma'an.' *Syria* 60 (1983) 317-323, reports on some interesting small dams or wadi barriers near Ḥumayma. For parallel techniques in North Africa, see P. Trousset, 'Les oasis présahariennes dans l'antiquité: Portage de l'eau et division du temps.' *Antiquités africaines* 22 (1986) 163-193.

[27] J. P. Oleson, 'Eine nabatäische Talsperre in der Nähe von Ḥumeima (das antike Auara) in Jordanien.' Pp. 65-71 in G. Garbrecht, ed., *Historische Talsperren,* 2. Stuttgart: Wittwer, 1991.

have been necessary to keep this sort of structure functioning properly. The famous dam across the upstream end of the Sīq at Petra was designed simply to divert the water through a tunnel, leaving the original wadi bed free as a road.[28]

Enhancement, diversion or containment of runoff or spring water often had to be combined with transport of the water to a location more convenient for its use or storage. Prof. Jobling has found some low, block-built barrier walls in the Ḥisma that created small pools of runoff water in sandstone gullies and directed the overflow into small channels cut into the bedrock that conducted the water to cisterns nearby.[29] Short stretches of conduits cut into sandstone blocks were also used in Nabataean settlements to guide water from roofs or paving into cisterns. This type of conduit block, consisting of a channel usually around 12 cm wide and 15 cm deep cut into a block of local sandstone, marl or limestone 60 to 90 cm long, is the typical water channel in the area of the Nabataean kingdom from at least the first century BC through the Byzantine period.[30]

Conduits built in this manner were typically associated with spring water, which was highly valued for its quality and which was more likely than other sources to be found in a location inappropriate for a cistern or inconvenient for human habitation. Conduits have been found at virtually all the springs in the region, varying in preserved or conjectured length from several metres to a colossal 27 kilometres for the aqueduct serving Ḥumayma.[31] The conduit that carried the water from 'Ayn Mūsā to Petra was approximately 6 kilometres long. The conduit carrying the water from 'Ayn ash-Shallālah in Wādī Ramm to the adjacent sanctuary was 1.5 km long (FIG. 9). All of these conduits fed reservoirs along their courses and at their termination and they share technical characteristics peculiar to the Nabataean examples. In the first place, the channel size and design flow are far below those of the typical Hellenistic or Roman aqueduct. While the water channel of the Aqua Marcia was approximately one metre wide and deep, and its flow 187,600 cubic metres per day, the channel of the main aqueduct serving Petra was 15 cm square and had a maximum flow of no more than 500 cubic metres per day. The long conduit serving Ḥumayma had a channel 12 by 15 cm, and could have discharged at most 148.6 cubic metres per day.[32] These capacities, of course, were designed to correspond to the resources available, which were far less abundant than the springs and rivers of central Italy. The Ḥumayma aqueduct had two branch lines fed by three springs with a maximum total flow at present of only 53 cubic metres per day. Nabataean water conduits also differed from Roman aqueducts in their typical ground-level course. They did not tunnel through the bedrock or soil for the first part of the run, then rise up on arches to maintain as much of the head as possible at the point of use. The date of the introduction to this region of the *qanat*, or subterranean conduit excavated by means of the chain of access shafts, is still uncertain. It may belong only to the Islamic period, but in any case, it was rarely used in Arabia Petraea. There are examples at Yotvata, Qaṣr al-Mushāsh, and Udhruḥ.[33]




10. Ḥumayma aqueduct (Photo: Oleson).

Some well preserved stretches of a typical ground-level conduit were excavated along the Ḥumayma aqueduct (FIG. 10).[34] The conduit blocks were laid end-to-end in a bedding of crumbly mortar and fist-sized rubble, framed by heavy, roughly trimmed blocks and boulders. A course of small stones set in plaster ran along either side of the channel to support heavy, partly-trimmed cover slabs. A ground-level channel of this type had to be roofed, in order to prevent obstruction by falling rocks or blowing sand, evaporation, the entry of pollutants, and unauthorized diversion of the water. Evidence was found that in the last years of its functioning, portions of the conduit leading to Ḥumayma were left uncovered, allowing algae or grass to grow in the channel. The tiny stalks attracted calcium carbonate deposits, which grew

28 Parr (above, n. 26); al-Muheisen (above, n. 10).

29 Jobling (above, n. 26).

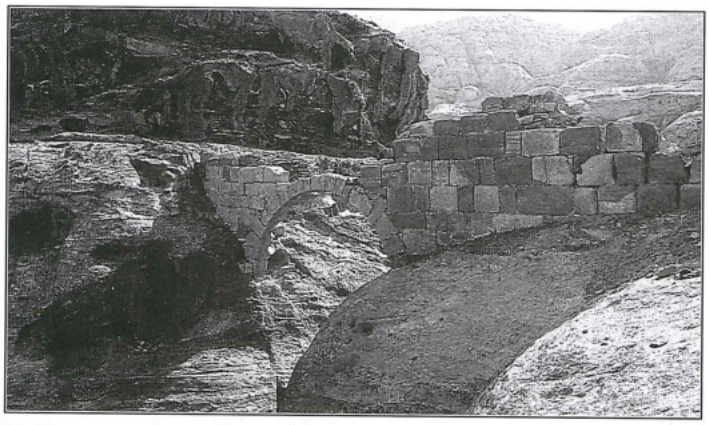
30 There is a discussion of conduit blocks in Oleson and Eadie (above, n. 18) 69-70; see also Oleson (above, n. 18) 1987, 1988, 1991.

31 *Ibid.*

32 Aqua Marcia: D. R. Blackman, 'The Volume of Water Delivered by the Four Great Aqueducts of Rome.' *Papers of the British School at Rome* 46 (1978) 52-72; Petra: al-Muheisen (above, n. 10); Ḥumayma: Oleson and Eadie (above, n. 18) 68-69.

33 Yotvata: Evenari *et al.* (above, n. 4) 173-178. Qaṣr al-Mushāsh: G. King, 'Qasr el-Mushash.' Pp. 391-96 in Homès-Fredericq and Hennessy (above, n. 18). Udhruḥ: A. Killick, *Udruh. Caravan City and Desert Oasis*. Romsey, 1987. See also Graf (above, n. 17) 137 on possible Achaemenid *qanawāt* in the Ḥijāz. On *qanawāt* in general, see P. W. English, 'The Origin and Spread of Qanats in the Old World.' *Proceedings of the American Philological Society* 112 (1968) 170-181; H. Gablot, *Les Qanats: une technique d'aquisition de l'eau.* Paris: Mouton, 1979, and on their use in modern Oman, J. C. Wilkinson, *Water and Tribal Settlement in South-East Arabia.* Oxford: Oxford University Press, 1977.

34 See Oleson (above, n. 18) 1987.



11. Petra aqueduct arch over Wādī al-Wu'ayra (Photo: Oleson).

rapidly until they blocked the channel with a mass of worm-like concretions–like a pot too small for a load of vermicelli. Aqueducts are expensive and difficult to build, require constant observation and maintenance, and are easily disrupted. It is no wonder that the settlement of ancient Auara was built around two public cisterns filled by runoff water, and that smaller cisterns of the same type were built beneath private homes even after the construction of the aqueduct system and the reservoir it fed. To Nabataean eyes, harvesting desert precipitation was a more dependable form of water-supply than reliance on a long, spring-fed conduit. The same pattern can be seen even at Petra, which was served by a shorter conduit fed by a far more generous spring.

Because of their smaller scale, Nabataean aqueducts were more flexible in their design requirements than Roman aqueducts, but they still had to cope with a ground-level course in landscapes that were often very highly dissected. Nabataean engineers dealt with the resulting problems by the use of heavy support walls, viaduct bridges–seldom more than a metre or two high, but not infrequently 10 or 20 metres long–slab bridges over small gulleys, channels cut in cliff faces, and in a famous instance at Petra, an arched bridge over the deep, narrow Wādī al-Wu'ayra (FIG. 11).[35] Although some Nabataean conduits incorporated terracotta pipelines for part of their course–notably in the Sīq at Petra–I am not aware of any documented examples of intentionally pressurized systems used as inverted siphons to carry water across a significant depression without the use of a wall or arch. Such inverted siphons were prominent features of many Hellenistic and Roman water systems, as close by as Jerusalem and the Jordan Valley.[36] Because the capacity of their conduits was relatively small, Nabataean hydraulic engineers could lay out channels down slopes that were unthinkable to Roman engineers, and could build into the system sharp bends and sudden changes in level. Vitruvius proposes a slope of 0.5 percent as appropriate for an aqueduct channel, and surviving Hellenistic and Roman aqueducts typically have slopes between 2.0 and 0.03 percent.[37] The overall slope of the aqueduct leading to Ḥumayma is 2.5 percent, but at points where the channel descends the ash-Sharāh escarpment, the channel slope varies from an impressive 10 to an astonishing 50 percent.

It is interesting that Auara reached out farther into the countryside for its water than any other Nabataean settlement and at the same time made use of a full array of the other more typical Nabataean water-harvesting techniques. Although the technology is typically Nabataean, the scale of the Ḥumayma aqueduct may reflect a familiarity on the part of King Aretas III (who was given the epithet "Philhellene") with Hellenistic and Roman aqueduct systems in the eastern Mediterranean. To be sure, there was marked Hellenistic influence on the design of the typical Nabataean cistern (see below).

Just as their resources were smaller, Nabataean applications of running water were fewer, and the physical arrangements for distribution correspondingly less elaborate than those for a Roman metropolis. Instead of being divided up into pressurized pipelines serving public fountains, public baths, and private homes–as Vitruvius recommends (8.6.1-2)–the water splashed quietly into public reservoirs to which access was arranged by Nabataean tribal custom and probably sanctioned by religion, sometimes visibly, in the form of Dhushara blocks representing a major Nabataean deity.[38] The overflow from the primary storage tanks probably was conducted into private cisterns and small agricultural plots in accordance with similar arrangements. At Ḥumayma, the aqueduct, built soon after the settlement's foundation, was designed to fill a large, shallow reservoir with a capacity of 633 cubic metres, located on a rise 300 metres northeast of the settlement centre (FIG. 12). It is likely that this water was intended to support the needs of transient groups that pitched their tents on the flat ground around the reservoir when agricultural, pastoral, or commercial activities brought them to Auara. King Aretas,

35 The Petra arch is illustrated in A. Kennedy, *Petra*. London: Country Life, 1925, FIG. 188; A. Musil, *Arabia Petraea*, II: *Edom*. Vol. I. Vienna: Hölder, 1907, p. 58, FIGS. 20-21. A very Roman-looking arch supports a Nabataean type aqueduct serving a site at as-Sādah, near Petra: M. Lindner, S. Farajat and J. P. Zeitler, 'Es-Sadeh: An Important Edomite-Nabataean Site in Southern Jordan.' *ADAJ* 32 (1988) 75-99.

36 For Jerusalem, see J. C. Wilkinson, 'Ancient Jerusalem. Its Water Supply and Population.' *PEQ* 106 (1974) 33-51. There were many cut stone pipeline siphons serving fortresses in the region of Jericho; see G. Garbrecht and J. Peleg, 'Die Wasserversörgung geschichtlicher Wüstenfestungen am Jordantal.' *Antike Welt* 20.2 (1989) 2-20. On the technology of Roman siphons in general, see A. T. Hodge, *Roman Aqueducts and Water Supply*. London: Duckworth, 1992, pp. 147-160.

37 Vitruvius 8.6.1; see now Hodge (above, n. 36) 347-348, and *passim*.

38 There are Dhushara images at several of the cistens around Ḥumayma, and a large Dhushara block adjacent to the stairs giving access to the pool formed by the dam south of the city; Oleson (above, n. 27) FIG. 4. On the religious overtones of water-supply systems in the ancient Near East, see J. P. Oleson, 'Water Works.' *Anchor Bible Dictionary* 6 (1992) 883-893.



12. Reservoir at end of aqueduct, Ḥumayma (Photo: W. and E. Myers).

the founder, may have intended this reservoir, like the more conventional cisterns in the settlement centre below, to serve as an impetus to sedentarization. In its original state, the reservoir channeled overflow water into a covered conduit that carried it towards the settlement centre, possibly to fill smaller private cisterns, or more likely to serve small orchards and vegetable gardens south of the settlement. Unfortunately, this section has now been completely lost.

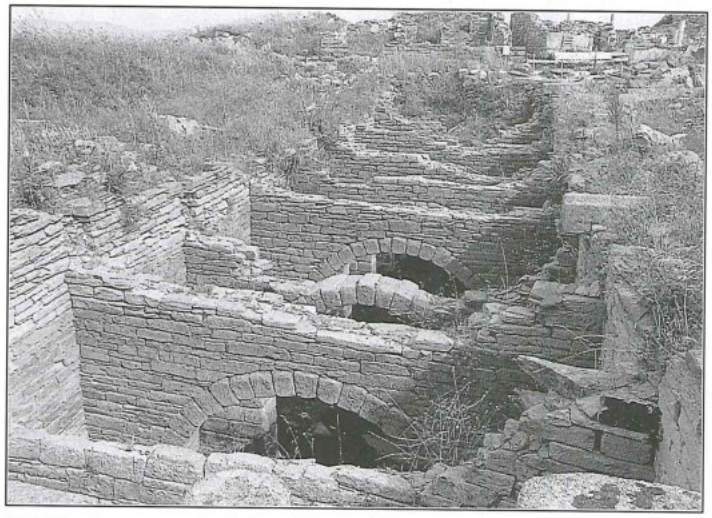
Although Nabataean reservoirs such as the one at Ḥumayma can hold significant amounts of water, Nabataean engineers did not have the means to roof them.[39] The water in the Ḥumayma reservoir was constantly renewed by the flow of the aqueduct, but dead-end reservoirs in this region, fed only occasionally by runoff, must have involved significant problems. In the absence of a roof, evaporation would have claimed up to four metres of water every year, and exposure to the sun would have fostered the proliferation of plant and animal life that rapidly spoiled the quality of the water. In addition, pollutants are more easily introduced into un-roofed cisterns, and animals and people can fall in. It may be that large, unroofed, dead-end reservoirs were used only to water animals, or that the water was carried by porters to

[39] For other early reservoirs, see the citations in Oleson and Eadie (above, n. 18) 61.

fill domestic tanks and cisterns soon after it was captured.[40] The typical Nabataean arrangement for long-term storage of still water was very different. The bottle-shaped cistern cut into bedrock, mentioned above in the passage by Diodorus, was in use in Edom by the Iron Age, and it was part of the secret of the early Nabataean success in taming the desert.[41] Such cisterns were relatively easy to plan and excavate, but they had the important drawback that they had to be located where suitable bedrock was available in conjunction with an appropriate runoff field. Since Nabataean stonemasons were producing beautifully trimmed ashlar blocks for the construction of substantial buildings from at least the second century BC, cisterns obviously could have been built where they were needed using the same sort of blocks, and waterproofed with the same kind of plaster used for the rock-cut cisterns. Roofing, however, was the problem, particularly since the friable sandstone used for so much Nabataean architecture could not bridge any significant span and timber was unavailable. The solution ultimately adopted was to span the cistern with transverse arches, the squinches of which were levelled off with filler blocks to support roofing slabs (see FIG. 5). The use of this design allowed the construction of cisterns wherever the water they could contain was needed, and wherever the catchment area was most suitable, regardless of the local geology. King Aretas III, for example, was free to select as the site of Auara a location appropriate all at once for water harvesting, agriculture, housing construction, campground and land communications. The two public cisterns were built just to one side of the focus of a catchment of a size obviously more than sufficient to supply them, but at the same time not so large or so steep as to constitute a danger to nearby structures. The cisterns were roofed with 16 arches, carrying a roof of heavy stone slabs well chinked and sealed with mortar, so that people and goats could move around and over them without hazard to themselves or the precious water within.

This cistern design quickly became typical of virtually every Nabataean site, and the method of roofing was soon applied to the stone houses of which the newly sedentarized Nabataeans became so proud.[42] Cisterns and houses continued to be roofed in this manner throughout the area of the former Nabataean kingdom until the early Islamic period. The Nabataeans seem to have discovered through experiment that a span of six to seven metres was the maximum that could reliably be roofed by this method, and that depths greater than five or six metres were inconvenient, unnecessary, or structurally difficult.[43] As a result, cisterns that had to be large in capacity were built on a rectangular plan, seven metres wide and as long as necessary to provide the desired capacity. The design was applied to rock-cut cisterns as well. Cisterns beneath the private homes at Auara, in contrast, tended to be round, with a maximum diameter of five or six metres, and depth of around five metres (FIG. 6). The circular plan may represent the tradition of Iron Age bottle cisterns, but it is also more economical of material, easier to build and plaster, and more resistant to the compression of the surrounding soil than square or rectangular plans. All of these cisterns had relatively long, block-built intake channels incorporating a small, rectangular settling tank, usually with arch-supported roof. These tanks allowed at least some of the debris carried by the rapid runoff to settle out before the water spilled over into the main tank.

Unfortunately, because of the lack of excavation and problems in dating Nabataean ceramics, the chronology of the spread of this useful design is still not known. The ceramic evidence uncovered so far at Ḥumayma suggests strongly that the two public cisterns there were built at the time of the settlement's foundation in the 80s BC. The design, however, had appeared in exactly comparable form in the Hellenistic world by at least the third century BC. Such cisterns can be seen at arid, treeless sites such as Delos, where a particularly large one appears next to the theatre, although others can be found throughout the site (FIG. 13). The design of the cistern of the Nekromanteion at Ephyra is also similar. The same roof design also occurs in Hellenistic military and temple



13. Theatre reservoir, Delos (Photo: Oleson).

40 See Oleson (above, n. 38) for literary sources concerning these practices.

41 For bottle cisterns, see above, n. 14.

42 Strabo 16.4.26. A good example of a stone house of Strabo's period has been excavated at Petra: see R. A. Stucky *et al.*, 'Schweizer Ausgrabungen in es-Zantur, Petra.' *ADAJ* 34 (1990) 249-283. Although restored over a long period, the houses at Mampsis are Nabataean in origin: see Negev (above, n. 26) *passim*.

43 It is very difficult to date these cisterns, which generally remained in use for centuries. The statistics on dimensions are based on measurements taken by Oleson from cisterns associated with possibly Nabataean contexts in Jordan and southern Palestine.

architecture where rooms must be placed beneath a heavy paving, as in the Temple of Apollo at Claros.[44]

The question of the means by which this design was brought back to Nabataea, and spread throughout the small scattered settlements and the arid landscape around them is tantalizing. Alexander the Great's army is felt to have played some role in bringing back the knowledge of the arch and vault from Mesopotamia to Macedonia, and military engineers seem to have been involved in the further spread of the technology of vaulting.[45] From the late fourth century BC until the arrival of Pompey, the Nabataean kingdom bordered on Greek-ruled or Hellenized states on all but its east and southeast borders, and there is ample evidence for the activity of Greek armies in and around the kingdom during the appropriate period. Nabataean officers or engineers might well have learned the design from Greek allies, or from the inspection of abandoned or captured Greek outposts or settlements. Josephus describes the travels of Syllaios and other Nabataean officials around the Mediterranean (e.g. *AJ* bk. 16), and Nabataean officials (and soldiers) must have seen a number of Hellenistic capitals around the Aegean. In addition, Nabataean merchants were active on both the Red Sea and the Mediterranean by at least the first century BC. Inscriptions in Aramaic or in Aramaic and Greek set up by Nabataeans, or in Greek relating to Nabataeans, have been found in Egypt, at Sidon, Cos, Rhodes, Delos, Puteoli, Ostia and Rome.[46] The character of the sites where Nabataean inscriptions have been found suggests commercial interests. At Delos, for example, Nabataean merchants could have seen this type of cistern in operation and easily have comprehended the splendidly simple principles of the design and its appropriateness to conditions in the Nabataean lands. It is also possible, although ultimately probably impossible to document, that the Nabataeans noticed the roofing design in the context of military structures rather than cisterns, and brought it home to facilitate the construction of dwellings. In view of the remarkable similarity of design linking Nabataean and Hellenistic cisterns, however, and given the critical importance of water supply to Nabataean survival, it seems more likely that the cistern application was primary.

However the design for the arch-supported roof arrived, it must immediately have helped foster the growth of Nabataean settlements and the sedentarization of their culture. Once cisterns with stable roofs could be built wherever they were needed rather than cut in bed-rock, the Nabataeans were freed from their previous dependence on rocky outcroppings and the hazardous runoff fields associated with them. They could then settle sites such as Auara, arranging for runoff water supplies close to routes of travel and agricultural land. The built, arched roof was also applied to rock-cut cisterns, since it facilitated excavation and maintenance of the tanks, and concealment was not a major concern after sedentarization of the Nabataeans.

Although our research at Ḥumayma is still in progress, we can now discuss it as an excellent, well preserved and well documented example of all the aspects of Nabataean hydraulic technology. The archaeological research must now be supplemented by literary and ethnographic evidence in an attempt to reconstruct the patterns of water use and social context of distribution and consumption. The provision of both fresh and cistern water must have been a source of great satisfaction to the inhabitants of Auara and the neighbouring desert. They probably preferred to drink fresh spring water rather than cistern water whenever possible, but the procedures for arranging access and sharing of this portion of the water supply can no longer be documented directly. There must also have been some method of ensuring the equitable division of the runoff water in the public cisterns. The water in private cisterns then, as today, must have been private property. In a related matter, there must have been some social control over catchment fields.[47] Certainly the catchment field for the public cisterns at Ḥumayma seems to have been protected from extensive construction throughout Auara's history. There must also have been some method of social control over the appropriation of catchment fields for private cisterns. The water supplies in the settlement centre would have sustained the populace and the animals kept in the town, and would also have been used for washing, and for craft processes such as pottery production or fulling. Any excess, particularly overflow from the reservoir, may have been directed to the irrigation of small plots of vegetables or fruit trees in the immediate downhill vicinity of the settlement. This is the practice today near the springs.

The fields of wheat and barley, however, which probably spread out over thousands of hectares around Auara as they do today, were irrigated naturally by direct winter rainfall and, to a much greater extent, by run-off from adjacent slopes or the great wadis themselves, which brought down the water of the ash-Sharāh escarpment.

44 R. Vallois, *L'architecture hellénique et hellénistique à Délos*. Paris: de Boccard, 1966, pp. 264-279. For early Greek arches and vaults, see T. D. Boyd, 'The Arch and Vault in Greek Architecture.' *AJA* 82 (1978) 83-100; S. Miller, 'Macedonian Tombs: Their Architecture and Architectural Decoration.' Pp. 153-171 in B. Barr-Sharrar and E. Borza, *Macedonia and Greece in Late Classical and Early Hellenistic Times*. Washington D.C.: National Gallery, 1982; R. A. Tomlinson, 'The Architectural Context of the Macedonian Vaulted Tombs,' *Annual of the British School of Archaeology in Athens* 82 (1987) 305-312.

45 See references in note 44, esp. Tomlinson.

46 A summary of the location and publications of these inscriptions can be found in R. Wenning, *Die Nabatäer—Denkmäler und Geschichte*. Göttingen: Vandenhoeck und Ruprecht, 1987, pp. 22-25.

47 Compare the situation at Shivta, Y. Kedar, 'Ancient Agriculture at Shivta in the Negev,' *IEJ* 7 (1957) 178-189.

As today, farmers probably owned specific fields that they would plant in the winter after observing which had received sufficient moisture to nurture a crop.

On the whole, this arrangement must have lasted basically unchanged for as long as Auara did. Sometime during the Roman period, probably in the second or third centuries AD, a new reservoir was provided on the ridge, inside the protective walls of a new military camp. Although this reservoir diverted only part of the water brought by the aqueduct, it represents confiscation of the greater portion of the highest-quality source of water for the settlement. Such total reliance on aqueduct rather than runoff water is typically Roman, expressive of a confidence in complex, highly artificial systems of water management and in long-term political stability. This same self-confidence is represented by the provision of a bath building for Auara during the late Roman period, with the typical radiant heating in the floors and walls.[48] The stopcock installed in the Nabataean reservoir to replace the previously uncontrolled outflow, and the pipeline laid in the outflow conduit, are also typically Roman. Together with the enclosed castrum reservoir, they seem to represent both new applications of the water and new restrictions on its consumption. The replacement of an unrestricted overflow conduit with a locked, valved pipeline can be seen as a technological metaphor for the way in which Roman law, which had evolved to serve the needs of a developed, cosmopolitan empire, replaced the rigid but unwritten, informal laws of the desert tribes.[49] Here again we see outside influence on Nabataean hydrualic technology, but this time more vivid and easier to appreciate. Nevertheless, it was still essentially a veneer on a native, Nabataean system, as the ultimate history of the site shows.

We do not as yet know precisely when the aqueduct stopped bringing water to Auara, because the settlement proper probably could have survived on runoff sources alone. Umayyad potsherds do, however, appear in significant numbers around the Nabataean reservoir, and in the fill of the castrum reservoir, so one or both of these structures probably held water into the Islamic period; the aqueduct is the only method of filling them. In addition, a round cistern with domed roof in the settlement area may be an Umayyad construction. It is a testimony to the essential reliability of the indigenous runoff system that most of the ancient cisterns in the Auara catchment still fulfill their original purpose after only minimal renovation, while the aqueduct, and the reservoirs it served, are dry.

48 See Oleson (above, n. 18) 1990.

49 On Roman water administration, see W. Eck, 'Die Wasserversorgung im römischen Reich: Sozio-politische Bedingungen, Recht und Administration.' Pp. 49-102 in G. Garbrecht, ed., *Die Wasserversorgung antiker Städte.* Mainz: von Zabern, 1987. On tribal administration, see Wilkinson (above, n. 33); *idem*, 'Islamic Water Law with Special Reference to Oasis Settlement.' *Journal of Arid Environment* 1 (1978) 87-96; Trousset (above, n. 26).

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# La protection du site de Pétra à l'époque nabatéenne

A la différence de certains sites antiques qui ont été réoccupés de façon plus ou moins extensive à une époque récente, le site de Pétra n'a été que relativement peu affecté par la présence à l'époque moderne d'un petit groupe de bédouins qui n'ont d'ailleurs pas tenté de s'y implanter de façon irréversible. Mais si le site n'a que peu souffert de destructions dues à une quelconque réoccupation, il n'en a pas été de même en ce qui concerne sa préservation à l'égard des conditions naturelles et climatiques, au long des siècles qui ont suivi son abandon définitif. La ville de Pétra est en effet dominée par des massifs rocheux fortement érodés et entaillés par de nombreux wadis et anfractuosités par où se déversent les eaux pluviales qui ruissellent des sommets et qui s'écoulent ensuite dans les wadis de façon torrentielle. Car, contrairement à une image encore fréquemment répandue[1], Pétra ne se trouve pas dans une zone désertique, mais dans un secteur dont la pluviosité annuelle est d'environ 200-250 mm, où les précipitations hivernales sont particulièrement abondantes et se caractérisent par des pluies souvent violentes, ainsi que de fréquentes chutes de neige, notamment sur le Jibāl ash-Sharāh, au nord de Pétra. Aux premiers temps de l'occupation du site, soit essentiellement à la période édomite, des petits groupes installés sur les hauteurs, telles que celle d'Umm al-Biyāra, pouvaient s'accommoder de ces données topographiques particulières, d'autant qu'ils pouvaient s'y aménager des refuges inexpugnables. Mais à l'époque nabatéenne, où l'ensemble du site a progressivement été occupé, ces mêmes données constituaient une difficulté majeure car elles représentaient une menace sérieuse pour les aménagements situés en contrebas des hauteurs ou en aval des wadis. Aussi les Nabatéens, pour assurer le développement de leur capitale, ont-ils dû fermer la majeure partie de ces wadis au moyen de barrages construits en aval, qui jouaient le rôle de mur de retenue en hiver. En amont de ces barrages, les eaux de ruissellement s'accumulaient et, au moyen de canalisations, pouvaient également contribuer à l'approvisionnement de la ville. Ces dispositifs devaient être très nombreux à l'origine, mais un grand nombre s'étant effondrés, il n'en subsiste fréquemment que les fondations et un amoncellement de pierres en contrebas[2].

Il est à remarquer cependant que beaucoup, parmi les dispositifs les plus essentiels quand à la préservation du site et des monuments, continuent à jouer un rôle de protection relativement efficace.

Le plus important de ces aménagements disparus, que nous présenterons un peu plus loin, était situé à l'entrée du Sīq, qu'il protégeait des eaux du Wādī Mūsā tout en facilitant l'accès au centre de Pétra. Après l'abandon de la ville, ce barrage qui n'était plus entretenu a presque été entièrement arasé, peut-être aussi par suite du remploi de certains blocs à une date inconnue, ce qui a permis aux crues du Wādī Mūsā de traverser le Sīq et le bassin de Pétra en y causant de nombreux dommages, et en érodant notamment le niveau inférieur de plusieurs tombeaux. Un barrage a été construit récemment au même endroit, mais son aménagement est très différent de l'ancien puisqu'il ferme seulement l'entrée du Sīq. Plusieurs études ont été consacrées à la restitution du plan original du barrage antique qui barrait le lit du Wādī Mūsā, tout en permettant aux eaux de ce dernier de gagner le tunnel de dérivation construit à une quinzaine de mètres en aval[3].

D'autres barrages, moins importants mais également très significatifs, ont été particulièrement bien conservés, permettant ainsi d'en effectuer une étude exhaustive. Ces barrages sont construits au moyen de blocs en grand appareil, revêtus d'enduit et assemblés à l'aide de mortier,

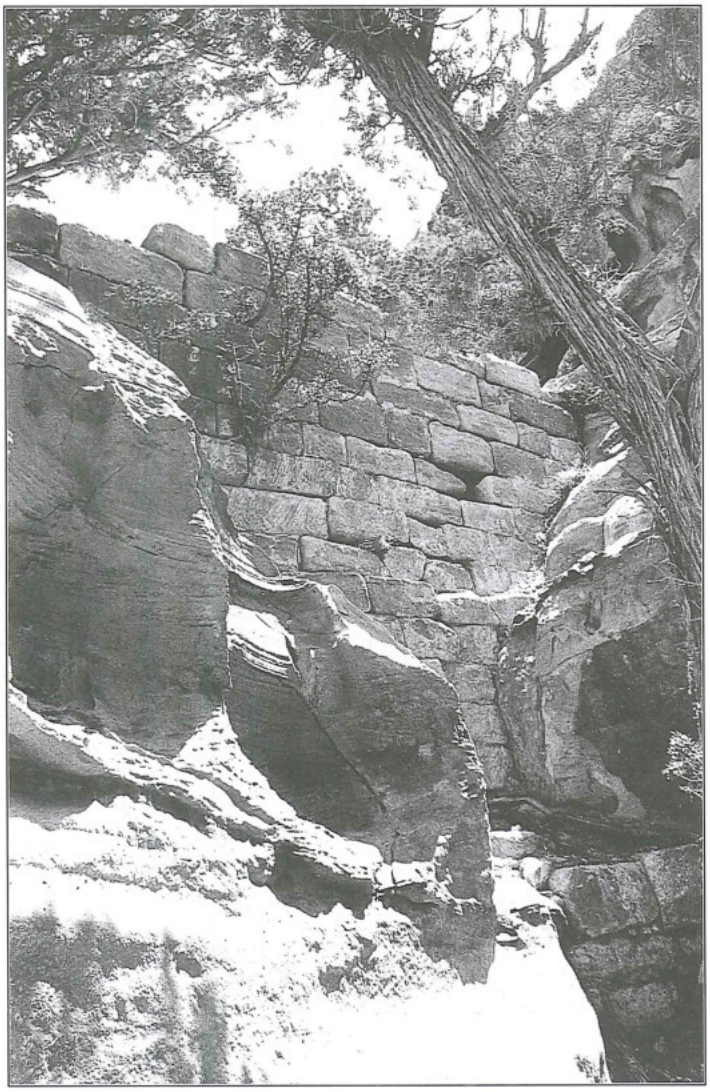
[1] Voir notamment le titre d'un article paru dans une revue de vulgarisation: "Pétra, une ville de légende au coeur du désert de la Jordanie", *Archeologia* 2 (1965) pp. 44-57.

[2] L'ensemble de ces aménagements a été présenté par Z. Al-Muheisen dans *L'alimentation en eau de Pétra*. Thèse de Doctorat de 3e cycle, Paris I-Sorbonne, (1983) et dans *Techniques hydrauliques dans le Sud de la Jordanie, en particulier à l'époque nabatéenne*. Thèse de Doctorat, Paris I - Sorbonne, (1986), (publication prévue).

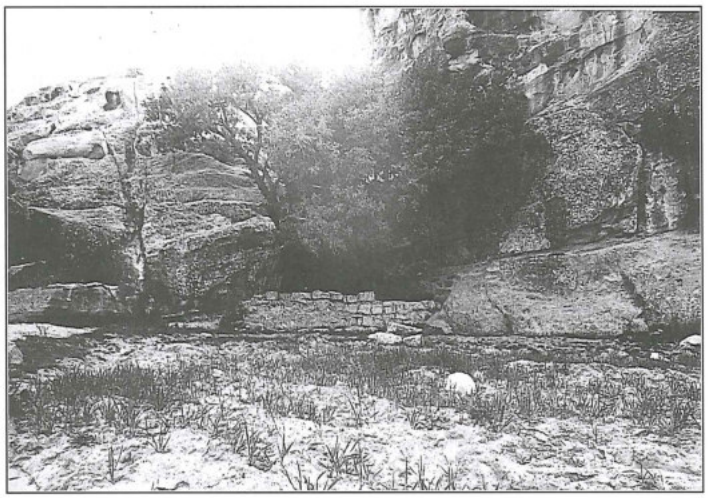
[3] W. Bachmann, Petra, in Th. Wiegand, *Wissenschaftliche Veröffentlichunqen der Deutsche - Türkischen Denkmalschutz-Kommandos*. Heft 3 (1921), pp. 4-7, FIG. 4.

et parfois de cailloux pour caler les pierres. La construction témoigne parfois d'un soin particulier avec notamment l'utilisation d'un appareil à bossage. Dans certains cas, particulièrement dans les secteurs situés un peu à l'écart, le travail peut être plus simple quoique aussi résistant. Les barrages aménagés au creux des wadis épousent la forme de ces derniers et affectent donc très fréquemment la forme d'un V, un ou plusieurs blocs, selon le profil de la vallée, servant de base (FIG. 1). Mais l'on rencontre aussi des barrages-murs de forme rectangulaire. Ces ouvrages sont constitués de plusieurs séries de pierres, trois le plus souvent, permettant d'atteindre communément une épaisseur de plus d'un mètre (FIG. 2). De chaque côté, le rocher était entaillé assurant ainsi une meilleure assise du mur et accroissant ainsi la résistance du barrage à la pression des eaux (FIG. 3). Dans certains cas, ce dernier servait également de bassin de retenue, d'où partait une canalisation destinée à l'alimentation de citernes aménagées en contrebas. Dans ce domaine, l'exemple le plus remarquable est sans doute celui du barrage qui surplombe un wadi situé à droite de la Khaznah. Ce barrage, d'un travail très soigné, protégeait le secteur d'al-Jarra, tout en contribuant à son approvisionnement en eau. En effet, au niveau inférieur était ménagée une ouverture rectangulaire, profonde de 0,50 m au fond de laquelle se trouve un orifice circulaire destiné à l'écoulement de l'eau retenue en amont. Ce dispositif est d'ailleurs comparable à ceux que l'on reconnaît au bas des citernes situées dans le Wādī Farasa Est et dans le centre ville, ainsi qu'en contrebas du canal rupestre dans le Sīq. Dans d'autres cas, ces barrages jouaient également le rôle d'aqueducs permettant aux canaux de franchir les wadis. Ce type d'aménagement se reconnaît à plusieurs reprises pour le canal rupestre venant du secteur de Wādī Mūsā.

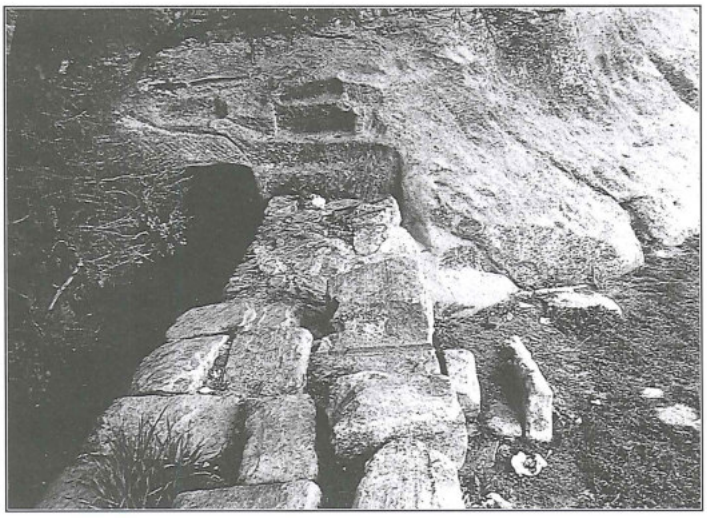
On peut ajouter à la catégorie des barrages, les murs qui traversaient des wadis beaucoup plus larges, alin non seulement de retenir les eaux, mais aussi de créer des terrasses à des fins horticoles et agricoles.



1. Barrage de protection dans la région du Dayr.



2. Barrage-mur fermant la gorge d'al-Kharrūbah.

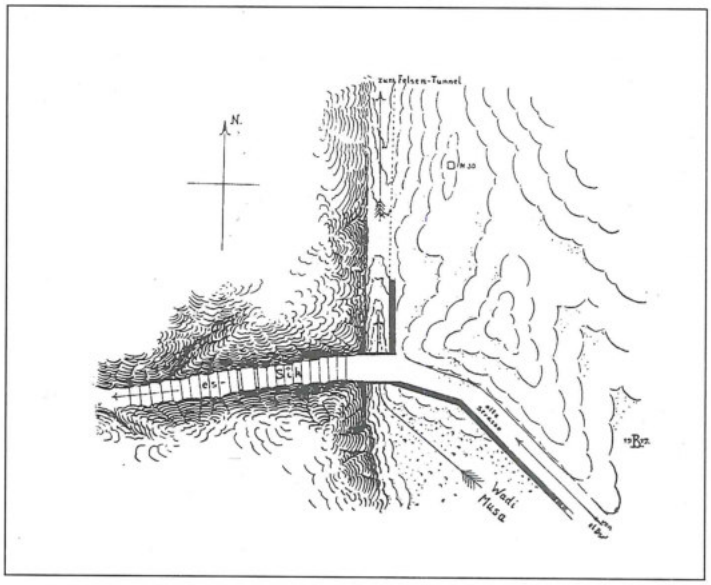


3. Détail du même barrage.

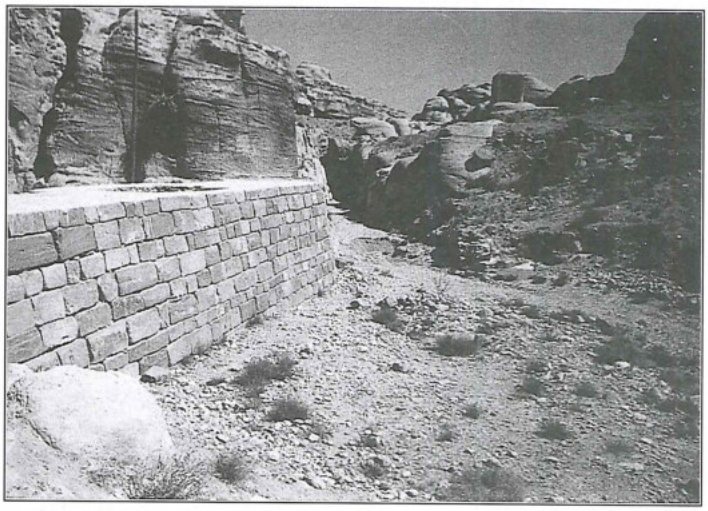
## Le Wādī Mūsā et le barrage du Sīq

Ce wadi, qui traverse le site de Pétra, collecte l'ensemble des précipitations provenant de la région située au Sud-Est de la ville et connaît donc de ce fait des crues extrêmement importantes en hiver souvent imprévisibles, puisque les eaux peuvent provenir de secteurs situés à plusieurs dizaines de kilomètres en amont. A partir de Ramlah, soit à l'entrée de Pétra, le lit du wadi suit une direction Est-Ouest, puis fait un brusque détour vers le Nord, en direction de Bāb as-Sīq. A l'origine, il reprenait très vite la direction de l'Ouest en s'engouffrant dans la gorge du Sīq. A la période nabatéenne, ce phénomène, même s'il n'était que de courte durée, représentait un grave danger car le Sīq constituait également une des principales voies d'accès au centre de la ville. C'est pourquoi les Nabatéens ont dû construire un barrage à l'entrée du Sīq, ainsi qu'un tunnel de dérivation un peu plus au Nord, long de 88 m pour une largeur et une hauteur de 6 m, ce qui indique d'ailleurs de manière significative l'ampleur que peuvent atteindre les crues. Ce tunnel débouche dans le Wādī Muẓlim que le cours du Wādī Mūsā suit jusqu'au défilé du Sadd al-Ma'jin, où il s'infléchit vers l'Ouest pour rejoindre le Wādī al-Maṭaḥa, grâce auquel il parvient au centre de la ville à la hauteur du Nymphée. Il continue sa route en longeant le Cardo avant de pénétrer dans le Wādī aṣ-Ṣiyyagh, qui achemine ses eaux en direction de l'ouest vers la dépression du Wādī 'Arabah. Quand au barrage qui fermait l'entrée du Sīq, sa construction représente un fait majeur dans l'histoire de l'urbanisme de Pétra, car ses fonctions étaient nombreuses. Tout d'abord il protégeait le Sīq contre les brusques crues du Wādī Mūsā dont les eaux passaient en dessous du barrage, ce dernier affectant la forme d'un pont, ainsi que le montre clairement la restitution proposée par Bachmann (FIG. 4). D'autre part, ce barrage communiquait, en la prolongeant, avec l'ancienne route d'accès à Pétra qui passait à un niveau supérieur au lit du Wādī Mūsā, pour d'évidentes raisons de sécurité, puisque les pluies tombées à des dizaines de kilomètres en amont peuvent transformer ce wadi, généralement à sec, en un torrent dévastateur. La date de cet aménagement pose cependant quelques problèmes, étant donné que le barrage cachait des stèles commémoratives datées du Ier siècle de notre ère[4], ce qui semble indiquer que la date de construction du barrage, tel qu'on l'a reconnu, serait relativement tardive, soit au plus tôt la deuxième moitié du premier siècle de notre ère[5]. Toutefois il paraît certain, contrairement à l'opinion exprimée par Peter Parr[6], que cet aménagement a dû être précédé par un dispositif plus modeste, peut-être assez semblable à celui que l'on a mis en place récemment pour des raisons de sécurité (FIG. 5).

L'aménagement de la Khaznah, que, malgré certaines controverses, la plupart des études récentes qui lui ont été consacrées, s'accordent à dater de la fin du premier siècle avant J.-C., ou du début du premier siècle après[7], mais aussi la présence de nombreux tombeaux, stèles et




4. Restitution du barrage antique à l'entrée du Sīq d'après Bachmann.



5. Barrage moderne (au premier plan) et tunnel antique de dérivation (au fond).

[4] J. Starcky, Nouvelles stèles à Pétra, *ADAJ* 10 (1965), pp. 43-49, pls. XXI-XXII.

[5] P.J. Parr, La date du barrage du Siq à Pétra, *RB* 74 (1965), pp. 45-49, pls. 1-111.

[6] Ce dernier écrit "il parait impossible de ne pas conclure qu'avant 50 de l'ère chrétienne, au plus tôt, il n'y avait à l'entrée du Sīq aucun ouvrage d'art, et que jusqu'à ce moment-là tant les eaux du wadi que le chemin (saisonnier et discontinu) pour Pétra empruntaient dans cette direction la route naturelle qui suit cette fissure" (*op. cit.* pp. 48-49). Cette affirmation conduit le même auteur à conclure que la Khaznah pourrait donc être plus tardive, puisque, dit-il justement, "il n'est pas probable qu'un tombeau de cette importance ait existé si près du lit du wadi à une époque où celui-ci était sujet à des crues...", (*op. cit.* p. 49).

[7] Sur la date de la Khaznah, voir J. Starcky, Pétra et la Nabatène, *Supplément au Dictionnaire de la Bible*. Vll, (1966), Cols. 969-971 et Pétra, conservatoire de l'art alexandrin, *Le Monde de la Bible* 8 (1979), pp. 19-21.

graffiti taillés dans les parois du Sīq ne semblent guère imaginables sans une quelconque protection de cette voie de passage et de son débouché sur le centre de la ville avant la fin du premier siècle de notre ère. En outre, étant donné le soin qu'ont eu les Nabatéens de fermer même les wadis les plus secondaires, et si l'on tient compte de la qualité technique de l'ensemble des barrages et aqueducs, aménagements qui, pour une grande partie, doivent être considérés comme bien antérieurs à la date proposée du barrage du Sīq, il est difficile de croire qu'un de leurs premiers soucis n'ait pas été justement d'établir en priorité un dispositif de sécurité à cet endroit.

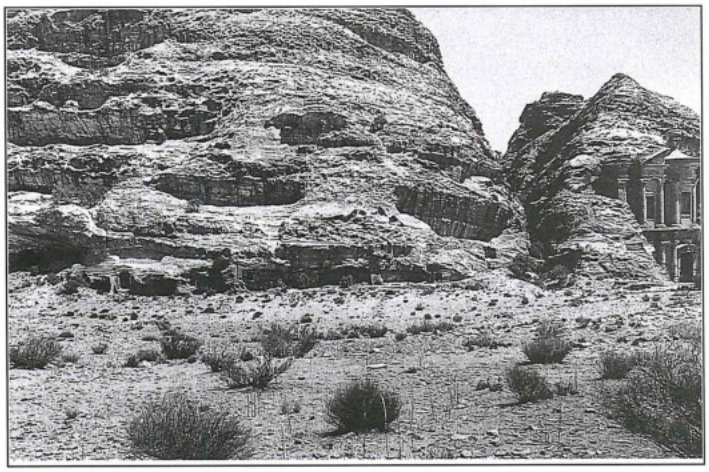
**La région du Dayr**[8]

Cette hauteur qui borde au Nord-Ouest le centre de Pétra, est surtout connue grâce au célèbre monument rupestre aménagé sur son sommet, mais elle comprend également de nombreuses installations rupestres ainsi que des vestiges d'habitats construits. Là aussi se posait donc le problème de l'approvisionnement en eau, en l'absence de toute source, si l'on excepte celle plutôt médiocre du Qaṭṭār ad-Dayr située en contrebas du plateau sommital, ainsi que celui, tout aussi essentiel, de la préservation de ce secteur. A cet égard le dispositif le plus significatif se trouve au sud du plateau, où l'on reconnaît à une dizaine de mètres au nord du Dayr, une vallée débouchant de l'est. Cette vallée était fermée en aval par un barrage, toujours en place actuellement, d'une longueur de 3 m pour une hauteur de 2,50 m et une épaisseur de 0,80 m (FIGS. 6 et 7). En amont de ce mur de retenue partait une canalisation rupestre aménagée sur le côté droit de la vallée afin de dévier les eaux qui s'y écoulaient en hiver, selon une direction nord-ouest. Ce canal, long d'une quarantaine de mètres, possède une longueur et une profondeur tout à fait exceptionnelles, soit respectivement 1 m et 1,50 m au début de son parcours, ce qui est une bonne indication du volume et de la hauteur des eaux qui s'accumulaient derrière ce barrage et qu'il importait donc d'évacuer rapidement. Il alimentait tout d'abord une première citerne creusée dans la paroi de droite de la vallée et affectant la forme d'une jarre. Cette citerne possédait deux ouvertures: une de forme circulaire dans sa partie supérieure et une autre rectangulaire donnant sur le côté longeant le canal. Ses dimensions exactes sont difficiles à préciser car il est impossible d'y accéder mais on peut les estimer à 6 mètres pour le diamètre et à 5 mètres pour la hauteur.

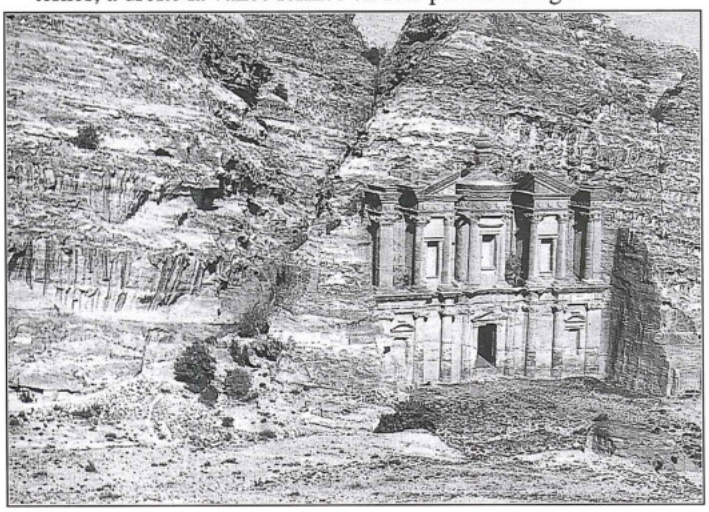
Le canal alimentait ensuite quatre autres citernes, celles-ci en forme de salles rupestres aménagées à un niveau inférieur par rapport au canal qui pouvait ainsi s'y déverser directement. La capacité de l'ensemble de ces citernes peut être évaluée à environ 150 mètres cubes mais il faut tenir compte que ces citernes étaient régulièrement approvisionnées durant l'hiver et que le véritable stockage ne concernait que la période de sécheresse, soit les mois de mai à novembre.

**Protection des bâtiments et des aménagements rupestres**

Si grâce à l'ensemble des travaux évoqués plus haut la sécurité du site pouvait être assurée, il n'en demeurait pas moins la question tout aussi essentielle de la protection et de la préservation des aménagements, non plus seulement contre les risques de crues mais aussi contre les phénomènes de ruissellements, les eaux s'écoulant alors directement des hauteurs en surplomb et éventuellement, selon l'emplacement, contre l'érosion due à l'action du vent. Tous les ouvrages traitant de Pétra ont insisté sur la diversité ainsi que l'effet esthétique des grès colorés qui constituent l'ensemble du site. Cependant ces roches, extrêmement friables, sont particu-



6. Vue de la vallée au nord du Dayr: Au centre de la photo les citernes, à droite la vallée fermée en aval par un barrage.



7. Vue rapprochée de la même vallée.

[8] Les aménagements hydrauliques du Dayir ont été signalés et décrits par Z. Al-Muheisen dans un travail de recherche de maîtrise (Paris 1 -Sorbonne 1980), et dans *L'alimentation en eau de Pétra*. Thèse de Doctorat, (1983). (voir *supra* note 2).

lièrement sensibles à l'érosion, ce qui explique la détérioration de nombre de façades et d'intérieurs rupestres, même en l'absence de toute destruction et de vandalisme.

Que les Nabatéens aient été conscients de ce problème, nous en avons pour preuve différents vestiges qui permettent de définir la solution qui lui avait été trouvée.

Ainsi, lorsque l'on considère la façade du Qaṣr al-Bint, le grand temple de Pétra, on reconnaît la présence de stucs décorés le long des parois intérieures et extérieures[9]. Ce type de décor, que l'on retrouve également dans d'autres temples nabatéens, notamment ceux de Ramm[10] et de Dharīḥ[11], avait bien évidemment une fonction essentiellement décorative, puisque les stucs architecturaux du Qaṣr représentaient notamment des portiques à pilastres, ainsi que des rinceaux et des bustes. Mais l'on est en droit de penser que pour certains de ces bâtiments, surtout pour ceux construits avec des blocs de grès comme le Qaṣr, un souci de protection n'était pas complètement absent. Il en est de même pour les maisons et triclinia rupestres dont les façades, ainsi que les parois intérieures, étaient revêtues d'enduit peint, de façon à donner l'illusion de maisons construites en pierre de taille[12]. Ceci pourrait d'ailleurs expliquer en partie l'affirmation rapportée par Strabon selon laquelle les Nabatéens vivaient dans de somptueuses maisons de pierre[13]. Enfin, et ce dernier fait est peut-être encore plus significatif, de nombreuses traces d'enduit ont été relevées sur les tombeaux et chambres funéraires par G. Horsfield tout d'abord[14], puis par une expédition conduite en 1959 par P.J. Parr, avec la participation de l'alpiniste himalayen J. Brown, au cours de laquelle des échantillons d'enduit provenant de la tombe Br. 67 ont pu être collectés[15]. Cet enduit de couleur brun rouge, donc assez proche de la teinte du rocher qu'il recouvrait, était composé d'un mélange comprenant deux tiers de sable de quartz et un tiers de calcaire réduit en poudre. Ce mélange résistant était appliqué sur la façade, puis recouvert d'une mince couche colorée posée comme un badigeon[16]. La conclusion de Peter Parr, en référence à d'autres exemples de ce genre cités par Horsfield, est que cet enduit, notamment dans le cas des tombeaux comme le No 67 servait à cacher le grès et donc à modifier l'aspect des façades qui, toujours selon cet auteur, devait être bien différent de celui qu'on leur connaît aujourd'hui[17]. Cette explication, particulièrement valable pour des monuments tels que le Qaṣr, ainsi que pour les maisons rupestres, ne semble pas prendre en considération que l'enduit brun-rouge appliqué sur les parois extérieures des tombes, étant de la même teinte que le rocher qu'il recouvrait, ne pouvait guère jouer ici un quelconque rôle esthétique. Il est donc plus vraisemblable de supposer que l'utilisation de cet enduit dans ce dernier cas ne correspondait qu'à des fins de protection contre les érosions pluviale et éolienne, puisque les façades des tombeaux, aménagés le long des parois qui bordent les wadis, se détachaient en relief de ces parois et ne bénéficiaient pas, à l'inverse de la Khaznah, de la protection du coffrage de la roche d'origine enserrant de tous côtés la fragile façade du tombeau. Nous avons donc ici un indice sûr qu'une partie au moins des façades étaient protégées, grâce à cet enduit, contre les dommages de l'érosion.

D'après les éléments que nous avons présenté ci-dessus, il semble donc hors de doute que les Nabatéens, qui résidaient déjà depuis plusieurs siècles sur le site quand les monuments les plus importants ont été élaborés, et avaient donc le recul nécessaire pour évaluer les dommages provoqués par les différents types d'érosion, connaissaient parfaitement les risques encourus par leurs aménagements, tant rupestres que maçonnés, et qu'ils ont donc cherché, selon les moyens et les techniques dont ils disposaient, à en assurer la préservation. Une réévaluation de ces solutions semble donc particulièrement utile à l'heure où les spécialistes chargés de la conservation du site se trouvent confrontés à ces mêmes difficultés.

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9 H. Kohl, *Qasr Firaun in Petra*. Berlin (1910).

10 R. Savignac et G. Horsfield, Le temple de Ramm, *RB* 44 (1935), pp. 251 et 278.

11 F. Villeneuve et Z. Al-Muheisen, Fouilles à Khirbet edh-Dharih (Jordanie) 1984-1987: Un village, son sanctuaire et sa nécropole aux époques nabatéenne et romaine (Ier - IVe siècles ap. J.-C.), *CRAI* (1988), pp. 458-479.

12 D. Tarrier, *Les triclinia nabatéens dans la perspective des installations de banquet au Proche-Orient.* Thèse de doctorat, Paris 1 Sorbonne, (1988), (publication prévue), pp. 55-59.

13 Strabon, *Géographie*, XVI, 4, 26.

14 G. et A. Horsfield, Sela-Petra, The Rock of Edom, *QDAP* 7 (1938), pp. 1 -42.

15 P. J. Parr, The Investigation of some Inaccessible Rock-Cut Chambers at Petra, *PEQ* 100 (1986), pp. 5-15, pls. I-VI.

16 *Ibid.* p. 14, note 41

17 *Ibid.* p 15.

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# The Technology of the Hydrological System at Abila of the Decapolis

A Jordanian city of 8000 to 10,000 population like Abila in the Roman-Byzantine periods needed an adequate water supply as an essential element in its infrastructure. The ancient Near East and Rome had already developed an intricate set of hydrological systems which Abila could take advantage of.

This paper will study the following aspects of the ancient hydrological systems, particularly that of Abila of the Decapolis: a brief survey of the earlier development of a variety of ancient Near Eastern and Roman water systems; an analysis of how these systems were established and developed at Abila; a study of how these Abila hydrological systems were financed and controlled, based on analogy from Rome and other cities in the Roman Empire; and an analysis of how the water of hydrological systems, such as the systems of Abila, was tested and kept chemically pure.

## Survey of Earlier Ancient Near Eastern and Roman Water Systems

Forbes adequately outlines the development of early water systems in the Near East, Greece and Rome, observing that in the Upper Palaeolithic and Mesolithic periods, European and Near Eastern food-gathering peoples camped near springs or on the banks of rivers and used them directly as water sources to meet their basic needs, exampled by the Jerusalem Gihon Spring, wells in the Arabian wadis and hand-dug wells found in a number of places (Forbes 1964: 149). Finding where good water sources were located was one of the arts of ancient times. Vitruvius, the Roman engineer, gives the following instructions as to how to find water: "observe the nature of the ground, and the water vapors rising from it; analyze the types of soil; observe the types of vegetation growing in it (bulrushes, willow, alder, etc.); bury bronze or lead vessels for a short period to detect any drops of water remaining on them; and seek water in mountains where the rains fall" (Vitruvius 1962: VIII, Ch. 1 and 2). The very ancient wells were hand-dug (cf. 2 *Chron.* 26:10) and lined with stone, brick or wood, as in the Indus Valley and Mesopotamia; such wells in many cases were quite wide and deep, as in Egypt where they were as deep as 85 m; the well at Lachish was 76 m deep. Water from these wells was often hand-drawn (Forbes 1964: 150, 151).

The ancients also used cisterns for the storage of water; compare *Jer.* 2:13, and *Isa.* 36:16, and also the catchment system for collection of rain water at Capitolias, near Irbid, and the catchment territory around Ḥumayma, ancient Auara, in southern Jordan (Oleson 1990: 292). As needs increased, the ancients began to see the need of bringing water from a distance by gravity flow. Thus, they developed the open duct or conduit system (rock, terracotta, and timber trunk types), often covered with slabs to protect the water from pollution (Forbes 1964: 152, 153). But also very early the ancients began to use earthenware or stone pipes, especially where they wanted to carry smaller quantities of water and to use it for drains, including the use of metal pipes (of copper) (as at Abūṣīr, Egypt), as well as pipes of bronze and lead (as used by the Greeks and Romans). Especially in hilly Palestine and Syria the mining technique of drilling within the rock to expose water sources was adapted for the finding and channeling of water. In this case cities drilled tunnels within their fortifications to the spring source; cf. the *sinnor*, or water tunnel and stairs technique, which consisted of stairs leading down a shaft to a tunnel which led to the spring outside the city (for example, the *sinnor* at the City of David in Jerusalem, 2 *Sam.* 5:8). The water tunnels at Gezer, Megiddo, Hazor, Lachish and Gibeon are good examples of early water tunnel installations in Palestine, which began to appear in the Late Bronze and Iron I Ages. At Jerusalem such a tunnel was Hezekiah's Tunnel from the Iron II, period which brought water from the Gihon Spring to the pool of Siloam (2 *Kings* 20:20; 2 *Chron.* 32:30) and also in a modified way, the earlier irrigation channel which ran down the west side of the Kidron Valley floor, "the gently flowing waters of Shiloah" (*Isa.* 8:6) (Mare 1988: 104-107).

Another related system was the ancient "*qanat*" used

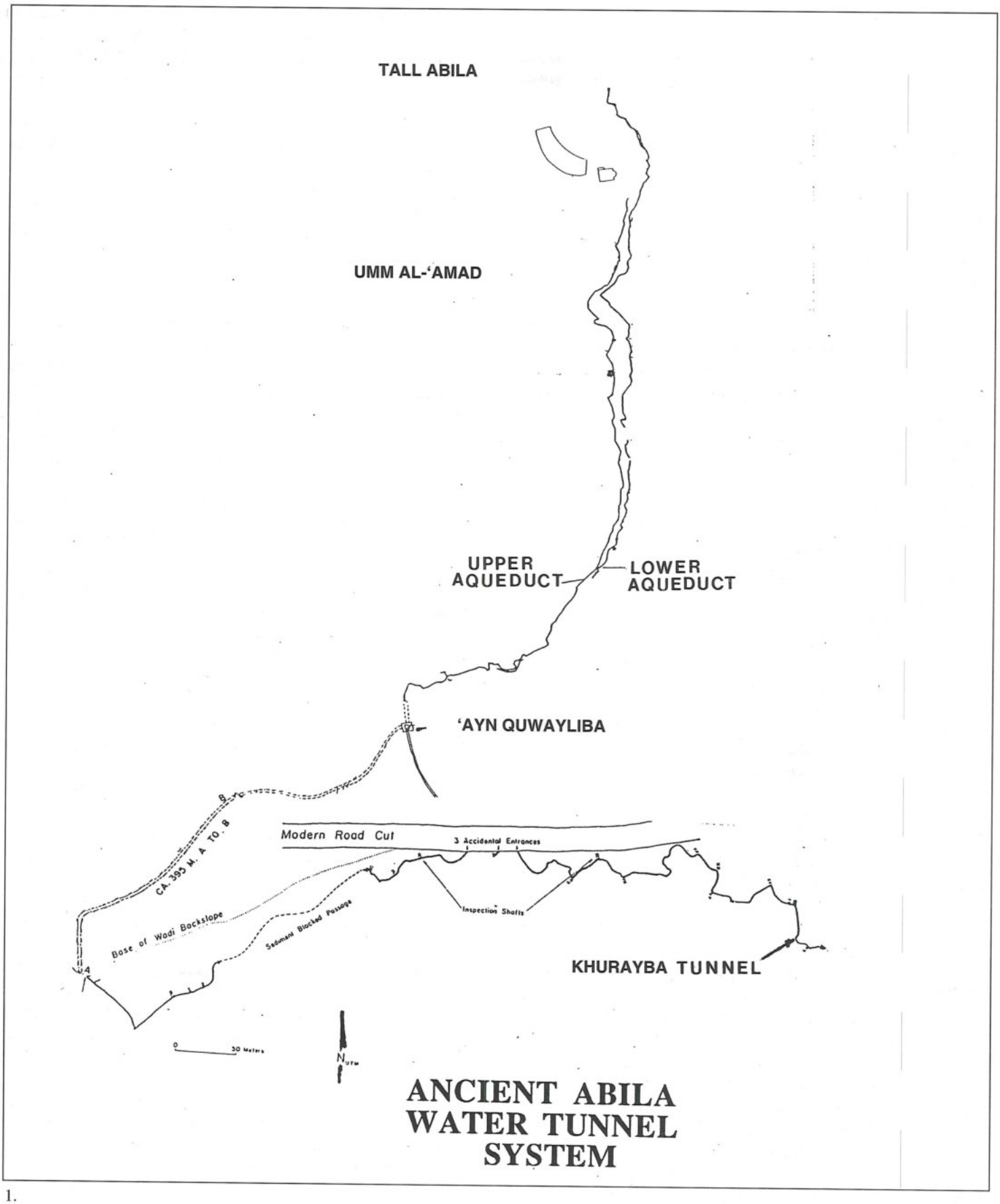
in ancient Mesopotamia, Persia and ancient Arabia; the *qanat* technique which originated in Armenia, consisted of "tapping water from the foothill [including the use of the tunnel] to transport it to distant fields by gravity flow," (Forbes 1964: 156-158). The *qanat* technique, widely employed in antiquity, included the use of vertical air shafts (or inspection shafts, called putei by Vitruvius 1962: VIII, VI, 3: 182), spaced at regular intervals, a procedure reminiscent of old mining techniques. The classical Greek water tunnels, although not *qanats* in the strictest sense, also used air-inspection shafts (Forbes 1964: 158). Vitruvius (1962: VIII, VI, 3) comments about this: "If there are hills between the city and the fountain head, we must proceed as follows. Tunnels are to be dug underground and leveled to the fall already described. If the formation of the earth is of tufa or stone, the channel may be cut in its own bed; but if it is of soil or sand, the bed and the walls with the vaulting are to be constructed in the tunnel through which the water is to be brought. Air shafts (*putei*) are to be at the distance of one actus (36 m) apart." In a real sense these water tunnels in essence were the same as the Graeco-Roman aqueducts.

In the first large water supply system used in Nineveh, for the royal palace and for the irrigation of the surrounding fields, Sennacherib, Sargon's son (703 BC) built a dam (weir) across the Khosr River, north of Nineveh, dug a channel (canal) through the "high and low grounds," and brought the waters "across the plain (around) Nineveh and made them flow through the orchards in irrigation ditches"; in addition, to some 18 water courses here, "to arrest the flow of these waters (he) made a swamp and set out a cane-brake within it" (Forbes 1964: 160; Campbell Thompson and Hutchinson 1929: 130-132). Sennacherib also constructed a canal from Bavian to the Khosr River which crossed several small streams and valleys by arched aqueducts, such as at Jarwān (Forbes 1964: 162, 163; Jacobsen and Lloyd 1935: 6-18). In ancient Greece a number of water systems were used, aqueducts such as the Athens *qanat* type aqueduct, with air shafts in the tunnel about every 15 m (which brought water from Mount Pentelicus), and that of Samos, an installation consisting of a stone supported straight-line pipeline with vertical air shafts, 1100 m long bringing water from a copious spring through a hill to the city of Samos. The Greek tyrants and others, especially in Asia Minor, (also Hellenistic kings from Sicily and southern Italy), at an early period, employing a modified example of this system, used the siphon principle, as was the case at Pergamum in the time of Eumenes II. Here the water was brought by gravity flow over 360 m from a mountain spring east of the city to two settling tanks at Hagios Georgios; then with pressure flow by means of two siphons (which ran through 30 cm holes in perforated stone slabs 1.20-1.50 m long, 61-69 cm wide and 20-25 cm thick), which were spaced on their edges c. every 1.20 m, the water was carried through two valleys (over 177 m and 195 m), over a ridge (over 235 m) to Pergamum (over 332 m). What the siphons were made of, and how they solved the problems of the siphon we do not know, but we do know that at least earthenware pipes (possibly installed in Roman times) were used for the distribution of water from the city reservoir (Forbes 1964: 163-165).

Although Roman aqueducts are generally thought of as consisting of spans of aqueduct arches which transversed many valleys in Spain, France, Italy and the Roman Campagna, the fact is that the greater extent of Roman aqueducts ran underground, providing for the city an abundance of water for households, baths, fountains, public governmental and commercial installations, sewer flushing, other hygienic needs, *naumachia* (water battles or shows), and sometimes providing water for field irrigation (especially in areas where rainfall was not sufficient to meet the need of dry farming). It is to be observed that in the Near East water-lifting equipment, such as the water wheel, also began to be used (Forbes 1964: 166, 172). Rome, in the later Republic and in the Empire, was well known for its aqueduct installations which brought water long distances from the south, east and north of the city. The nine well-known aqueducts at Rome are listed and discussed by the Roman Water Commissioner, Sextus Julius Frontinus, as follows: Appia, Old Anio (*Anio Vetus*), Marcia, Tepula, Julia, Virgo, Alsietina (also called *Augusta*), Claudia and New Anio (*Anio Novus*) (Frontinus 1962: Book 1, 5-22, pp. 339-365; Forbes 1964: 166-168).

## How Hydrological Systems Were Developed at Abila of the Decapolis

Roman-Byzantine Abila no doubt used a number of the features from the various ancient hydrological systems of the Near East, Greece and Rome, although basic archaeological evidence is not extensive. As was true in the case of the average ancient Mediterranean and Near Eastern city, Abila was blessed with adequate water sources, including 'Ayn Quwayliba located at the south end of Umm al-'Amad, a class A spring producing a mean average of 7.7 liters per second (according to the Hydrology Division of the Jordanian Natural Resources Authority 1966 study; Fuller 1985: 37). Besides this copious spring, auxiliary water supplies included 'Ayn Khurayba, located to the south of Abila, and no doubt an underground spring located within the heart of the hill to the south of 'Ayn Quwayliba, which the ancient Roman and Byzantine engineers tapped into when they constructed the Khurayba Aqueduct (Fuller 1983: 23) (FIG. 1). A further water source may have come from springs west and southwest of Abila, evidence for which is an air


TALL ABILA
UMM AL-'AMAD
UPPER AQUEDUCT
LOWER AQUEDUCT
'AYN QUWAYLIBA
Modern Road Cut
3 Accidental Entrances
CA. 395 M. A TO B
Base of Wadi Backslope
Sediment Blocked Passage
Inspection Shafts
KHURAYBA TUNNEL
0
30 Meters
N UTM
ANCIENT ABILA
WATER TUNNEL
SYSTEM

1.

shaft (*puteus)* located about 1.5 km west of the site (Fuller 1985: 57-58). Compare the ancient underground aqueduct with *putei* and accompanying rock-cut stairs found in the recent archaeological survey activity at the acropolis of Umm Qays, ancient Gadara (Weber 1991: 224-229, and FIG. 1), located several Roman miles west of Abila. All these water supplies would have adequately provided for the 8000 to 10,000 persons living in Roman-Byzantine Abila (Mare 1992: 309-313). In addition, rain water must have been collected on roof tops of public and private buildings to help fill the many cisterns; cf. at Abila the cistern next to and north of the Umm al-'Amad Area D seventh century AD basilica, and the Tall Abila Area A Byzantine plastered water channel which carried water toward the Area A sixth century AD basilica there, presumably to a cistern on the north side of the basilica; this Area A surface water channel must have received rain water collected from the roofs of public buildings located on the acropolis of Tall Abila.

With the adequate spring sources at and around Abila, the ancients then devised a means of bringing water from these sources to the necessary installations in the city (cf. FIG. 1). There were two periods when hydrological systems at Abila were planned and developed: 1) the Iron/Persian/Hellenistic periods when the Lower Umm al-'Amad (south *tall*) Underground Aqueduct was dug and used (and then later repaired/reused in the Roman period). It truncated several small pre-Roman tombs, evidence that it was constructed and used earlier in Early Roman or Hellenistic times, or even in the Iron Age/Persian Period (Fuller 1985: 56). This aqueduct ran north from 'Ayn Quwayliba under the east ledge of Umm al-'Amad toward the central civic center in the saddle depression in the middle of Abila; and 2) in the Roman-Byzantine periods when two underground aqueducts were dug: the Upper Umm al-'Amad Underground Aqueduct which also ran north under the east ledge of Umm al-'Amad, but 1 to 3 m higher than the Lower Aqueduct (Fuller 1985: 39) (both of these Umm al-'Amad Aqueducts ran north-south c. 1400 m — Fuller 1985: 56) and the Khurayba Underground Aqueduct which ran in a winding course 2.5 km through the hill south of 'Ayn Quwayliba. In the case of Umm Qays/Gadara, the hydrological system there is estimated to date back into the Roman imperial times, and possibly as far back as into the Hellenistic era (Weber 1991: 227).

The earlier Iron Age/Persian/Hellenistic Lower Umm al-'Amad Underground Aqueduct has parallels in several Late Bronze-Iron I and II aqueducts in Palestine. These aqueducts consisted of shafts dug within the fortified city, with steps leading down to a horizontal underground tunnel extending out to a spring water source outside the city walls: examples are found at Gezer, Megiddo, Hazor and Gibeon (Gibeon's shaft may have first been used as a cistern and later dug down to a level where a tunnel was then dug extending out to the spring source). One prime example, of course, is found at Jerusalem, which, over the course of time in the Late Bronze and Iron Age periods had three hydrological systems: 1) the earlier Warren's Shaft system of the time of the Jebusites and David (2 *Sam.* 5:6-8); 2) the Siloam Channel, used at least by the time of King Ahaz (735-715 BC, "the gently flowing waters of Shiloah" (*Isa.* 8:6; Mare 1988: 106); and 3) Hezekiah's (715-686 BC) Tunnel (Mare 1988: 100-107; cf. Cole 1980: 8-29; Shiloh 1981a: 169-170; 1981b: 24-39) which carried water from the Gihon Spring outside the city to the Pool of Siloam inside the city (2 *Kings* 20:20).

Although a deep shaft like the Palestinian examples has not yet been found in Abila's central saddle depression area which could be identified with the Abila Iron Age/Persian/Hellenistic Lower Umm al-'Amad Aqueduct which extended south to the 'Ayn Quwayliba spring outside the city, the numerous deep well shafts in this tunnel (Fuller 1985: 38, FIG. 1) cut down some 3 to 4 m to the horizontal tunnel floor, suggest that there may well have been such a deep central shaft within the city which connected with this tunnel leading to the water source. The course of the Lower Aqueduct was sinuous, which may have been accidental because of the lack of precise sighting engineering instruments or because of the lack of light in the dark tunnel which made precise excavation difficult (no lamp niches were found in this tunnel (Fuller 1985: 56.); or purposeful, in some cases, to avoid geological faults. As the Lower Umm al-'Amad Aqueduct aged through use and time, officials in the Roman period repaired the structure by coating the walls of the tunnel with a gray lime mortar to cut down on leakage and thus increase water volume; also at a later time, to increase its water flow, the Lower Aqueduct was increased in size by nearly doubling the depth of the tunnel, and widening it in its northern section. Possibly because of damage from earthquake activity in the Late Roman/Early Byzantine periods, a well constructed peaked roof section (the pottery in the construction mortar was Late Roman/Early Byzantine) was constructed near this tunnel's northern end, and a well engineered by-pass tunnel was also built (Fuller 1985: 56, 57).

The Abila hydrological system became much more complex in the Roman-Byzantine periods when the city reached a population of 8000 to 10,000 persons (Mare 1992: 311). Then the water systems dug included at least: 1) the Upper Umm al-'Amad Underground Aqueduct: 2) the Khurayba Underground Aqueduct to the south of Umm al-'Amad; 3) an inter-connecting underground aqueduct segment in the south Wādī Quwayliba, connecting these two aqueducts; and 4) possibly a fourth aqueduct segment 2 or 3 km to the west, southwest of

Abila.

In these Roman-Byzantine times a number of parallel aqueduct installations existed in Palestine, Transjordan and in the surrounding area, as well as many such structures in Rome and elsewhere in the Roman Empire (Forbes 1964: 166-168). A prime Palestinian example is to found in the system south of Jerusalem which supplied the city with water. This system consisted of underground and surface aqueduct segments, including a Low Level segment hewn in the rock (probably built by the Hasmoneans in the first and second centuries BC), and large stone pipe segments of an Upper Aqueduct (constructed by the Tenth Roman Legion in the second century AD), bringing water from c. 25 km (70 km of contours, developed for gradient purposes) from the Pools of Solomon near Hebron and from farther south, from the Kuwayziba Spring, and from the 'Arrūb Spring near Hebron (Josephus, *Jewish War*, II, 175; *Antiquities* XVIII, 60 also mentions an aqueduct built by Pontius Pilate) (Shanks 1984: 46-54). Another example is to be seen at Caesarea Maritima with its high aqueduct (built by Herod the Great and enlarged by Hadrian), extending 21 km to the south from the area of Mount Carmel on the north — half the length ran underground, and half on a series of arches; and Caesarea Maritima had an additional low level aqueduct, carrying water to the city from a river 7.2 km to the north (an aqueduct in use in the fifth century AD) (Bull 1982: 24-32). A further example is found at Antioch of Syria where two Hellenistic aqueducts were built, and two aqueducts constructed later in the time of Caligula (AD 37-41) and Trajan (AD 115) (Fuller 1983: 24). At ancient Auara (Avara), modern Ḥumayma in southern Jordan, an extensive hydrological system of surface aqueducts, channels and dams have been investigated, a system some 27 km long, extending from the springs in the hills to the north down to Auara itself; this Ḥumayma aqueduct system is called by Oleson (1986: 257), "...the most remarkable surviving example of Nabataean hydraulic technology so far reported anywhere. The main structures of this hydrological system were no doubt funded or sponsored by the Nabataean king, Aretas III (87-62 BC), and so this system dates to the Nabataean period, but its use extends into the Roman and into the Late Byzantine, and possibly into the Umayyad periods" (Oleson 1988:168; 1990: 306). At Qumrān a surface conduit brought water from the cliffs to a large retaining basin from which the water flowed into thirteen cisterns (Sanders 1973: 120). At the Herodium near Bethlehem, the complex hydrological system consisted of an aqueduct, bringing water 5.6 km from springs near Bethlehem to an elaborate pool with central pavilion; also a number of tunnels and cisterns were at the site (Netzer 1983: 41-42). Samaria had an elevated aqueduct which, with a gradient drop of 2.54 cm, crossed the low land area, paralleled the sea until the aqueduct delivered its water into collection basins for distribution to public baths, fountains and private dwellings; ceramic pipes brought fresh water from Samaria's domestic water box to the city's homes.

In northern Jordan examples include Gadara (Umm Qays) about which it is said that an aqueduct brought water 48.3 km from the east to the city. About the Gadara hydrological system, Weber (1991: 225) has recorded "25 plots with traces...[of the rock-cut aqueduct] between the eastern slope of the Gadarene acropolis hill...and Wadi ash-Shellaleh," a tunnel which ran "alongside the natural watershed of the northern 'Ajlun range." As noted above, the Gadara underground aqueduct ran in a somewhat sinuous route through the acropolis hill (with intermittent *putei* observable), finding its end "at the artificial basilica terrace...at the western slope of the acropolis hill." (Weber 1991: 228; compare FIG. 1). Weber (1991: 227) also notes that one distributor (*castellum*) had been known at an earlier time at nearby al-Qabū, but he could not ascertain if this irrigation system had drained into the main Gadara aqueduct. An additional northern Jordanian example is to be seen in Umm al-Jimāl, where water accumulated from a dammed area brought water for field irrigation, and the city's ground level aqueduct brought runoff water from the slopes on the north a number of kilometers south to the city where many branch channels brought the water into large open pools distributed throughout Umm al-Jimāl, and also to smaller roofed over cisterns located next to most every house and public structure.[1]

The technique of digging the Roman-Byzantine underground aqueducts at Abila can be described as follows. Once the water sources had been established, the Abila engineers determined the points where water needed to be brought and then laid out the courses they wanted the aqueducts to take and the gradient requirements necessary for an adequate gravity flow of the water. They recognized that a steady gradient needed to be maintained, and, as Forbes has indicated, in the Roman period there were a number of surveying instruments available to enable an accurate digging of tunnels and the maintaining of a proper gradient. The primitive instruments included the plumb bob; the *merchet* (sighting device), *libra aquaria* (simple water level); the *chorobates* (primitive plane table or field service level some 6 m long; the *dioptra* (a water horizon with sights mounted on a divided circle); the *groma* (or Grecian star, to trace 90 degree angles) and leveling rods. Forbes (1964: 171) comments, "Skillful work with these prim-

[1] Beebe 1975: 98-99 (Samaria). In the Jordan Valley between Jericho and Sablata remains have been found of an aqueduct built by Herod in which ceramic pipes carried water to Phasael's palace (Fuller 1983: 24; De Vries 1979: 52).

itive instruments would, however, enable them (the engineers) to maintain a gradient of 1:2000 very closely. Even accurate tunneling was possible with these instruments and only seldom do we hear complaint of careless and negligent work."

Having determined the course of the aqueduct to be dug, the engineers at Abila began their work by digging vertical shafts (*lumina, columnaria,* also called *putei* by Vitruvius [1962, VIII, VI, 3, p. 183; VIII, VI, 14, p. 191]; Forbes 1964: 171), with steps, at a c. 55 to 60 degree angle2 down to a depth of c. 3 to 4 m, to reach the desired level at which the underground aqueduct was to run. At Abila these shafts were spaced somewhere between 20 and 30 m apart.[3] Presumably the Roman engineers started their work by digging the Upper Umm al-'Amad Aqueduct, in order to add to the water volume brought through the earlier Iron/Persian/Hellenistic Umm al-'Amad Lower Aqueduct which, with age and use, had already had to be repaired (see above). To meet the expanding needs of the growing governmental, business, cultural and religious establishment of Abila, the Roman engineers, at about the same time and using the same techniques, dug the Khurayba Underground Aqueduct 2.5 km back into the hill south of 'Ayn Quwayliba to reach spring water deep within that hill (Fuller 1983: 23) — they may also have cut the Khurayba Aqueduct clear through the south hill to reach 'Ayn Khurayba. The engineers may have dug this Khurayba Aqueduct in a winding course to avoid serious geological faults, or it may be that the quantity of winding within the aqueduct evidences less careful work done by local contractors, after the more accurate initial work had been finished by the master engineer (Fuller 1983: 21). As in the case of the Upper Umm al-'Amad Aqueduct, in order to initiate standard tunnel digging procedures, and also to provide ventilation and additional light, and to avoid air lock, the engineers used a number of vertical air shafts (*putei*) to reach the level the horizontal tunnel was to run. To centralize the whole system of aqueducts further, and to obtain a better flow and volume of water, these engineers connected the Upper Umm al-'Amad Aqueduct (whose mean height and width are 1.76 and 0.78 m, respectively) on the north with the Khurayba Aqueduct (whose mean height and width are 1.44 and 0.73 m, respectively;[4] the mean height and width of the earlier Lower Umm al-'Amad Aqueduct are 2.38 and 0.88 m, respectively — Fuller 1985: 41) on the south by means of an additional and intermediate underground aqueduct, the South Wādī Quwayliba Underground Aqueduct; they accomplished this by running this latter aqueduct in a winding pattern from the exit of the Khurayba Aqueduct for c. 750 m northeast across the south Wādī Quwayliba valley (one can trace on the surface of the wadi floor the winding course of the South Wādī Quwayliba Underground Aqueduct, with its easily identifiable *putei*, until it emptied into the Upper Umm al-'Amad Underground Aqueduct at a point somewhere near the Upper Aqueduct's connection with 'Ayn Quwayliba.[5] We do not have any detailed information yet as to how the proposed additional fourth Underground Aqueduct (possible *putei* have been sighted at a point on the southwest edge of Umm al-'Amad, and also in the West Transect 15, 1.5 km west/southwest of Abila) fitted into the Umm al-'Amad-Khurayba system, but we assume that it would have somehow brought water from springs west/southwest of Abila to the central civic center of the city. It is possible that the Abila aqueduct system was somehow connected with the Gadara aqueduct running east to Wādī ash-Shallālah (Weber 1991: 225).

Air shafts (*putei*; many of their blocked entrances have been observed), referred to above, were needed: to check and help maintain a proper gradient for a proper flow of water from 'Ayn Quwayliba; to prevent air lock; to provide personal access to shafts cut into the tunnels (cf. the well shafts spaced at intervals in the Upper and Lower Umm al-'Amad Aqueducts, well shafts which exhibit rope rubbings in their sides); to obtain necessary access for periodic cleaning of the aqueduct (cf. the Abila inscription found on the wall of the Upper Umm al-'Amad Aqueduct not far from the 'Ayn Quwayliba spring head, indicating cleaning was done in AD 568);[6] to assure proper ventilation; and to provide access to water in times of siege. When the engineers had dug the *puteus* to the desired tunnel level, they began to dig from this level in both directions to the determined points where additional *putei* were, or had already been, dug.

To facilitate their digging, they carved out small lamp niches on either side of the tunnel walls, to give necessary light for the task and to identify that there was a proper oxygen supply in the tunnel. The quantity and

[2] This was the situation at the exit passage *puteus* in the Abila Khurayba Underground Tunnel (Fuller 1983: 21).

[3] From my own investigation in June, 1991. Fuller (1985: 41) calculates mean spacing putei for the three underground aqueducts as follows: Upper Umm al-'Amad, 31.2 m; Lower Umm al-'Amad, 25.7 m; and Khurayba, c. 50 m(?). Fuller (1983: 21) states that the Khurayba entrance passage *puteus* had steep stairs, 22 cm steep and 32 cm high, and indicates that the *puteus* passage at the base was 1.55 m wide, whereas at the entrance, which is blocked, it is 1.7 m to 2.0 m wide.

[4] The average height of the main Gadara aqueduct is c. 2.50 m, and its maximum width is c. 1.40 m (Weber 1991: 225).

[5] During my investigation in early June, 1991, two individuals trucking water from 'Ayn Quwayliba verified that water ran north (through the aqueduct) from the exit of the Khurayba Underground Aqueduct towards 'Ayn Quwayliba on the north edge of the wadi.

[6] Van Elderen 1989: 2-5. This painted inscription (located on the wall of the Upper Umm al-'Amad Aqueduct not far from the 'Ayn Quwayliba end), of which a considerable part has been preserved, can, in the main, be made out to read, "(At the time of.....) the most holy and most blessed bishop, the upper channel was cleared in the month(s) September (and) October, in the second indiction (and) the year 631," i.e. AD 568, according to the Era of Pompey, 64/63 BC, which was the era system used in the Decapolis, especially at Jarash (Welles 1938).

spacing of lamp niches in the aqueducts can be summarized as follows: for the Upper Umm al-'Amad Aqueduct the mean distance between lamp niches placed on the left (west wall, facing north) is 0.93 m and the mean distance between lamp niches on the right (east) wall is 1.29 m; for the Khurayba Aqueduct the mean distance between lamp niches on the left wall is 0.80 m, while on the right wall it is 1.38 m; no lamps niches have been found in the Lower Umm al-'Amad Aqueduct (Fuller 1985: 40; it is possible that in this earlier period they used torches).

The significance of numerous engineering inscriptions and graffiti found in the Upper Umm al-'Amad and Khurayba Aqueducts can be summarized as follows. In the Upper Umm al-'Amad Aqueduct there were painted or smeared on the walls seven Greek letters or combinations of Greek letters, consisting of four short inscriptions in the southern end of the Upper Aqueduct, possibly initials smeared on the walls by the tunnel maintenance crew, and three Greek "painted" letters consisting of single letters, and one inscription of three letters which were painted (red paint) on the ceiling; these may have indicated locations in the engineer's plan for the aqueduct. In addition four engineering graffiti were found, consisting of crude geometric shapes, an engineer's abbreviated notes.[7] In the Khurayba Aqueduct along the north wall of the *puteus* off the exit, were discovered two red painted Greek inscriptions: the Greek alphabet letters seem to indicate *Pi 25* (the upper inscription) and *Pi 9* (the lower inscription), which may well represent elevation-gradient markers and benchmark symbols; the finding of a painted arrow pointing down a short distance above the upper inscription supports this interpretation (Fuller 1983: 21). Also in the Khurayba Aqueduct on the northeast wall of an almost choked *puteus* exposed by the modern road-cut near and to the south of 'Ayn Quwayliba, another elevation-gradient marker was found, consisting of a Greek letter *Pi* painted in red on the wall, with a possible Greek *Theta* to the right of the *Pi*; both letters were painted above a horizontal line cut in the wall. The Greek *Pi* was surmounted by a small tear drop, possibly a Byzantine convention, similar to such a mark above a *Pi* on a painted Byzantine inscription in the Syria National Museum, Damascus (Fuller 1985: 57).

If we had been able to investigate the Abila hydrological installations as they existed in the first and second centuries AD, we would no doubt have found many of the devices, instruments, equipment and installations described by Sextus Julius Frontinus, Water Commissioner of Rome in the late first century AD (Frontinus 1962 Vol. II, VIII, pp. 132-193). Frontinus describes the step by step procedures and necessary equipment needed for a full fledged hydrological system to function completely and efficiently from water source to consumer. Forbes (1964: 172-177) summaries these features as follows. 1) From the water source (spring, river or dammed area) the water was directed to settling tanks (called *piscinae* and *castellae limonariae*) which usually had two compartments with sloping floors for better cleaning. Then, 2) the water was brought through a *specus* (a "real duct") often 15 m underground. These "real ducts"[8] were punctuated with 3) air shafts (called *luminae, columnariae*, or *putei*) every 36 to 45 m (at Abila the distance averaged 20 to 30 m), to prevent air lock and allow inspection and cleaning. Then, 4) the water then flowed to *castella* (water towers, which were only distribution tanks, and not like our modern water reservoirs, since they only had a small storage capacity).[9] Three mains 5) (the *specus*,[10] or water box) tapped water from near the bottom of the *castellum* to provide water for baths, fountains and domestic use[11] — the overflow from the two outer water boxes (which directed water to the baths and to domestic installations) flowed into the central box whose water went to the fountains. To the water boxes 6) were attached ajutage nozzles,[12] which included the bronze *calices* (the *calix* was the water meter) by which the *aquarii* (the water meter officials) charged the customers. And to the bronze calices 7) were attached individual private service pipes (*fistulae*), placed to deliver no more than 1 *quinaria* of water every c. 15 m.[13]

7 Fuller (1985: 46-50). There were also found fourteen crosses incised on the walls of the Upper Aqueduct, including the following varieties: 5 Greek crosses, with equal length of their horizontal and vertical beams (*crux quadrata*); 7 variants of the Greek cross, also with equal beams, but with bi- or tri-lobes, called also the "forked cross" (*crux fourchee)*; there was also one St. Andrews cross, one which is in the shape of an X (the *crux decussata*). Some religious significance can be adduced for these numerous crosses incised on the walls of the Upper Aqueduct, indicating the presence of Christian workmen, or some Christian symbolism for testimony, Christian ceremony, or theological statement (three crosses were found in one place together), or for some apotropaic purpose, etc. There were also found in the Upper Aqueduct three early Christian monograms in simple star designs, two of them similar to a six pointed star, possibly abbreviation for the Iota and Rho symbols for Jesus Christ (Fuller 1985: 50-56).

8 Forbes (1964: 172) says: "The area of the specus [the "real duct"] varied from 0.5 m. to 3.0 m., it consisted of a 50- 60 cm cement lining enclosed and carried by a mass of masonry."

9 Each aqueduct had a number of *castellae* (at Rome Aqueduct Appia had 20, *Anio Vetus* 92; the total *castellae* for all was 247).

10 "Though tapping from the *specus* or main was unlawful, the overflow from reservoirs, fountains and public baths (called 'lapsed water' or '*aqua caduca*') was often free though it was also used for swilling drains or for industrial purposes. The basement of the baths of Caracalla contained mills driven by this surplus. Apartment houses and other buildings had secondary reservoirs in which the water supplied was pumped by water wheels, force pumps and the like." (Forbes 1964: 173).

11 In provincial towns like Pompeii where the water was not so plentiful as at Rome, the officials frequently rationed or cut off water to private individuals during parts of the day to provide a sufficient amount for the baths and public buildings which formed the central part of city life.

12 At Ḥumayma there has been found in connection with one of the reservoirs a large, bronze stopcock valve which may have been similar to one of the ajutage nozzles described by Forbes. Cf. Oleson 1988: 162, 163; PL. XXX 1, 2.

13 "The *quinaria* was a measure not of volume but of capacity, i.e. as much water as would flow through a pipe one and one quarter digits in diameter, constantly discharging under pressure". (Frontinus 1962: I, 25, pp. 366-367). "A *quinaria* was about 5,000 or 6,000 United States gallons per twenty four hours, plus or minus 2,000 or 3,000 gallons, according to circumstances, favorable or unfavorable (Herschel)." (Frontinus 1962: I, 25, pp. 366-367, fn. 3).

Although the archaeological evidence at Abila has not yet provided the artifacts and installations corresponding to all the items that Frontinus and Forbes describe, yet we can assume that Abila, a Roman-Byzantine city under the overall government and direction of the Roman and Byzantine Empires, in addition to having the *putei*, underground aqueducts and Roman and Byzantine engineering symbols which were clearly found in its ruins, had also a number of other technical instruments and installations described by Frontinus. For example, we have found just to the east of the Abila Area C bath/nymphaeum, just north of the theater cavea and in the heart of the saddle depression city civic center, remains of a large vault (Mare 1990: 2, FIG. 1) where, on its south side, water channels coming from the direction of the Umm al-'Amad Underground Aqueducts emptied their contents into the vault; this may have been a distribution tank (*castellum*) or one of the water boxes through which distribution was made to the baths, to the fountains and to the domestic units, an installation similar to the type described by Frontinus and Forbes. Just as smaller equipment items described by Frontinus (such as the ajutage nozzles, and bronze calix water distribution and water meter installations) had difficulty in surviving in ancient Rome, the same would have been true of this kind of equipment at Abila. Interestingly near the vault just mentioned and next to it are remains of another vault which may likewise have fitted into this water system. Also we have found remains of a small covered water channel running north-south along the west side of the proposed Area C bath/nymphaeum ruins; and, in addition, on the south of the Area C ruins, near the front of the theater cavea we have uncovered small water channels running on either side of a north-south street which extends toward pavement stones found in the peripheral sector of Area C.[14] All these installations may have been part of the central water distribution system of Abila.

**How the Abila Hydrological Systems Were Financed and Controlled; Analogy from the Roman Model**

Fuller (1983: 24) has aptly commented on the importance of the Khurayba Tunnel:

> The significance of the water tunnel - aqueduct [the Khureibah tunnel] at Abila cannot be underestimated. It reflects something of the community's wealth and integration into the Roman Empire. The inferred date for its construction (Roman-Early Byzantine) corresponds to the period of major urban and suburban expansion at Abila. The growth in the urban center probably taxed the flow from Ain Quailibah and an alternate source had to be located. An interesting discovery during the survey of the West Transect is a number of choked shafts which greatly resemble the *puteus* shafts associated with the water tunnel discovered in 1982. We do not have positive evidence for an aqueduct coming from the West, but there are several enticing clues. All of this suggests that Abila was more than a simple farming village or a caravan stopover. It was an urban center with a significant population density, public buildings, and an aqueduct system.

Commenting on the additional evidence of the Umm al-'Amad Aqueducts, Fuller (1985: 57) remarks:

> The construction of the Upper and Lower [Umm al-'Amad] Aqueduct system was an expensive investment which allowed the urban population of Abila to transport a class A spring to the foot (and possibly beneath the base) of Tell Abila. This maximized their resources in terms of water and defensive elevation.

The question now arises how these expensive installations were financed and how they were financially maintained for large urban populations. In ancient Rome and other town installations there were a large number of consumers. Frontinus (1962: II, 78-87, pp. 407-417) divides the consumers at Rome into three large groups: 1) those who had received special grants from Caesar (*sub nomine Caesaris)*; 2) private parties; and 3) public uses or supplies (*usus publici*), which included water for camps (*ex eo castris*), public structures (*opera publica*), ornamental fountains (*munera*), and water basins or cisterns (*lacus*). Forbes summarizes Frontinus' categories and percentages as follows:

| | | |
|---|---|---|
| Special grants from Caesar (including baths) | | 17.1% |
| Private parties (houses and industries) | | 38.6% |
| Public uses or supplies: | | |
| 19 military barracks | 2.9% | |
| 95 official buildings | 24.1% | |
| 39 public buildings and theaters | 3.9% | |
| 591 cisterns fountains | 13.4% | 44.3% |
| | | 100.0% |

All these equipment items and installations for such a large population would have cost a great deal of money, and the system had to be regulated carefully to make the system efficient and financially viable. In Rome the entire hydrological system was under state supervision, and the state or town council purchased the land upon which the aqueduct was to be built (including a reserved strip of 12 Roman feet which was leased for pasture, or hay or for cutting brushwood). Often the purchase included portions that were not needed for the aqueduct; the excess was then sold. The aqueducts at first were financed by

[14] "R. Bullard [the Geologist] observes that the travertine accretions on the sides of the channel [on the east side of the street] gives good evidence of use over a long period of time." (Van Elderen 1990: 25-27).

tribute gained from captured countries, and then the cost was shifted to the *viri triumphales*, those Roman commanders who were successful in battle, and then finally the state and many provincial towns imposed a water tax upon the private citizens and businesses who received water piped to them from the main aqueduct. In addition, in places like Roman Syria the aqueducts were financed out of temple revenues, and also in numbers of cases public minded citizens gave aqueducts as beneficent gifts to their own towns.[15] To be sure, definite regulations and restrictions were needed on the use of water. Some of these restrictions were made by the decree of the Senate who permitted water to be drawn only from the reservoirs (*ex castello duci*) (Frontinus 1962: II, 106, p. 441). Frontinus (1962: II, 103, p. 435) gives further details on regulations, as he indicates that no one could draw water from the public supply without Caesar's authority, that is, without a license, and that no one was to draw more than had been allowed. To help him discharge his duties, the Water Commissioner had two lictors, three public servants (*servi publici*), an architect, and an administrative staff consisting of scribes (*scribae*), clerks (*librarii*), assistants (*accensi*), and criers (*praecones*) (Frontinus 1962: II, 100, pp. 429-431). Forbes further comments (1964: 169, 170):

> His [the Water Commissioner's) technical personnel consisted of *villici* (who attended to the pipes and orifices), *castellarii* (for the reservoirs), *circuitores* (line-inspectors), *silicarii* (pavers) and *tectores* (masons). Agrippa [Marcus Vipsanius Agrippa, to whom at an earlier period Caesar Augustus had entrusted the duties of the water supply of Rome] had used a band of 240 slaves of his own, whom he trained and left to the state at his death and Claudius had formed "Caesar's gang" of 460 men. These gangs were then combined and together with the specialists [already mentioned], further architects (*aquarii* [inspectors]) and free labor (hired occasionally), they formed the regular technical staff.

Abila, a city of the Roman Empire, no doubt also had to finance its hydrological system from similar public, religious and private sources, and had to depend on public decrees and public servants to administer its water system as efficiently as possible and to keep the system financially solvent.

## How the Water of Hydrological Systems Like Abila's was Tested and Kept Chemically Pure

Besides funding the system and taking care of the equipment as discussed above, there was also the testing and maintaining of the purity of the water carried in these hydrological installations, a detailed and costly process. Forbes talks about ancient concern for lead poisoning, which a number of the ancients, Hippocrates, Galen and Vitruvius, warned against when lead was used as lining for cisterns and pipes; but Forbes (1964: 177), however, argues that this problem was overly stressed, since "the manifold cases of rather intense incrustations of calcium carbonate on the interior of ancient lead pipes suggest that this complaint is grossly overrated." Vitruvius (1962: VIII, IV, p. 177) talks about testing for the purity of the water supply, and suggests that such testing should include sprinkling the water "over a vessel of Corinthian bronze [an alloy of gold-silver-copper]" (Forbes 1964: 177). Vitruvius also suggests that water be boiled in a copper vessel, be allowed to stand, and then poured off to see that there were no traces of sand or mud in the bottom of the copper vessel; another recipe was to test the water by boiling it with vegetables until they were cooked. Of course, he says that good water must not be contaminated with filth or with moss or reeds.

Numbers of ancient procedures were suggested for purifying water, such as exposing it to the sun or air (cf. our modern open reservoirs), boiling it, filtering it through porous pottery made of mixes of zeolite and clay, and filtering it through tufa, wool or wick siphons. Other prescriptions included desalination by percolation of sea water, percolation through sand, addition of salt (Vitruvius 1962: VIII, VI, 14, p. 193; cf. 2 *Kings* 2:21, 22.79) to counteract lime, addition of herbs for purification (cf. *Exodus* 15:25) or the cooking of water with a bag of barley or laurel or crushed coral, or the use of chalk from Rhodes or clay (*argilla*) from Italy, or mixing the water with wine (Forbes 1964: 178).

Whatever the processes used for testing or purifying the water supply at Abila, it was a constant problem and an item of public expense.

The analysis of the hydrological systems at Abila of the Decapolis has brought us to the conclusion that these water systems were large enough and sophisticated enough to meet the needs of the people living here in this Iron to Hellenistic Age city and also to meet the needs of the larger Roman-Byzantine Abila of 8000 to 10,000 people (Mare 1992: 313) as the city continued to grow culturally, industrially, agriculturally and religiously.

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[15] "At Rome the public could draw water freely without paying and even by the end of the first century A.D. the water-tax collected amounted to some 250,000 sesterces per year, hardly enough for the upkeep and repairs. Italian cities usually managed to pay for an excellent supply of clean water. Villages paid water-tax to a neighboring town for the use of a branch line." (C.I.L. IX. 5144) (Forbes 1964: 168).

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# Water Collection in a Dry Farming Society

The climate of Jordan can be divided into three main zones according to the topography of the land. The most western zone is the Ghawr or Jordan Valley depression where the weather is very hot in summer with usually little rainfall. The middle zone is the hilly region known ash-Shafa or Plateau which enjoys a pleasant Mediterranean climate and may receive during a cool wet winter (mid November - mid March) an annual rainfall varying between 200 and 700 mms. The eastern zone is the steppe or the Bādiya which lies east of the Ḥijāz Railway and is characterised by hot summers and cold winters with very little precipitation. The land has "four magnificent rifts or wadis that traverse it from east to west and cleave it into four divisions".[1] These are clearly outlined on the map reproduced herewith (FIG. 1), which also shows the major catchments as well as the Isohyets of estimated average rainfall for the period 1901-1930. Notwithstanding the four wadis, however, the topography of the land around them did not make it possible for people to cultivate more than a few fields that were suitable for irrigation.[2]

No wonder, therefore, that rainfall — the ultimate source of water — has been since time immemorial the most important element for the population living on the Jordanian plateau. The presence of wadis or rivers, as they seem to be during winter, was no guarantee against the shortage of water. This fact has been a basic element in the livelihood of Jordanians all throughout their history. The good management of their water resources, by necessity, has been a very important aspect of their lives. All throughout, the collection of water was a most essential part of their endeavours to raise crops from land that could be only cultivated for dry farming.

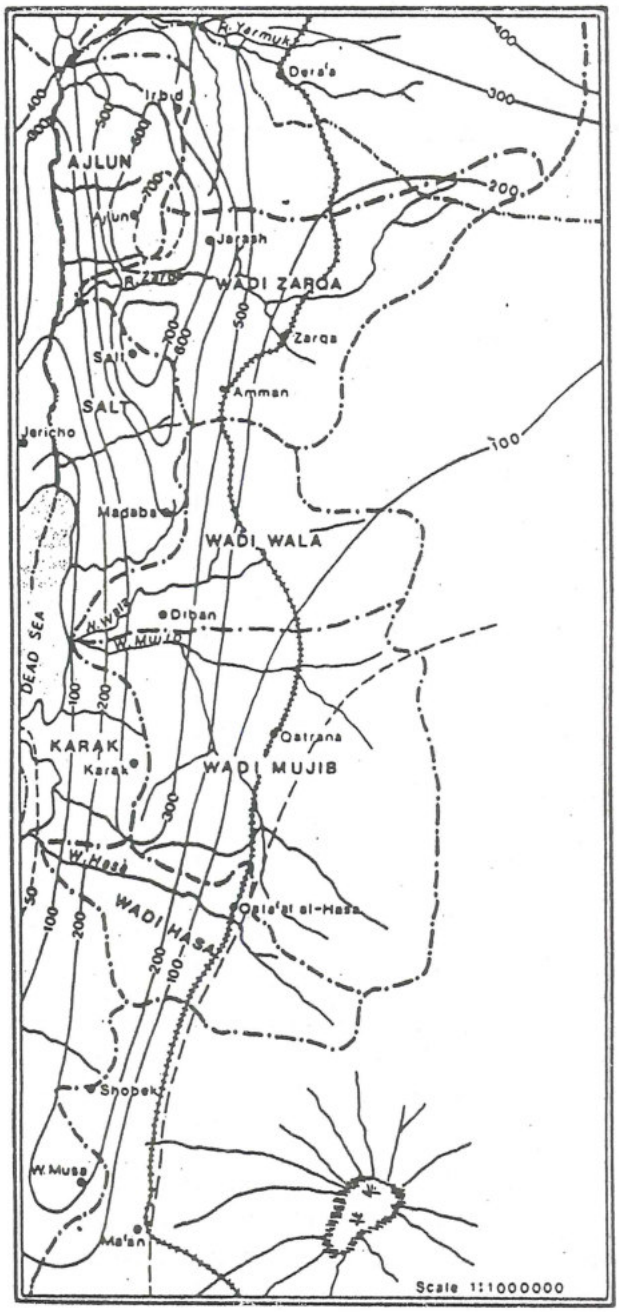
## Archaeological and Historical Background

Although the subject is basically a socio-economic study, it is of interest and benefit to present the findings of archaeologists in the Jordanian Plateau because they are of great importance with regard to water collection during the different historical periods. Naturally we have to be aware that as we go further back into the past and our knowledge becomes more scanty, we have to deal with bigger time units.[3] Therefore, the archaeologist may have to lump together the collected information and say that it illustrates a period of several centuries.

To start with, reference can be made to the Neolithic settlement at 'Ayn Ghazāl north of 'Ammān with an area far exceeding twelve hectares, making it the largest Neolithic (5700-5000 BC) village in the Near East.[4] The period before that, "The Mesolithic Period (14000-8000 B.C.) is considered as the time in which the first successful attempts were made by man to produce his food by primitive agriculture and probably also by breeding animals."[5] By the start of the Neolithic period (8000-4500 BC) some groups of people were capable of living in one spot such as the site near 'Ayn al-'Umayrī south of 'Ammān. During this period people were by no means numerous, but they had a much better chance of survival when they succeeded in growing their food and breeding animals on a larger scale. A water procurement policy had to be organised, however, so that both agriculture and animal husbandry could be maintained.

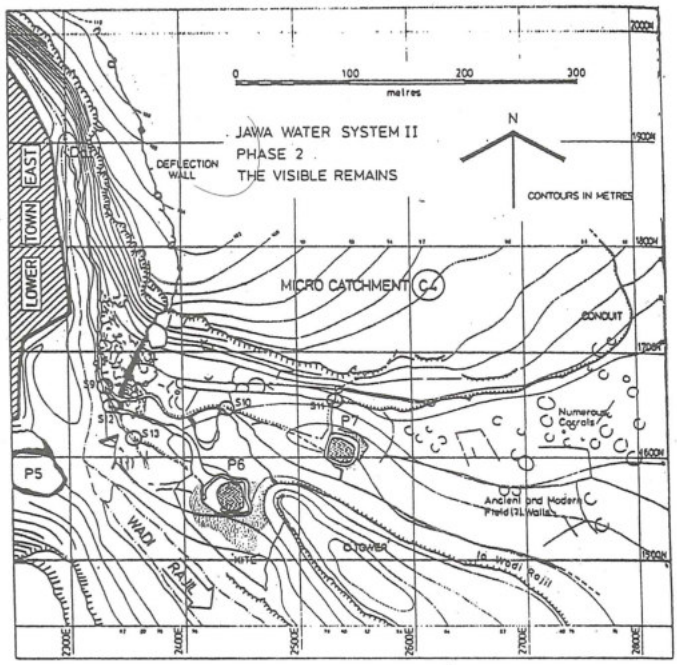
The following stage in human development was during the Chalcolithic period (4500-3000 BC), when villages must have been rather prosperous and apparently people did not feel the need to build walls around themselves for defensive purposes. There was still plenty of water, land and forests on the slopes which prevented erosion of the soil.[6] The Early Bronze Age (3000-2100 BC) witnessed the continuation of the development and progress which took place during the Chalcolithic. Implements made of copper were used on a larger scale,[7]

[1] Libby and Hoskins, *The Jordan Valley and Petra*, 1905, p. 32.
[2] R. S. Abujaber, *Pioneers over Jordan*, 1989, p. 8.
[3] L. Woolley, *Digging up the Past*, 1930, p.105.
[4] G. Rollefson and A. Simmons, Excavations at 'Ain Ghazal 1984, *ADAJ* 29 (1985), pp. 11-30.
[5] H. Franken, *Yadoudeh. The History of a Land*, 1979, p. 3.
[6] Franken, *Yadoudeh*, p. 4.
[7] G. Lankester Harding, *The Antiquities of Jordan*, 1990, p. 31




1. Map of Jordan showing the four main wadis and their catchments as well as the average rainfall in the years 1910-1930 (source: Abujaber, *Pioneers over Jordan*).

however, "the forests began to disappear and with it the erosion of the land started on a large scale. As a result permanent streams became seasonal wadis. Invasion of nomadic warriors who are often associated with the Amorites put an end to the cycle of habitation at 'Ain Emairi in the lands of Yadoudeh. As far as we know every town in Palestine and Jordan was destroyed and abandoned for centuries at about 2300 B.C."[8] Truly a vivid example of what happens when nomads, in large numbers, destroy the natural balance existing in a certain area between the number of people and their basic requirements of water and crops. A similar event took place during the eighteenth and early nineteenth centuries when waves of Bedouin tribes from Najd caused Jordanian farmers and villagers on the plateau to abandon the countryside and move westward.




2. The Jāwa water system (source: Helms, *Jawa*).

A unique example of water collection was the settlement at Jāwa (FIG. 2) in the black desert or Ḥarrat ar-Rājil in the northern part of the country, south of Jabal ad-Drūz. Built during the later part of the fourth millenium BC: "Its technical excellence of the support systems and the high level of the kind of science inherent in them, as well as the geographical location of the site, lead to the hypothesis that the people of Jawa came from a developed urban tradition. It is now understood that towns in the more arid regions relied on surface water resulting from winter rains which was collected and stored in man-made reservoirs or cisterns".[9]

The Iron Age (1200-550 BC) was the period when the three Jordanian kingdoms of Edom, Moab and Ammon flourished, and had wars amongst themselves as well as with the Israelites. Writing about this period, W. F. Albright dwelled on the importance of cistern construction and their lining with water-proof material. Although later excavations and studies have brought different views about the population composition in Palestine and Transjordan, it is still interesting to read what he wrote about water collection and the role it played in the life and de-

[8] Franken, *Yadoudeh*, p. 5.

[9] S. W. Helms, *Jawa, Lost City of the Black Desert*, 1981, p. 9.

velopment of the area: "Thanks to the rapid spread of the art, then recent, of constructing cisterns and lining them with waterproof lime plaster instead of the previously used limey marl or raw-lime plaster, the people were able to settle in any site where there was rain".[10] It was during the Iron Age, and probably around the year 890 BC that Mesha the King of Moab, ordered the royal and impressive inscription be carved on what has become to be known as the Moabite Stone (presently displayed at the Louvre Museum, Paris). Its special importance for this study is in the fact that Mesha, in his moment of victory, did not forget water collection and the vital role it played in his realm. He had recorded: "And I built Ball Meon and made therein the water pool (ditch). And there was no cistern in the wall in Korcha and I said to all the people, make for yourselves every man a cistern in his house and I dug the ditch for Korcha with the chosen men of Israel."[11]

Since good ideas, such as the one ordered by no less than King Mesha himself, are contagious, it is fair to assume that the construction of cisterns and wells spread out to Edom and Ammon as well. The great number of wells that we have in the Plateau is evidence that the construction of wells developed into an obsession which continued through the following Hellenistic, Roman and Byzantine periods. After all the Arab proverb says "Need is the mother of invention" and water was needed by everybody.

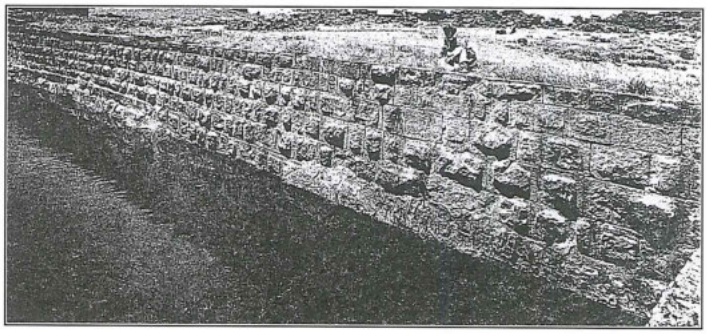
Writing about the kingdom and the land of the Nabataeans, Nelson Glueck stated that: "Long experience has taught us that wherever there are springs or wells of sweet water in this semiarid part of the world, human beings have invariably built permanent places of dwelling, political conditions permitting. In many instances, Nabatean settlements were established on top or by the side of earlier ones and in most instances they in turn were superseded by Byzantine ones."[12] This continuous chain of settlement on the land has been the common trend as far as the plateau was concerned. The Edomite rulers were followed by the Nabataeans who were followed by the Romans and the Byzantines and the Arabs. Dry Farming dictated living conditions by its need for a water supply near fields that were fit for cultivation with rain water. No wonder therefore that settlements were built in these areas on top or by the side of earlier ones. The ruins of old settlements had wells and pools as well as stones for building. This gave to new settlers an assurance that, with an average rainfall, a crop could be grown and harvested.

An outstanding example of Nabataean ability in the field of water collection is the town of Umm al-Jimāl at the edge of the desert.[13] Surveys have revealed that every house had at least one well and the population collected, during winter, all the rainwater they could in pools, as they did not have one single spring. They developed a network of water canals with which they channelled the rainwater to these large pools which were open to free use by the inhabitants (FIG. 3).

The Nabataean performance in the transfer of water from one place to another has been a special feature of their water policy. At as-Sādah, located about 15 kms south-southwest of Petra, Manfred Lindner described this performance in an article about the site: "Where no channel could be attached, due to a bend in the rock, two aqueduct arches were built. One of them is still standing. With its height of 5 metres, it is a noble monument of Nabatean enterprise in the middle of a now forlorn Valley of Southern Jordan. The building of temples, cisterns, caravan pathways, terrace walls and other communal projects allow us to draw conclusions about some kind of centrally organized building programme of aqueducts in Nabatea."[14]

The period of Hellenistic Roman influence started with Alexander's campaigns in 333 BC and came to end after the Muslim conquest of the land in AD 636. During this millennium, there were uprisings especially in neighbouring Palestine, but the general trend in Transjordan was one of relative stability. This was due to stronger government control especially "after Pompey restored around the year 64 B.C. all the Greek Cities which had been destroyed by the Jews, and laid the foundations for the commercial league known as the Decapolis. The general level of security and prosperity during the next few centuries was higher than it had ever been. During the second and third centuries, villages and towns sprang into being all over the country."[15]

Undoubtedly the stability in the countryside encouraged settlement all around and it seems that the large



3. Large pool at Umm al-Jimāl (source: Glueck, *Deities and Dolphins*).

[10] W. F. Albright, *The Archaeology of Palestine,* 1949, p. 113.

[11] W. Pakenham Walsh A.M., *The Moabite Stone*, 1873, p. 21.

[12] N. Glueck, *Deities and Dolphins,* 1966, p. 55.

[13] Harding, *The Antiquities of Jordan*, pp. 149-152.

[14] M. Lindner, Es-Sadeh, An Important Archaeological Site in Southern Jordan, in S. Kerner (ed.), *The Near East in Antiquity,* vol. 2, 1991, p. 104.

[15] Harding, *The Antiquities of Jordan*, pp. 49-51.

number of wells and cisterns in the old *khirab* or ruined villages, was constructed during this period. Writing in his *A Handbook for Travellers in Syria and Palestine*, J. L. Porter reported in 1958 about his visit to Ḥisbān. He stated that: "Below the city to the east are the remnants of water courses, and an enormous cistern or fishpond. The old wells are so numerous that we had to ride with great care to avoid them".[16] Another more recent survey was obtained during my work at al-Yādūda, an estate of nearly 22,000 dunums of good dry farming land, 10 km south of 'Ammān (FIG. 4). Elders there in 1965, confirmed that at the start of this century it had more than 300 used wells and cisterns in its domain. In addition there was a *birka* or large pool which, in good years, provided water for all the estate's animals, as well as those of the guests' passing flocks. Water was stored in the wells and it was not unusual to drink from them, during drought years, water that was three years old.[17]

However, there were many times during these one thousand years when the sedentary population had to push back the waves of nomads who attempted to encroach upon the settled regions. In years of drought or in times of weakness of the government, these nomads tried to move from the desert border zones into the plateau seeking pasture for their herds and flocks as well as water. The strength of the authorities determined the result of these attempts. If it was strong, they were forced back into the desert to meet more hardship until the rain came, or they were allowed to make use of the facilities in the settled areas after coming to terms with these authorities. The Romans and Byzantines realized the importance of protecting the sedentary population from the havoc that would befall them if the nomads had their way and entered the countryside by force. The Romans therefore developed an elaborate frontier fortification system when they created the Provincia Arabia after the annexation of Nabataea.[18] The Byzantines inherited the Limes Arabicus after AD 325 and continued to station their forces in the forts on the borderline, such as al-Lajjūn, which was most likely constructed during the reign of Diocletian (AD 284-305).[19] The system seems to have continued until Abbasid times. Khaṭṭ Shabīb in the Rās an-Naqab area could have been one of the devices executed by the authorities to regulate nomadic incursions into the settled plateau. The name probably refers to the Governor of Jordan Shabīb al-'Uqaylī at the time of the Ikhshidis just before the end of the tenth century. However, further excavations and studies will have to be made to ascertain the true background.

Water was no less important during the centuries that witnessed the rule of the Umayyads, Abbasids, Crusaders, Mamluks and Ottomans. However, the countryside seems to have been gradually depopulated which in turn lead to the neglect of the water collection system as a whole. This neglect explains why practically all the wells and reservoirs were filled by sand and dirt over the years. It is therefore not surprising that the conclusion derived from the survey held recently in the Ḥisbān area and supported by historical studies of such scholars as Hitti, Lewis, Seetzen, Burckhardt and Buckingham, is not very favourable to the Ottomans: "The 400 years of Ottoman rule was a time of very meagre settled population."[20] However, these water collection facilities of antiquity have been of great assistance to the settlers who started moving eastward during the second half of the nineteenth century. With these wells, *birak*, and reservoirs, the newcomers to al-Yādūda, the Banī Ṣakhr *khirab*, Mādabā and Saḥāb[21] in al-Balqā', could start a new life during these difficult times. Likewise the newcomers to Nu'ayma and other villages on the border of the Bādiya in the north, were able to consolidate their existence on the land with the help of these facilities. The same trend happened in the south at Ḥmūd, Smākiyya and the villages on the fringe of the arid lands although at a later stage. Since the extension of agriculture in the eastern part of the al-Karak district had to await the arrival of the Ottomans in force, some forty years later in 1894.

## The Pilgrimage Caravan

The Ottoman sultans were very attached to the privileges and responsibilities of their exalted posts as Caliphs of Islam and defenders of the two Holy Shrines. They did not spare money or effort to see that the Pilgrimage Caravan crossed all the way from Damascus to Makka and



4. Al-Yādūda from the northeast (photo: Abujaber, 1985).

[16] Published by J. Murray, London 1858.

[17] Abujaber, *Pioneers over Jordan*, p. 8.

[18] I. Shahid, *Rome and the Arabs*, 1984, p. 20.

[19] S. T. Parker, *Limes Arabicus Project,* 1985, p. 132.

[20] R. D. Ibach Jr., *Archaeological Survey of the Hesban Region*, 1987, p. 195.

[21] Abujaber, *Pioneers over Jordan.* Please refer to the five chapters about these villages.

al-Madīna and back without mishap. A strong escort was usually attached to the caravan and every precaution was taken to insure the comfort and safety of the pilgrims whose number sometimes exceeded thirty thousand. Therefore it is not surprising that the Ottomans gave a great deal of money and attention, whenever they could, to the water supply during that long and arduous journey over a period of two months. They constructed, in addition to forts, a good number of *birak* in practically all the caravan stations south of al-Muzayrīb, just north of the modern Jordanian border with Syria.

During the ten years of Egyptian presence in Syria between 1831 and 1841, Muhamad Ali Pasha and his son, the commander of the Syrian Expedition Ibrahim Pasha, did not lose any opportunity to improve the services during the caravans' journey. This was very important for them as it placated all Muslims and gave their regime in Syria a much better image than that achieved by the Ottomans. In 1835, a team of Egyptian engineers at the direct orders of the Pasha surveyed all the caravan stations and submitted a report under number (27) 1251 AH of their findings. They also recommended that measures be taken as follows:

*Ar-Ramtha*: The pool is half full of silt and must be cleaned. This can be effected in a few days by employing 200 labourers, so that repairs on the bottom can be carried out in preparation for the season.

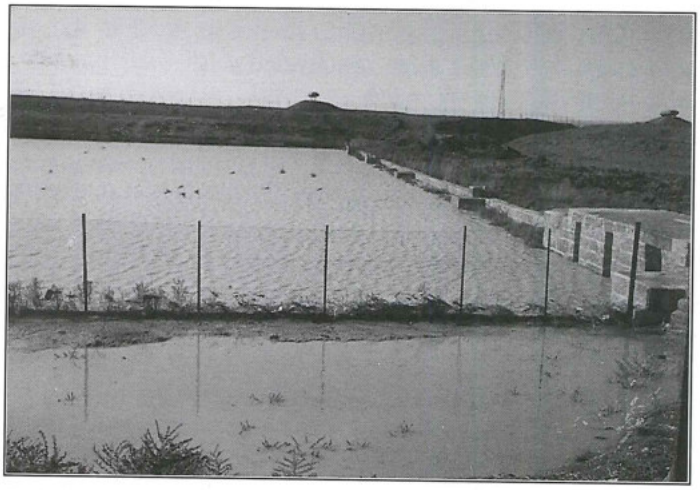
*Az-Zarqā'*: The river here has very sweet water but the fort, Qaṣr Shabīb, is in need of immediate repairs.

*Al-Balqā' (Zīzīa):* Has a well inside the fort, in addition to two pools outside it. These two were full to the brim but nevertheless needed some cleaning after the return of the caravan. The size of the smaller pool was 50 x 10 yards and 5 yards deep and will provide the caravan with its needs of water. Evidently the larger pool was measured some 30 years later by Tristram who mentioned in 1872 that it was 140 x 110 yards and 17 feet 6 inches deep.[22] The larger pool was in good shape and full of water at the end of December 1991 when visited by the author (FIG. 5).

*Al-Qaṭrāna:* Has a large pool 100 x 100 yards and is in good shape but needs lining. Here also, the water is so abundant that the caravan cannot have any water shortage when the pool is full. However, a dam is urgently needed to stand as a breaker between the pool and the strong inundation of water when the wadi pours down after rain.

*Al-Ḥasā:* Has a pool outside the fort which is 40 x 40 yards and 20 yards deep, and is in good condition.

*'Unayza:* Has a pool which is a short distance from the fort. It is 50 x 50 yards and is 6 yards deep. However it is half full with silt and needs cleaning.



5. The pool at Zīzīa (photo: Abujaber).

*Ma'ān*: There are few springs around the two hills and in the valley between them there is a pool that is 35 x 25 x 15 yards, which is filled by water from wells by using the shādūf system.

*Al-'Aqaba ash-Shāmiyya or Baṭn al-Ghūl:* Next to the fort there are two pools (*birkatān*) each measuring 40 x 40 yards with a depth of ten yards. They are half full of silt and need cleaning which is only possible by bringing labour from Ma'ān.

*Al-Mudawwara*: Has two pools (*birkatān*), the one nearer to the fort being 50 x 30 yards in which there are few springs. The second one is around 400 steps away and derives water from a canal that connects between the *birkatān*. The repair work was estimated to require four canal skilled hands, 10 lime operators for the liming and fifty labourers.

The report continues to mention all the stations until arrival at Makka. At the end it concludes by saying "should this project receive the favour of our lord the great Khedewi, he shall receive the great reward in the after-world. It will also make all the pilgrims acclaim his deed and pray for his long life and the dominance of his regime, as it is known that water on the pilgrimage route is the greatest necessity for the pilgrims who travel on it every year" – Ṣafar 1251 AH or May 1835.

## Activity in Modern Times

During a visit to Irbid some forty years ago, I expressed my interest in agriculture which was then the source of livelihood for perhaps 95% of the inhabitants. An elderly farmer amongst my hosts kindly volunteered to give me a brief idea about farming in the area. He stressed the fact that the region did not have any irrigated fields and that the dry farming system forced every farmer to depend on a secure water supply so that he, his family and his animals may not go thirsty. He said that this aspect of

[22] H. B. Tristram, *The Land of Moab*, 1873, p. 183.

daily life was very important, so much so that the six oldest clans of Irbid were associated with their having a well each. These six were generally referred to as al-Kharazāt (well-collars) and the environs of Irbid then was known as Irbid al-Kharazāt. Stories now have raised the number to seven and differ about who these clans were.[23] However, it is now safe to assume that they were amongst the following known families: al-Tlūl (Tell), Ḥijāzāt (Ḥijāzī), Irshaydāt, Jūdih, Dalāqmih (Dalqamūnī), Kharazāt (Khrais), Ḥatamlih and 'Abandāt.

The time during which the prominence of the well-clans started is not known now and cannot be ascertained anyway. However, records of the Ottoman fiscal census of 1595/1596[24] mention Irbid as being then a village of 72 *khānāt* or households and 35 *mujaradat* or bachelors. By Ottoman standards this meant a total population of nearly 400 people, which was the largest village in the Banī Juhma *Nāḥiya* or district. It seems also to have had the highest production of wheat and barley, the two main dry-farming crops, as the taxes paid by the village on these two crops totalled 31,500 *akcas* or *aspers* which was then equivalent to about 800 Ottoman Gold Pounds. This evidence of agricultural activity at the end of the 16th century, does not seem to have continued due to instability in the countryside. Little improvement, however, took place during the second half of the 18th century during the relative stability of Dhāhir al-'Umar's short period when his son Aḥmad was governor at Tibna.[25]

The countryside seems to have continued the same pattern when Burckhardt visited Jordan in 1812. Ar-Ramthā had one hundred families and two pools which supplied water to the yearly pilgrimage caravan. The villagers had also in the neighbourhood a number of wells of fresh water.[26] Bilād Irbid or Bilād Banī Juhma in his time had as its principal villages Irbid which is the Shaykh's residence, al-Barha, Kufr Jāyiz, Tukbul, al-'Āl, Kufr Yūba and Jamḥa.[27] These and most of the other villages in the north, lived on dry farming and had to drink from wells.

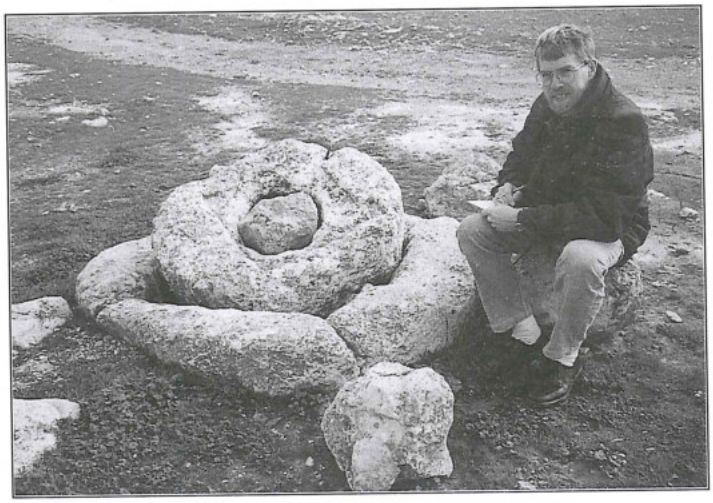
However, in al-Balqā', the situation was less developed as there were only three or four inhabited villages. Likewise in the al-Karak district and in the south, dry farming was being carried out on a small scale. It was towards the 1860s that people of as-Salṭ started moving eastwards to till the fields and this movement only gained force in the south towards the turn of the century. Farmers realised in these times the importance of cleaning the old wells and cisterns and using them for water storage so that the needs of the inhabitants and their animals could be satisfied.

**Water Storage**

Water storage took place in containers of different types and size. In Arabic there are a few words such as *bi'r* (well), *birka* (pool, often used to refer to reservoirs as well), *qī'* (pond or ditch), *sīḥ* (large well), *khazzān* (reservoir or tank), *sadd* (dam). However the most commonly used in Jordan during the last 150 years were:-

*1. Bi'r or Well*

Which was a relatively small rock-cut cistern with a narrow neck leading to a round bulb-like bottom. The shape of these wells was described as an *Ijāṣa* or pear and when one went down into them they truly had the shape of a pear. A good example is the one at the threshing ground at al-Yādūda called Bi'r al-Baydar. The opening on the surface was 156 cms in diameter and to cover it precisely a collaring of 170 cms diameter was placed on it. It is in four pieces of hard white rock with a hole in the middle, that has a 70 cms diameter. The purpose of this ring is to allow the passing through of men for cleaning when necessary. A smaller collar, square of hard white rock that is 95 cms by 75 cms, was imbeded on top of the lower ring. Through the hole of 38 cms diameter in this smaller square collar one could bail out water in a *dalū* or bucket. This elaborate system of well collars is not common and I have not seen many of it around, but it undoubtedly is excellent for safety and cleanliness (FIG. 6). The neck of the pear on the other hand, went straight down for 3.5 m whilst opening up gradually to connect with the main body of the well. The total depth from the surface to the bottom was 7.5 m, and the total quantity of water that could be stored in a well of this size may exceed a hundred cubic metres. Under the lower ring a



6. Elaborate well collar at al-Yādūda (photo: Abujaber, 1991).

23 It is a pity indeed that, like in other places, folklore in Jordan becomes mixed up with time, and research therefore becomes less certain and more difficult concerning dates, localities and people.

24 Hütteroth and Abdulfattah, *Historical Geography of Palestine, Transjordan and Southern Syria*, 1977, p. 203.

25 T. Muaamar, *Dhaher al-Umar*, 1979, p. 274.

26 J. L. Burckhardt, *Travels in Syria and the Holyland*, 1822, p. 247.

27 Burckhardt, *op. cit.*, p. 287.

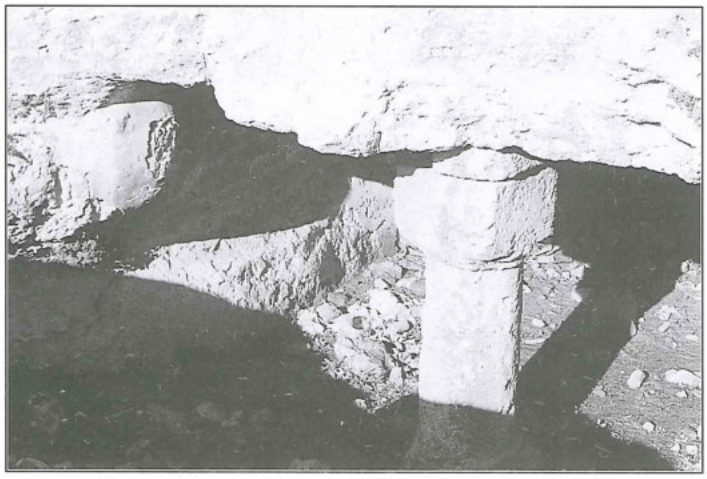
*fatḥa* or opening of 30 x 20 cms was kept open during the winter months for passage of water into the well.

*2. Qī' or Ditch*

This is an excavation in hard rock when no retaining walls were necessary, or in soft soil when walls were built as needed. Since many of these were originally natural caves. It is common to find in many of them pillars that were inserted to support the natural roof that had shown signs of weakness (FIG. 7). The disadvantage of this system of water storage is that it is open to contamination and severe pollution as a result of dirt falling in them. Therefore they were mainly used for watering animals but even then, I have seen animals that refused to drink from them because of the stench (FIG. 8).

*3. Khazzān or Reservoir (also called birka or pool)*

Generally these were the outcome of collective work amongst the villagers, or the initiative of the landlord of an estate. They were either built in the bottom of a valley or depression after a large excavation is made like at Zīzīa and al-Qasṭal (FIG. 5), or were built all around, after the lower side on the rock floor was blocked by a sand barrier or built masonry as at al-Yadūda (FIG. 9). The size of these khazzānāt (*birak*) permitted their use by the whole community living around them as well as by visitors or passers by. Generally the water in these khazzānāt became unfit for human consumption in April or May of every year and therefore ended up being used for building requirements and watering of animals. The communal spirit and organisation behind the building and unavoidable maintenance of khazzānāt is clear from their being in neighbouring villages. The records of the Lands and Survey Department in 'Ammān confirmed that there were twenty nine sites in the Governorate of al-Mafraq, in each of which there was an old birka. Most of these now are located on the fringe of or in the northern Bādiya stretching from Khirbat Umm Ṣurrah to al-Mukfita in the north and to al-Mafraq itself and Riḥāb in the south.



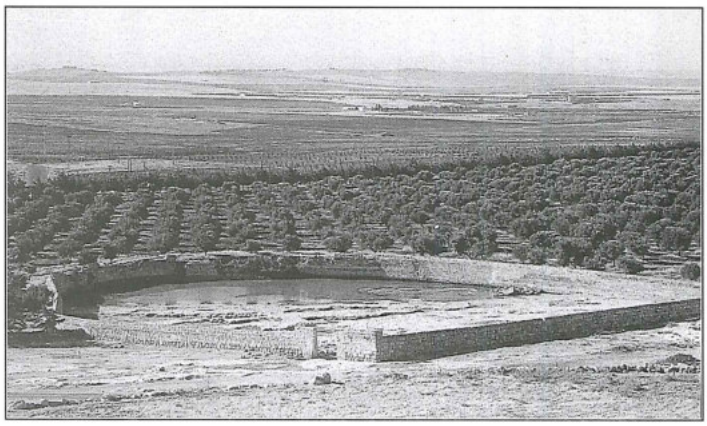
7. Pillar support in qī' or ditch (photo: Abujaber).



8. Pollution inside a qī' (photo: Abujaber).

The cleaning of wells and cisterns was carried out by the villagers themselves, or hired labour. In the thirties and the forties, labourers from al-Jawf, in Wādī as-Sirḥān, were supposed to be the experts in this field. Coming from an old oasis and a relatively established society which had to handle all matters related to water collection and distribution, they were better informed about the construction and maintenance of wells and their internal lining.[28] Besides they accepted wages that were not acceptable to the local villagers.

To assist them in their work, they resorted to rope ladders, wooden shafts and pulleys. After cleaning a well, a thorough inspection of the bottom and the sides was carried out. Necessary repairs were administered and then the actual lining work was started. Lime was usually produced in some villages by burning limestone rocks in locally improvised lime kilns. This was turned into slacked lime after mixing it with water and was then



9. Birka at al-Yādūda (photo: Abujaber).

[28] G. A. Wallin, *Travels in Arabia*,1843-1848, p. 148.

used to plaster the inside of wells. Rarely was a defect discovered in these wells because the workmanship was good and the elders used to maintain that some wells did not need any maintenance or repair during a stretch of fifty years. Rainwater was collected during the winter months over the watershed area through the digging of barriers and canals that directed the water to the *fatḥa* or opening of the well. This whole area was called in Arabic "dā'ī al-bīr" and if it was rocky, the water in the well was pure and more durable. People on the plateau often drank water that may have been over three years old in draught years. If at the end of the season, larvae of black and red colours were floating in the bucket, that did not disturb drinkers and kufiyas were then used to filter the water before drinking.

## Conclusion

The geography of the Jordanian plateau has undoubtedly forced the population to learn about hydrology and the importance of water storage as well. Since time immemorial they had to construct wells and reservoirs of different shapes and capacities. Their main aim was to insure that they had enough water for their needs when the draught years came. This is why one is really astounded by the large number of these storage facilities all over the plateau. At the village of al-Yādūda, the early pioneers in or around 1860 started the building of their primitive walls to make caves fit for habitation hand in hand with the clearance of silt from wells. At the top of the hill, which must have been the site of a prosperous large settlement during the first century AD, there were over forty wells in an area of one hectare. When one of the households became the property of my father, a third generation landlord, in 1917, it had seven wells which one could see at a glance. Building in the last seventy years has changed the nature of the site, but the photograph shown here (FIG. 10) reveals the presence of four wells within a few metres from each other. All the rainwater that reached the roofs was directed through pipes to the openings of these wells and therefore the water quality was cleaner than usual. Furthermore these wells evidently were cleaned, maintained and well kept because they were the source of life for a dry farming system at such a very short distance. What the older generations of antiquity provided, was put to good use indeed by farmers of the same system a few thousand years later. People living on the plateau have given water collection all the attention that it deserved. That was indeed the only way to guarantee the survival of the system and the people living by it.



10. Four wells next to each other at al-Yādūda (photo: Abujaber).

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# Water-Mills in Jordan: Technology, Typology, Dating and Development

The occurrence of water-mills represents a stage in the development of the human search to convert "natural energy into motive power" (Forbes 1955: 78), that is, for running other machinery involved in the production or processing of material. Forbes identifies five power stages which Smith (1977: 215) neatly summarizes: an opening stage in which mankind uses only its muscles; a second stage which harnesses the power of animals; a crucial third stage which exploits the energy of wind and water; fourthly what might be called the heat engine stage, a complex phase embracing the reciprocating steam engine, internal combustion engines and the steam turbine; and lastly the currently emerging atomic power stage. These "power stages" are not successive — often several stages existed together and were used to meet the same or varying demands in spite of different technology.

In milling the demand is that of efficiency in producing greater quantities of the end-product more quickly. In effect, water-mills for grinding flour brought mechanization to the rotary quern which was used in Bilād ash-Shām for grinding flour from the second millenium BC (Forbes 1955: 141). Rather than producing greater quantities of flour for the export market, it is the belief of the author that the watermills so common in the *widyān* of Jordan are a case of appropriate technology for an essentially rural society. Their apparent conservatism can be directly related to the fact that they served their purpose and that there was no need for any further development as they performed their function perfectly adequately. This type of use did not change with the introduction of steam-mills which were also used by a primarily subsistence economy.

The aim of this paper is to describe the various types of water-mills and their technology; to consider several examples from Jordan in more detail; to refer to the problems of dating and to comment on the appearance of steam-mills.[1] The article is based on field-work that was conducted in 1983 during the Wādī al-'Arab survey. Since then several water-mills in Wādī Ḥisbān and in Wādī Ibn Ḥammād[2] have been recorded. The enclosed map (FIG.1) shows the sites which will be referred to in the text.

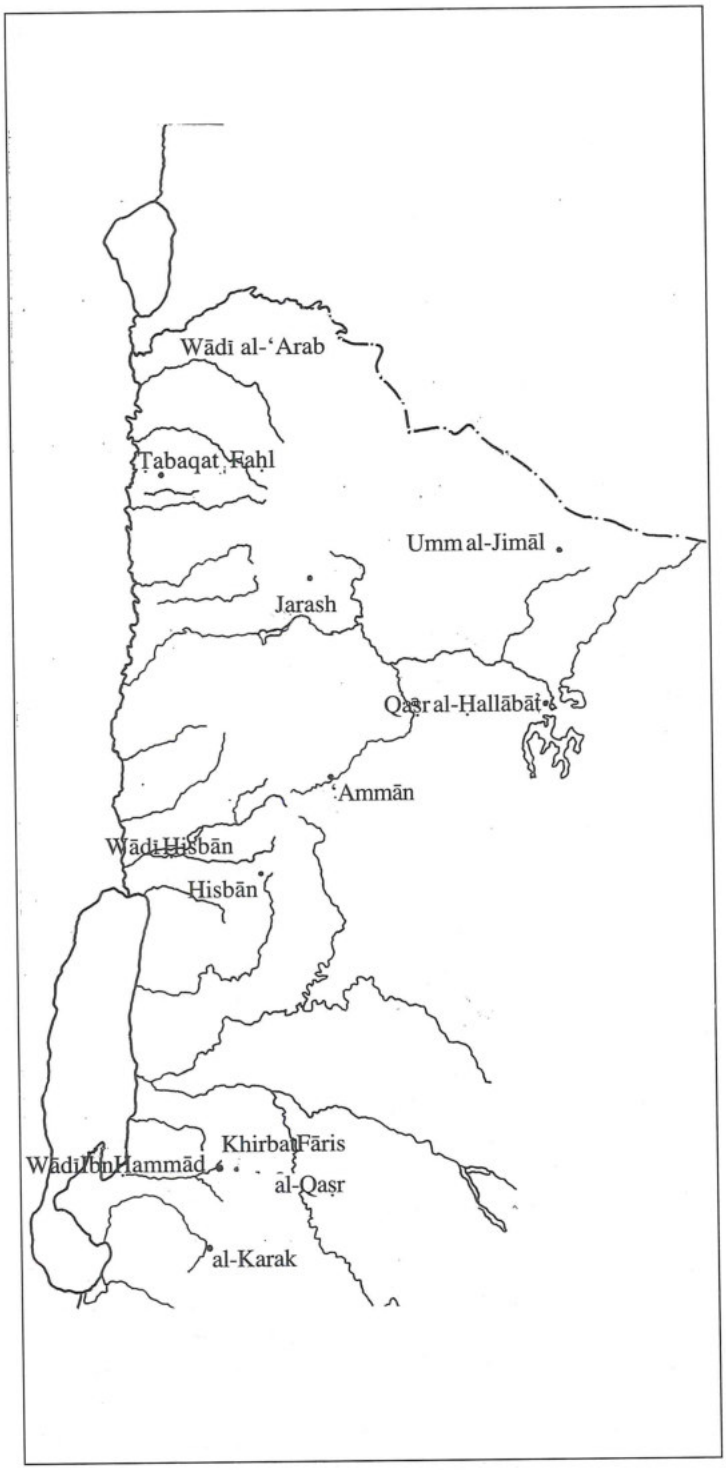
**Typology** (FIG. 2)

Water-mills fall into two main types — those with a horizontal wheel and those with a vertical wheel. In current literature this distinction is not always brought out. In fact the two groups share a technological concept but the execution is different.

The mills powered by vertical wheels involving the use of gearing again fall into two groups: 1. the under-shot wheel; and 2. the overshot wheel. Vitruvius describes a vertical wheel with horizontal shaft and gears in his *De Architectura X/V,* showing that the under-shot vertical wheel was in use by 25 BC. The vertical wheel was the type widely adopted in the Classical World and is known from a Byzantine mosaic in Constantinople (Tölle-Kastenbein 1990: 163) as well as from excavations, e.g. the Roman mill near the Mithraeum in the Baths of Caracalla, Rome, re-excavated in 1980 by Wikander and Schiler (Schiler 1989: 138), and Ephesos in western Turkey (Wikander 1984: 161). These vertical water-mills were those chosen for "research and development" during the Industrial Revolution in Europe. Vertical water wheels for lifting water are well-known from Bilād ash-Shām, e.g. Ḥamā and Antioch on the Orontes, but not vertical water-wheels with gearing for producing power to run machinery.

[1] I would like to acknowledge the support of the Raymond Carr Fund and the Committee of Graduate Studies, University of Oxford for contributing to the cost of attending the conference.

[2] The Wādī al-'Arab Survey was directed by Dr. J. Hanbury-Tenison. The water-mill study was carried out by the author and Mark Gardiner and its results can be found in Gardiner and McQuitty 1987. The Wādī Ḥisbān mills were recorded with the help of Ms. Suzanne Kerner, Dr. Cherie Lenzen and Dr. Kay Prag. The Wādī Ibn Ḥammād mills were explored during the course of the Khirbat Fāris excavations.




1. Map of Jordan showing places mentioned in the text.

*Distribution of Vertical Mills in Jordan*

Evidence for vertical water-mills in Jordan is confined to the wadi linked with the Roman fort of al-Lajjūn, which also provided the military population with their daily water requirements. Parker reports finding five undershot mills and a possible overshot mill (1983: 226) and de Vries has supplied a convincing reconstruction of the system in use (de Vries 1987: 399-428). However, excavation and oral history have shown that these structures date from the recent 19th century Ottoman use of the area and its spring (pers. comm. B. de Vries).

*Horizontal Wheeled Mills*

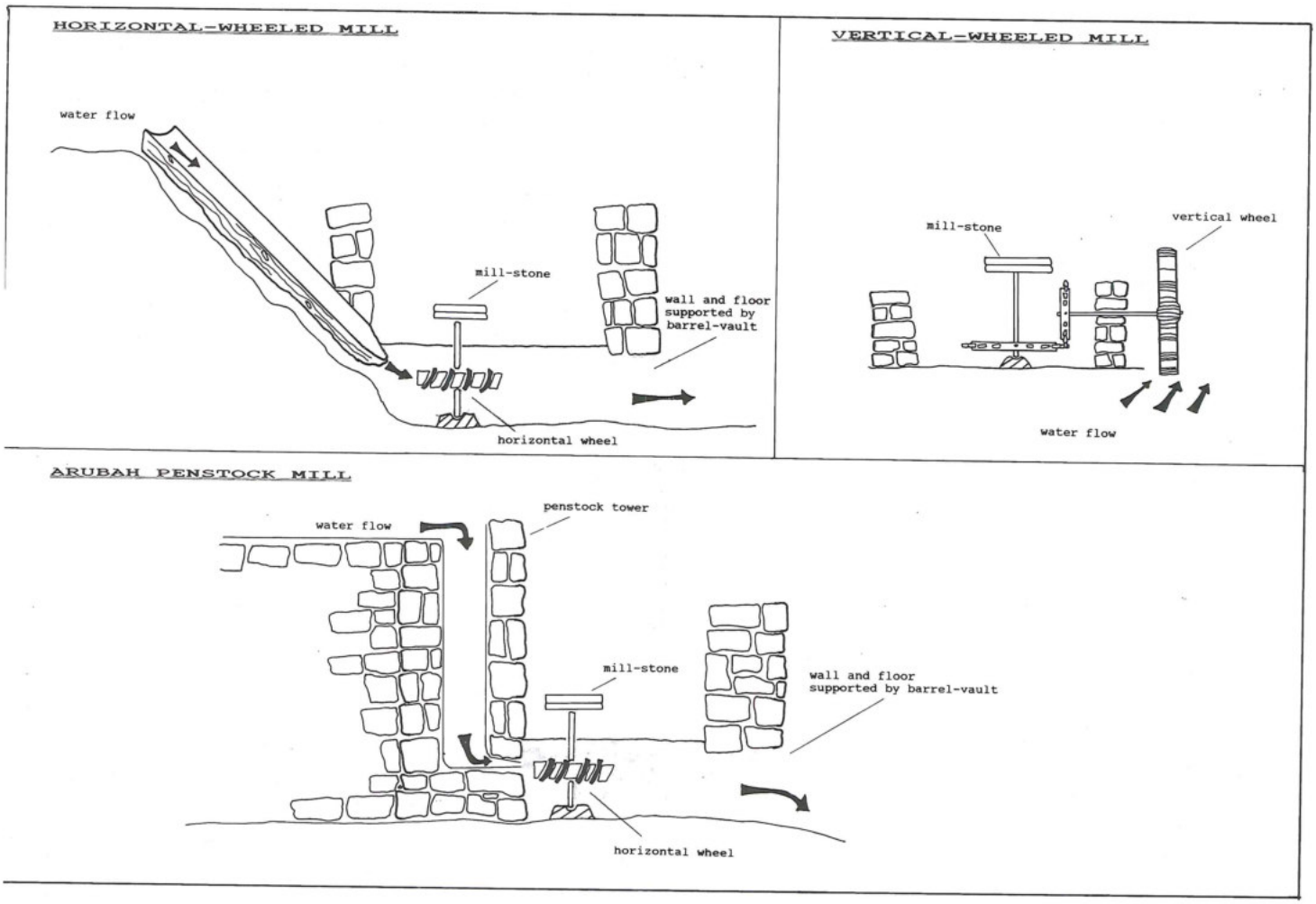
The mills driven by a horizontal wheel can again be considered in two main groups which are based on the differing methods of water delivery and associated superstructure.

1. The "Greek"/"Norse" mill which is driven by the force of flowing water hitting horizontal paddles and producing a slow rotation. As FIG. 2 shows, the water delivered to power this wheel can be down a simple chute, e.g. a hollowed-out log.
2. The horizontal wheel which operates under pressure of water delivered down a constructed tower and which exits through a narrow nozzle. This is the precursor of the turbine and not surprisingly produces more power (FIG. 3).

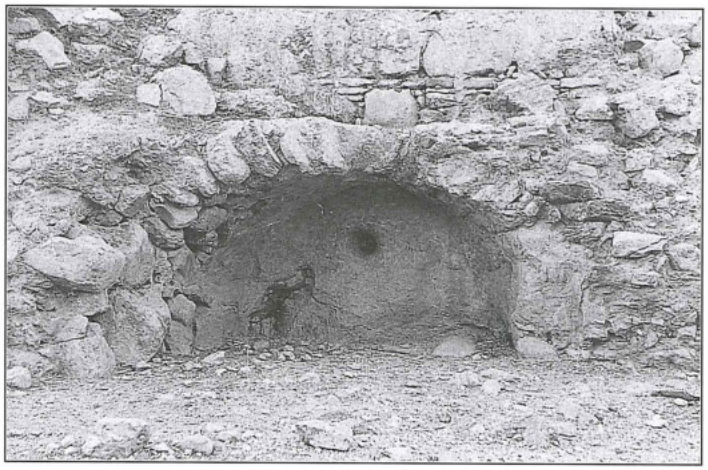
Horizontal-wheeled mills have a very wide distribution and in their most basic form (the so-called "Greek"/"Norse" mill depending on the preferred origin) were a common sight in agricultural communities. Such mills using a hollowed out tree-trunk down which the flow of water is directed, have been reported from Northern Europe (Strauss 1971: 22ff.), the Balkans (Wilson 1952: 2), Peru (Gade 1971: 44) and eastern Turkey (pers. comm. J. Hather). The original date of this type of mill is unclear — the earliest literary references to water-mills are to water-mills in general rather than identifying particular types. However, later Classical writers do refer to mechanisms which are to be associated with these horizontal mills, e.g. Pliny in the first century AD writes "in the greater part of Italy a roughened pestle is used, and wheels also that water turns round as it flows along; and so they mill" (*Nat. History* 18: 23).

An increase in this method of powering the wheel is introduced when the raised tower is constructed and the water exits the arubah penstock/water chute as a jet and hits the wheel at pressure. This is erroneously called a turbine *unless* the wheel operates in a closed-space. All the evidence from Jordanian examples suggests that this was not the case and that the water-jet exited freely from the wheel chamber rather than from a confined space.[3]

[3] It has recently been claimed by Schiler (1989) that he has evidence for Roman turbine mills on the Crocodile River near Caesarea Maritima, Palestine. However, as he himself points out, there is no proof for the turbine wheel and as far as I can tell it could equally well be a horizontal wheel turned by a jet of water. This in itself would be interesting since until now a Roman example of *this* type of wheel in Bilād ash-Shām has not been excavated. However, the Roman date of AD 345-80 was based on C14 analysis which is problematical for mortar, particularly in a limestone area (pers. comm. Dr. R. M. Hedges, Accelerator Unit, Oxford Research Laboratory). Another recent candidate for a Roman horizontal wheeled mill is that still standing at Wādī Faynān which is associated with the presumed Roman reservoir.




2. Watermill types.



3. Water outlet at the base of the penstock tower from which the water exits under pressure onto the mill-wheel.

*Distribution*

The distribution of this type of raised-tower mill is common throughout the Eastern Mediterranean. Those from Palestine have been catalogued by Avitsur (1960: 37-46) and Schiler (1989: 142), and Chehadé has reported on examples from Syria (1973: 241-273). Similar watermills are reported from Oman and are dated to the Islamic period and associated with *falāj*/irrigation systems dating to the 9th-17th centuries AD (Costa and Wilkinson 1987: 56-57 and PLS. 57-59). Wilkinson also refers to similar examples from the agricultural hinterland of Siraf, Iran (1975: 165-166). Dr. S. Roaf has recorded similar arubah-penstock mills from Iraq (pers. comm.). The chief variation of these southern examples from those of the Bilād ash-Shām seems to be that they are an integral part of a controlled irrigation system and do not rely on the mountain-stream aspect.[4] Doubtless the distribution of this simple horizontal-wheeled mill extends or extended all over the rural mountainous regions of South-West Asia. They occur as far east as Kashmir (pers. comm. B. Rehman).

The known, extant water-mills in Jordan are all of the

[4] This is not to say that the Jordanian examples do not form part of irrigation systems which lead water to agricultural terraces and gardens — some of them do — but it is not the prime aspect.

horizontal-wheel type and of the second group, i.e. with an arubah penstock on average 4.00 metres high (FIG. 4). Their distribution is wide-spread — along most of the east-west *widyān* running into the Jordan River and the 'Arabah depression, [for examples from other surveys see the Wādī al-Ḥasā Survey, MacDonald 1988: 284-288; the Wādī Ḥisbān Survey, LaBianca 1990: 194; Northwest Arḍ al-Karak Survey (Wādī Ibn Ḥammād and its tributaries) Worschech 1985: 17-20, 67]. The mills under consideration here show no sign of having been used for anything but grinding grain, i.e. they are not surrounded by fragments of sugar-pots.[5] The requirements for these mills are not major —a stream of fast-flowing water, and knowledge of hydrological methods both for installing the machinery and for ensuring the flow of water. Arubah penstock mills are an ideal adaptation to situations where the flow of water may not necessarily be strong or constant. The high penstock results in the build-up of a head of water and the resulting pressure. This can be increased if a holding-tank is introduced into the system. This contrasts with the "Greek"/"Norse" mills which rely on the speed of the flow of the water itself without manipulation. The arubah penstock mills seem to be a considerable advance, taking environmental factors into consideration in their design; a fairly steep bank but a situation that does not preclude access for animals bringing the grain to be ground; knowledge of construction methods for both the penstock and the leats and channels leading to it and the mill-house.

The mills considered here are all located on perennial *widyān* — Wādī al-'Arab, Wādī Ḥisbān and Wādī Ibn Ḥammād. Given the present needs of the population in pumping out water for irrigation, it is hard to reconstruct the water-flow at the time when the mills would have been in use. However, certain technical adaptations could have been made for dealing with a low body of water, e.g. the size of the nozzle directing the jet of water from the penstock to the wheel could have been increased or decreased (Wulff 1966: 400). Measures taken to ensure a steady supply of water can be seen in the remains of channels leading water off from upstream to the mill tower. In one instance in Wādī al-'Arab a dam has been constructed c. 2 km upstream from which the channel leads, in Wādī Ḥisbān similar channels could be seen running along the "cliffs" above the wadi, a situation which is paralleled in Wādī Ibn Ḥammād although here the channels seem to be part of a more complex irrigation system (pers. comm. William and Fidelity Lancaster). The mills are constructed in "chains" along alternate sides of the wadi where the topography is suitable.

*Distribution of Horizontal-Wheeled Types in Jordan*

The mills of Wādī al-'Arab are of two types: 1. single penstock mills; and 2. double penstock mills (FIG. 5).

Two mills examined in Wādī Ḥisbān are again of both types and the remains of the third are too fragmentary to determine its type. Those of Wādī Ibn Ḥammād are just single penstock examples. I know from travelling



4. Single arubah penstock in Wādī Ibn Ḥammād.



5. Double arubah penstock in Wādī al-'Arab.

[5] Sugar-mills are well known from the Jordan Valley, cf. Hamarneh (1977: 19) and MacDonald (1987: 410). A sugar-mill dating to the 13th/14th century AD on ceramic grounds has been excavated at Stavros, Cyprus (von Wartburg 1983: 303-304). Here the horizontal-wheeled, arubah penstock mill was used to pound and crush the cane. From the surviving structure it seems as if this type of mill was also used in Jordan for crushing sugar.

around, that in Wādī az-Zarqā' and Wādī Kufranja there are examples of both types, while in Wādī Shu'ayb there are just single penstock mills. In addition, it seems that in Wādī al-'Arab there is one example of a simple "Greek"/ "Norse" mill, (no. 062, Gardiner and McQuitty 1987: 32). The water-chute adjoins the natural incline in the land so that the fall in water can be achieved without a raised tower. Until further fieldwork is done, it would be rash to say that the presence of multi-phase and multi-penstock water-mills in the north as opposed to the apparent single-phase and single penstock of the southern mills means anything. However, it does seem that double penstock mills are more common north of Wādī al-Mūjib. G. Palumbo has recently noted a six-wheeled mill near Jarash, and this may be related to greater grain production in the immediate area or greater demand (pers. comm.). As yet the sample is too small to allow such conjectures.

**Date**

It seems clear that there is a history of such mills in Jordan, but as it has been so concisely and dampeningly put by Hill, "..the survival of an old mill does not necessarily tell us very much about its history. We cannot be sure, without further evidence, that there was a mill on the same site in mediaeval times, and in many cases milling installations were completely re-built on different lines in the eighteenth and nineteenth centuries." (1984: 130). Even scientific dating of the structures themselves is problematical; for the latest re-furbishment of these mills we can rely on documentary evidence (cf. Dr. E. Rogan's paper in this volume). For the *de novo* construction and the intervening use and re-use we cannot be so sure, and there was undoubtedly variation in periods of re-use throughout Jordan.

In Wādī al-'Arab two of the mill houses show several phases of use; in Wādī Ḥisbān one of the three mills examined showed an earlier penstock on the same site; the five noted in Wādī Ibn Ḥammād seem to be single phase but further investigation is needed to determine this. If the tentative dating of the mill in Wādī al-'Arab to the 18th century on grounds of tufa build-up is accepted,[6] and the reference of Conder that "At Sumieh and below 'Ain Hesban are the mills, which were erected by Dhiab of the Adwan in the year 1191 of the Hejirah" (AD 1777) (1889b: 129), it can be accepted that re-building took place in several *widyān* in the 18th century. Before that, perhaps there was another three hundred years of use on the same site. We know that mills existed in the 16th century because they were taxed (Hütteroth and Abdulfattah 1977: 72). But what of the period between the fourth and 16th centuries AD?

It is assumed that the 14th century AD sugar-mills of the Jordan Valley were horizontal-wheeled (Hamarneh 1977: 19). Hamarneh notes that al-Maqdisī, among others, speaks of the fame of the Jordan Valley for sugar-cultivation. This would push the date for production and processing back to the 10th century. Does one assume that horizontal-wheeled mills were also in use for grinding grain at this time? In the tenth century AD the Arab geographers refer to mills all over the Arab world (Hill 1984: 137ff.), but these seem to be references to more commercial mills. Before this date did hand-mills reign supreme? Were animal-powered Pompeian grain-mills in use? Was there a hiatus in water-milling between the fourth and tenth centuries AD? Excavation of some of these water-mills and certainly more detailed survey would help to contribute the answers to these questions.

**Water-Mills and the Community**

Would the environment in Jordan support production of a grain-surplus on a consistent basis or do these mills reflect processing for a subsistence rather than export economy? Grain keeps better than meal and flour and therefore "watermills would...tend to be positioned nearer to product consumers than corn producers" (Spain 1984: 173). Accounts of grain rather than flour being transported by camel and mule to Palestine are known from the 19th and 20th centuries AD and earlier. But in the case of rural Jordan for much of the past the main consumers were the producers. As shown by the following quote from Dalman writing in the 1930s, the water-mill was very important to the community: "Für Bauern und Beduinen ist die Wassermühle oft die wichtigste Art der Mühle im Grossbetrieb. Beduinenstamme schliessen zuweilen Waffenstillstand oder geben freis Geleit damit das Getreid zu einer Wassermühle geschafft werden kann." (1964: 243).

As to the ownership and use of these mills, Dr. Rogan's work sheds more light on this for the 19th century, detailing the considerable expense involved. The evidence from Conder (1889b: 129) and informal conversations about their use in the 20th century suggests that one or several were the property of one man. The names of the mills in Wādī Zahar as noted by Schumacher (1890: 143) suggest this and one of the mills on Wādī al-Kafrayn is recorded by Conder (1889a: 228) as "Tahunet Jodeh"; presumably originally belonging/used by the Jodeh tribe.[7] The Wādī al-'Arab examples show consistency in construction as do the Wādī Ibn Ḥammād examples, which suggests that they were all built at the same time, by the same craftsmen and probably at the in-

[6] The dating of the Wādī al-'Arab mill relies on the build-up of tufaceous deposits at a regular known rate (Gardiner and McQuitty 1987: 28). This same tufaceous deposit has been subjected to dating by the Oxford Research Laboratory for Archaeology and the History of Art; the results are as yet unknown.

[7] I am grateful to Dr. Kay Prag for bringing this to my attention.

stigation of one person or tribe. It seems clear that they were used by the local community although this may have been made up of several tribes. The arrangements regarding the water used to power these mills appear to have been customary involving negotiation between the various families/tribes who held sway in the area (pers. comm. W. Lancaster).

**Construction**

The construction techniques of the towers are fairly standard — well-built stone structures using both re-used blocks from antiquity sites and presumably locally quarried stone. The techniques required for building the arubah penstock and wheel-chamber were specific and it seems likely that there were groups of masons specializing in building the mechanism of water-mills as there were in building arches for houses. However the exterior of the towers shows no great variation from the stone vernacular house architecture of the last 150 years. There is much more variation in the mill-houses which would have held the grinding-stones. Some are as well-built as the towers; some are very shoddy and hardly deserve the term house; in many cases there is no trace of a mill-house. One presumes it was either made of impermanent material, e.g. mud-brick, that has been washed away by subsequent wadi flooding or did not exist in the first place.

**Steam Mills**

These mills were gradually replaced in the 20th century by steam-mills. The buildings housing the steam engines were of grand dimensions and although they were noted as early as 1886 by Schumacher in Ḥawrān (1886: 163), the greatest influx seems to have been in the 1940s when individuals imported them from Britain and France. Sometimes a village boasted more than one. The greatest contrast between these water-mills and the later steam-mills lies in their efficiency[8] and their siting, since the steam-mills were constructed in the villages up on the plateau very near the consumers. Water-mills still continued to be used after steam-mills had been introduced and sometimes there is an odd combination of imported and local technology, e.g. mill 003 on Wādī Ḥisbān is a single penstock stone and mud-brick construction with concrete foundations containing an imported conglomerate mill-stone bearing the words "Société Générale Meuliére France". Concrete was not in general use in Jordan until well after 1918, which would imply that this mill was refurbished at a late date. The introduction of steam-mills does not necessarily imply flour-production for the export market — it seems more probable that they were still used for the local market — for subsistence.

**Conclusions**

There seems to be no doubt that the "Greek"/"Norse" mill is represented in a more developed form in Jordan (and elsewhere in South-West Asia). The arubah penstock mills are more efficient and well-suite to an environment and topography which offers fast-flowing but seasonally varying water flow or an environmental situation which can be manipulated to produce the same conditions. In areas of permanently fast-flowing water, e.g. the Alps, there would have been no need to make such an adaptation. In Oman the mills were an integral part of the irrigation systems of the 9th-17th centuries AD — it would seem that the mills were the product of a culture that had the knowledge and skills of manipulating water. The wider distribution of arubah penstock mills shows a marked preference for the Arab/Islamic World. Examples from Europe appear to be confined to Spain and Sicily — both subject to Arab hegemony. Technical drawings of horizontal-wheeled mills are extant in Spanish documents of the 16th century (Reti 1967: FIG. 3) but all the information regarding other European late Medieval horizontal-wheeled mills points to the more primitive "Greek"/"Norse" mill. Apart from the possible Roman candidates mentioned above, the documentary and archaeological evidence for arubah penstock mills seem to date from the ninth century AD onwards. Could these mills have been introduced from the East along with the new agricultural crops of the Islamic "Green Revolution" (Watson 1981)? The mills may not always have been the tools of subsistence agriculture; certainly their role in the 13th century sugar production was not. However, this was the final result.

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[8] Efficiency in water-mills is measured by the number of times the grinding stones rotate compared to the number of times the water wheel turns. Forbes calculates that two slaves or a donkey move the querns at a rate of 0.4-0.5 HP; that the "Greek"/"Norse" mill moves the querns by 0.5 HP and that the Vitruvian mill produces an output of 3 HP (1955: 81). For an arubah penstock mill in Iran with a similar height tower to those encountered in Jordan but with larger grinding stones, Wulff calculates an output of 8.5 HP (1966: 400). The mechanism of one of the Jordanian mills would need to be reconstructed to settle this matter but there is no doubt they are more efficient than hand-grinding.

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# Reconstructing Water Mills in Late Ottoman Transjordan

For the early travelers to the East of Jordan, descriptions of abandoned structures served as the metaphor by which to contrast a past, implicitly pre-Islamic or at the very least pre-Ottoman, vitality with present desolation. Mills served this turn well; a derelict mill suggests acres of farmlands untilled. A functioning mill was noteworthy, the exception which proved the norm of derelict mills. Thompson wrote of Wādī Ḥisbān in the 1870s that "formerly there were several flour-mills along the banks of the stream... Now there is but a single dilapidated mill — a sure indication that the population of this region, even in modern times, was much greater than it is at present".[1]

If derelict mills were a metaphor for the state's neglect of agriculture from the 1600s to the 1860s, it seems reasonable to view the reconstruction of ancient mills as a sign of administrative and agricultural regeneration thereafter. The administrative intervention came in 1867, with the creation of *qaḍā'* as-Salṭ and the establishment of a permanent bureaucratic and military presence in the district. The Ottoman presence enhanced security to such a degree as to encourage flows of goods, capital and persons which radically altered local society and economy.[2] For one, the area under cultivation expanded and grain harvests with it. For another, the population expanded rapidly, raising demand for flour, burghul, and animal fodder. Both the increasing grain yields and the expanding demand for milled grain served as incentives to put derelict mills back to work from the 1870s on.

## Ownership of Mills

When considering the restoration of derelict infrastructure, one first question concerns the ownership of the mills — land, structure, canals, water rights.

TABLE 1 presents a survey drawn from Ottoman land registers for as-Salṭ spanning the decade 1307-1317 *malî* (1892-1902), which reveal certain norms about mill ownership. For one, mills tended to be jointly owned by two or quite often many more partners. Eighteen of 29 mills registered with or sold through the Ottoman land registry were held in shares (*qirāṭ* , or fractions of 1/24), in partnership with others. The eleven mills under single owners were the exceptions which proved the rule; in each case, the owner was either a leading beduin shaykh or a wealthy merchant. Secondly, a transfer from local holders to newcomers, often merchants, may be discerned. Often, five or ten local men sold a mill to two or three men who, judging by their honorifics (*ḥājī, bey*), were wealthy outsiders. The data presented suggest that mills were expensive properties,[3] which would have served both as an incentive to original holders to sell and a constraint on potential buyers.

The wide variation in gross prices of mills undoubtedly reflected differences in their conditions or locations. If derelict, the cost of restoration could prove substantial: Canals and pen stocks had to be cleaned and restored, mill houses had to be rebuilt or roofed, and the works had to be replaced — horizontal paddle-wheel, vertical axle and millstones. The magnitude of these expenses probably explains the tendency to own mills in partnership.

## Expense of Restoration

Given that the majority of mill sites in al-Balqā' had fallen into disuse by the mid-nineteenth century, their potential value could only be realized through significant restoration. Disputes between masons and mill owners shed light on the materials used and expenses incurred to bring a mill back into operation. In one such dispute, a mason brought suit against the four owners of a mill he

[1] J. M. Thomson, *The Land and the Book*, vol. 3 (New York, 1886) pp. 666-667.

[2] Cf. E. L. Rogan, *Incorporating the Periphery: The Ottoman extension of direct rule over southeastern Syria (Transjordan), 1867-1914.* Ph.D. diss. Harvard University (1991).

[3] In 1900, the pound sterling converted to 143 piasters in as-Sālṭ and 'Ajlūn; thus mills cost between $70-210 which was a sizable investment in 1900 terms. For comparison's sake, in 1313 a two-story 6-room house sold in central as-Salṭ for Pt5,000 ($35), as did a 3,000-dunum plot of rainfed grain land. For currency conversion cf. *Suriye Vilayeti Salname 1318 Hijri* (1900), p. 377.

**Table 1.** Mill ownership as per Ottoman Land Registers, 1307 - 1317 Malî (1892-1902).

| *Date (Malî)* | *Location* | *Details of the transaction* | *Gross Price (piasters)* |
|---|---|---|---|
| 1307 | 'Ammān | 4 mills registered to Shaykh | 5,230.5 |
| | | Saṭṭām al-Fāyiz, each on a | 5,000 |
| | | 2-dunum plot. | 5,000 |
| | | | 5,000 |
| 1310 | 'Ammān | 4 additional mills registered to | 5,609.5 |
| | | the now deceased Shaykh | 5,208 |
| | | Saṭṭām al-Fāyiz of the | 5,208 |
| | | Banī Ṣakhr tribe. | 5,208 |
| 1312 | 'Ammān | 6 qirāṭ shares in each of | 22,200 |
| | | 3 mills sold from Qasṭūn | 17,400 |
| | | Zurayq to Mirzā Waṣfī. | 12,600 |
| | Wādī as-Sīr | Registered to 9; sold to 2. | 15,200 |
| | Wādī as-Sīr | 4 qirāṭ sold by 2 men. | 9,480 |
| | Wādī as-Sīr | 2 qirāṭ sold by 1 man. | 10,800 |
| 1313 | Wādī Shu'ayb | Registered to 5 men. | 6,000 |
| | Wādī Kharbar | Unspecified share of 2 mills | 3,000 |
| | | registered to Fiyāḍ Efendi Nabulsī. | 1,500 |
| | ar-Rumaymīn | Registered to 2 men. | 1,710 |
| | Wādī as-Sīr | Sold by 6 beduin to 5 townsmen. | 2,002 |
| | Wādī Shu'ayb | 10 qirāṭ registered and sold. | 3,922 |
| 1314 | Wādī Shu'ayb | 3 qirāṭ. | 4,800 |
| | Wādī ar-Ramill | 4 q. sold by beduin to townsman. | 9,000 |
| | Wādī as-Sīr | 2 3/4 qirāṭ share registered. | 15,709 |
| 1316 | Wādī as-Sīr | 16 qirāṭ sold by 2 men to 4. | 6,776 |
| 1317 | Wādī as-Salṭ | 22 qirāṭ sold. | 5,500 |
| | Wādī as-Sīr | 12 qirāṭ sold. | 7,600 |
| | Wādī as-Salṭ | 18 qirāṭ registered. | 14,666.5 |
| | Umm Rumāna | 16 qirāṭ registered to 5 men. | 9,576 |
| | Ḥisbān | Reg'd to Sulṭān al-'Adwān. | 30,000 |

Source: *Defter-i Hakkane* (Imperial Register), vols. 2-4. Department of Land Registration, as-Salṭ.

spent nine days rebuilding. In the course of the dispute, the judge asked the mason to detail the materials and expenses incurred to restore the mill, which he gave as follows:

| | | |
|---|---|---|
| — 608 "lintels"[*i'tāb*], at Pt3 each: | Pt | 1824 |
| — 520 loads of "dressed stone"[*muḥkam*], at Pt | | 1520 |
| — 4300 "*rashiya'uqād*" [?], at Pt18 per 100 | | 774 |
| — 9 days' labor, at Pt15 per day | | 135 |
| Total | Pt | 3253 |

The integrity of the mason's figures is supported by the fact that the *qāḍī* awarded him the decision.[4]

In a dispute involving the reconstruction of another mill, the estimated costs of rebuilding were substantially higher. The *qāḍī* summoned an architect [*mi'mārī*], who gave a maximum estimate of Pt17,800 to rebuild the mill, and two experts [*mu'allim*] who gave maximum estimates of Pt22,500 and Pt10,000 for the same job. The judge tended to the middle estimate, for a shareholder with a three-*qīrāṭ* share was charged Pt2,100 towards the cost of restoration, making for a total bill of Pt16,800. The value of his share in the property before restoration was given as Pt665, which gives a total value of the mill before renovation at some Pt5,300. In this case, then, the owners spent roughly three times the value of the derelict mill to put it back in working order.[5]

Probably the most expensive single feature in a mill were its stones. Millstones in southern Syria were made of Ḥawrānī basalt, extracted and finished in the ancient lava flows of the Laja'. Buckingham described the mill stone quarries as the sole industry of the Laja'. Given an estimated diameter of some six feet and a thickness of six inches in the middle diminishing to four inches at the edge, the weight of each stone approached the limit of what a camel could carry.[6]

A good profit could be made off the resale of mill stones. Around 1898, two Christian merchants of as-Salṭ entered a partnership agreement to buy millstones directly from the producers. Each contributed 30 *riyāl majīdī* (Pt 720), with which they bought 12 millstones. While the average price paid per stone was only Pt120, their resale value in the district of as-Salṭ ranged between Pt192 - 288, according to each stone's quality.[7] From the mill owner's perspective, the pair of stones were a significant expense in the restoration of a mill, running between Pt400 - 550.

## Revenues Generated by Mills

Given the high price of restoring mills it seems worth considering their profitability. The Buqūriya mill in Wādī Shu'ayb just mentioned earned 3,400 *ṣā'* of wheat (17,000 - 20,000 kilos) in three years' operation, or at Pt5 per *ṣā'*, a total of Pt17,000. Thus, it took three years for the investors to recoup their outlay for the restoration of the mill (the purchase price of the mill not included). Yet mill rents varied according to location — a remote

[4] ICR as-Salṭ, vol. 6, Pp. 99-100, 2 Dhū al-Qi'da 1319 (10 February 1902). The mason was probably from Nāblus. The mill owners were Naqūlā Efendi Shalhūb, a Christian from Damascus and local treasury official; Dā'ūd Efendi Mihyār, a Muslim merchant from Nāblus; Amīn b. Aḥmad Nuwār, a Muslim of as-Salṭ who figures in other cases involving mills, and Ibrāhīm b. Khalīl al-Fār, a Christian of as-Salṭ who was involved in a millstone deal described below. As a group they fit the pattern of elite joint ownership set out above.

[5] ICR as-Salṭ, vol. 6, pp. 173-174, and 176, 30 Muḥarram 1320 (9 May 1902). Judging by the mill's name, al-Buqūriya, it had formerly belonged to members of the Buqūr branch of the 'Abbād tribe, as did the plaintiff in the case, Aḥmad b. Muḥammad b. Aḥmad al-Sa'āyda. He claimed to hold a three qirāṭ share of the mill, now restored by two residents of as-Salṭ whom he claimed had taken his share of the mill. The owners, al-ḥāj Ṣubḥī b. Aḥmad and Muḥammad b. Mubārak b. 'Abd al-Hādī, claimed to have obtained the beduin's permission to rebuild the mill, that his share of the restoration came to Pt2100, against which they took his part in collateral. Having ample witnesses to swear by their case, the judge awarded the decision to the defendants. Here again, we see the transfer from an indigenous owner to Nābulsī merchants.

[6] J. S. Buckingham, *Travels Among the Arab Tribes* (London, 1825) pp. 166-167 and 283-284. Buckingham estimated that Ḥawrānī mill stones cost five times the price of their equivalent in Britain due to the inefficiency of their extraction and the expense of transport.

[7] ICR as-Salṭ, vol. 11, pp. 57-58, 28 Rajab 1321 (20 October 1903). The prices seem surprisingly close to those given by Buckingham in 1815. However, John Wright quoted a price of some 570 piasters per stone in Buṣayr in the Ḥawrān in 1873, presumably reflecting a difference in size. My thanks to Norman Lewis for this reference, which he found in a London magazine, *The Leisure Hour* (1874) p. 810.

mill was rented for only Pt840 while a mill nearer to as-Salṭ was rented for over Pt3,500 per year. However, with basic maintenance undertaken by the miller, and subsequent outlays limited to the periodic replacement of mill stones, a mill, once put into working order, provided interesting and regular rents. This conclusion should come as no surprise, for the notables who invested in mills were serious capitalists.

Being serious capitalists, mill owners tended not to operate the plant but rather leased it out to a professional miller, or *ṭāḥḥān*, described in al-Qāsimī's dictionary of professions as:

> ... one who rents mills in order to grind wheat and other grains. ... People of this profession rent [mills] from their owners. Some have their own mills which they operate on their own account. ... It is an important and amply profitable profession.[8]

Millers were a distinct profession with a strong corporate identity. Kāmil Shaḥāda, in his study of the mills of Ḥumṣ and Ḥamāh in the sixteenth century, found millers to be one of three related trades [*ḥirfa*] composing a distinct "industry" [*ṣinā'a*], each with its own guild [*ṭā'ifa ḥirafīyya* ]: millers [*ṭaḥḥānīn*],bakers [*khabbāzīn* ] and flour merchants [*daqqāqīn* ]. He also notes that millers had a distinct vocabulary, and lists 75 terms and expressions which bore no relation to standard Arabic.[9] In Transjordan, Gottlieb Schumacher found this corporate identity somewhat tinged with arrogance.

> The millers consider themselves as of a superior race to the ordinary Fellahîn. We were lucky enough to find one of these *Malem et Tawahin* [*ma'alim aṭ-ṭawāḥīn*], or mill-masters, ready to serve us as a guide, and as far as this part of his duties was concerned, we had nothing to complain of. But the moment we approached a mill he became so insupportably proud and overbearing in his manner towards his companions, that on one occasion he received a good thrashing at their hands as a set-off for his insolence.[10]

According to al-Qāsimī, the fee charged by millers varied according to season. In winter and spring, when the water pressure was highest and thus the action of the mill fastest, the fee was 20-30 *para* per *mudd;* when the water was low, the rate per *mudd* could raise to two piasters, i.e. 3-4 times the price.[11] The productive capacity of tower mills varied according to the season, as suggested above. Shaḥāda claimed the maximum daily production was about 400 kg, making such mills appropriate for small villages or town quarters.

Given the expansion of the town of as-Salṭ over the last decades of Ottoman rule, rising from some 3000-4000 at the time of the Ottoman installation in 1867 to nearly 15,000 by the outbreak of the first world war, and an analogous expansion of the population of the Balqā', the alimentary needs of a booming population were met in part by the restoration of mills. The influx of merchant capital from surrounding cities — Damascus, Jerusalem, and Nāblus most of all — which was encouraged by the Ottoman presence would seem to have covered the expense of putting ancient, derelict mill infrastructure back into working order. These developments were of fundamental significance in the socio-economic history of Ottoman Transjordan. I would argue that they also shed light on the mill networks of an earlier period.

**Mill Infrastructure and State Investment**

Mills that were reconstructed had to have been originally constructed at some point in the past, though no mill in Jordan has yet been positively dated. All of the mills considered in this conference (published in this volume) were tower mills such as are described in the contributions by A. McQuitty and J. Greene, and most of them would have been part of a valley-wide network of interlinked canals and pen stocks. These were sophisticated networks running for hundreds of meters with junctions branching off to particular mills along a given water course, each canal progressively elevated to reach a tower which tended to be three to four meters above water level. All of this infrastructure had to be well built to survive the centuries, and indeed the contrast between the more ancient mill towers built of dressed stone and the roughly-built mill houses of the nineteenth century is striking.

By way of conclusion, the material on mill reconstruction will be examined for an *a posteriori* hypothesis on their original construction. If, as has been argued, the *restoration* of a mill was a substantial investment, one that took at least three years' rent to recoup the outlay, one that made even the wealthiest prefer to undertake the venture in partnership; and if such restoration amounted to no more than the purchase of millstones, the building of a *fallāḥī* mill house, and the clearing of water channels; then is it conceivable that individual investors would have had the means, let alone the incentives, to lay such costly infrastructure as the dressed-stone towers and canals? It seems unlikely that such networks as

8 Al-Qāsimī, *Qāmūs aṣ-ṣina'āt ash-shāmīya* (Damascus, 1988), p. 290.

9 K. Sḥahada, 'Ṭarīq aṭ-ṭāhūn ka-mu'assasa iqtiṣādīya,' *Annales Archéologiques Arabes Syriennes* 23 (1973) pp. 241-273 and 24 (1974) pp. 109-123.

10 G. Schumacher, *Northern 'Ajlun 'Within the Decapolis'* (London, 1890), p. 42.

11 The *mudd* of six Damascene *arṭāl* weighed approximately 17.4 kg. C. Issawi, *The Fertile Crescent, 1800-1914: A Documentary Economic History* (New York, 1988), pp. 477-478.

McQuitty describes in Wādī al-'Arab, Wādī Ḥisbān, and Wādī Ibn Ḥammād could have been built by private investment. The most likely explanation would be state investment, and the most likely state would seem to be the Mamluk Empire.

There is much to recommend the Burjī Mamluks for prime consideration in investigating the investment in mill infrastructure. They were a military regime for whom the expense of campaigns was always a central item of the budget. Provisioning that army in times of diminishing agricultural production (over the fourteenth and fifteenth centuries) would have encouraged Mamluk sultans to look to bread baskets beyond the Nile Valley, of which Transjordan, lying between its Egyptian, Syrian and Hijazi possessions, would have been a natural choice. There would have been no impediment to state investment, for as Carl Petry has observed, "the Mamluks...quite literally owned most of Egypt and Syria's assets in real estate. They were steadily augmenting their control over the industrial and commercial capital of the empire."[12] This was particularly the case from the reign of al-Ashraf Sayf ad-Dīn Barsbay (r. 1422-37), who inaugurated the policy of state monopolies over major forms of production which characterized Mamluk economic policy thereafter until the fall of the empire.

One other consideration is the advanced level of masonry during the Mamluk period, and the empire's high state of irrigation technology.[13] Finally, the socio-economic structure of the Mamluk regime would have been conducive to major investment in infrastructure; just as Ashtor found the Mamluk sugar industry (another major transformation industry) to be in the hands of "big trusts" with "the greatest sugar industrialists...the Mamluk amirs and the directors of the sultan's financial administration,"[14] so one could imagine "flour barons" with their interests protected by *iqṭā'* or appendages.

These observations are put forward to encourage further discussion of the subject. I can claim with some confidence that the reconstruction of mills in the late nineteenth century was a significant development, bringing together the influx of merchant capital and the growing alimentary demands of a rapidly-expanding population. I can only speculate on the anterior convergence of forces which produced the extensive infrastructure exploited by investors in the nineteenth century, though they too will reveal significant developments in the social and economic history of the Jordan region in the Islamic middle ages.

12 C. Petry, *The Civilian Elite of Cairo in the Later Middle Ages* (Princeton, 1981), pp. 30-32.

13 Cf. H. Rabie, 'Some Technical Aspects of Agriculture in Medieval Egypt,' in A. L. Udovitch, ed, *The Islamic Middle East, 700-1900* (Princeton, 1981), pp. 59-90.

14 E. Ashtor, 'Levantine Sugar Industry in the Late Middle Ages: A Case Technological Decline,' in Udovitch, *The Islamic Middle East*, pp. 91-13

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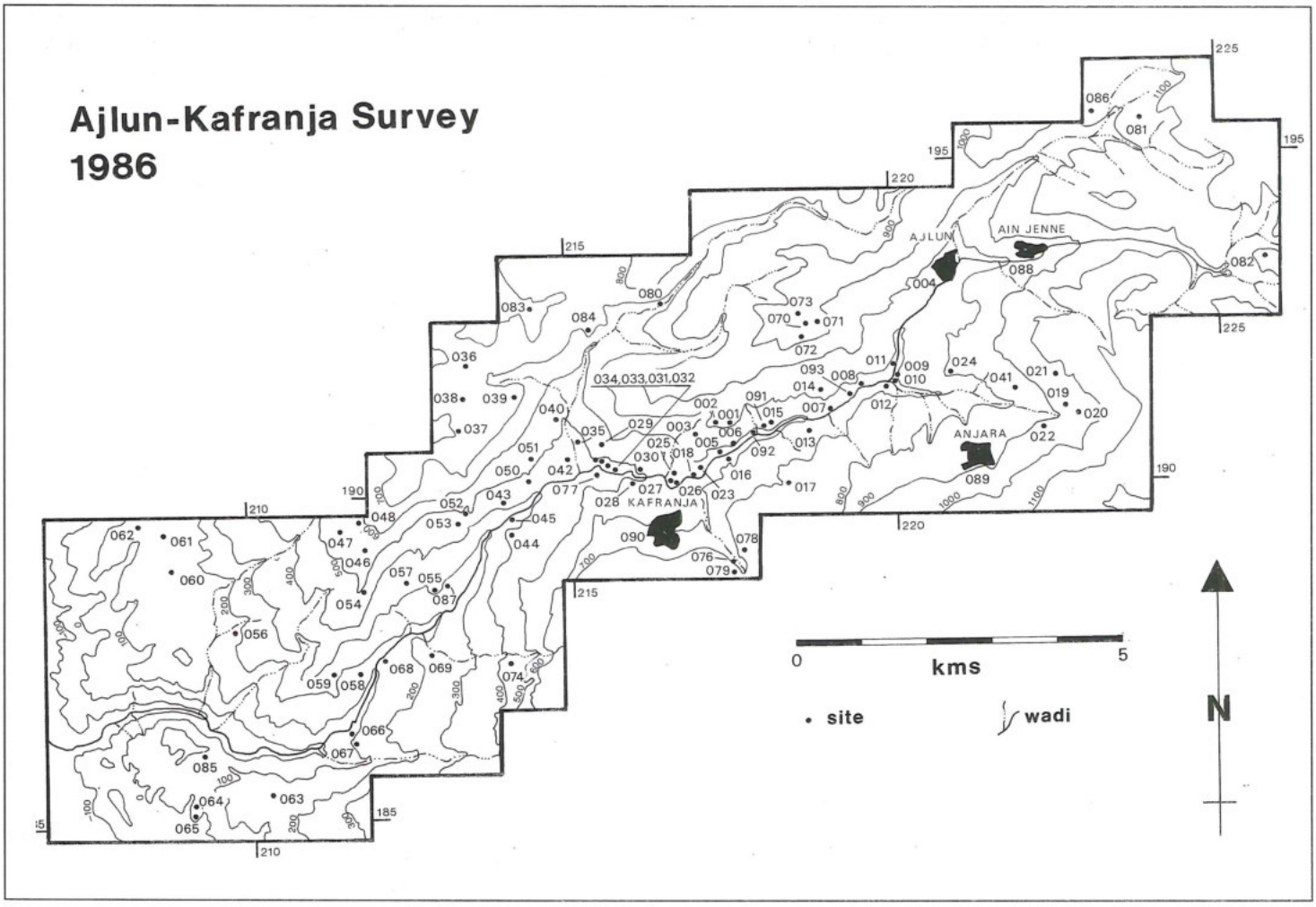
# The Water Mills of the ʿAjlūn-Kufranja Valley: The Relationship of Technology, Society and Settlement

Ruins of water-driven grist mills are ubiquitous in the wadis on the eastern side of the north Jordan Valley. Until the middle of the twentieth century AD, these mills were an integral part of the traditional system of cereal agriculture in Jordan. Now they stand abandoned, but their remains are more than simply quaint reminders of a vanished way of life. They preserve direct evidence of the relationship of traditional technology, past society, and previous patterns of human settlement in Jordan.

This discussion focuses on a group of mills in the ʿAjlūn-Kufranja valley, a watershed on the western face of Jabal ʿAjlūn between Wādī al-Yābis and Wādī Rājib (FIG. 1). The mills were recorded during an archaeological survey of the valley conducted in 1986 (Greene forthcoming). While the 1986 survey compiled a comprehensive inventory of settlement sites, it also recorded




1. The ʿAjlūn-Kufranja Survey Area, showing all sites located.

non-site features that indicated past land use practices: rural cisterns, rock-cut basins for treading grapes or pressing olives, and, best preserved and most obvious of all, water mills.

Results of this survey provide evidence on the location and dating of past settlements associated with these mills. Additional information about the date and function of the mills can be gleaned from medieval Arabic and Ottoman documentary sources and the accounts of early western travelers, as well as from comparative studies of Mediterranean and European water mill technology. Finally, there are the eyewitness accounts of the older residents of the 'Ajlūn hills who observed mills in operation in the valley during the early decades of this century. What follows is an overview of the presently available archaeological, historical, technological, and ethnographic data on mills in the 'Ajlūn-Kufranja valley. In preliminary fashion it examines these mills and their relationship to past settlement and society in the 'Ajlūn-Kufranja region. Rather than definite conclusions, it sets forth a range of possible interpretations and proposes some directions for further research.

## Landscape of the 'Ajlūn-Kufranja Valley

The 'Ajlūn-Kufranja valley consists of the drainage of Wādī Kufranja, the principal water course, and its main affluents, Wādī 'Ajlūn on the northeast and Wādī Ḥijla on the southwest. All are perennial streams fed by numerous springs issuing from the limestone slopes flanking the valley. Annual rainfall, varying from 600 mm in the hills at the eastern end of the wadi to under 300 mm at the wadi's juncture with the Jordan Valley, augments these sources. The wadi's greatest flow occurs in March and April with the springtime rains, dropping to a low at the end of summer.

The mountainous topography of Jabal 'Ajlūn isolates the valley from the plains north, east, and south and the Jordan Valley to the west. The Kufranja and its tributaries have deeply dissected the local limestone geology, forming a landscape of narrow, steep, interconnected gorges fringed by fluvial terraces of varying widths. Elevations range from 1100 m above sea level near the head of the wadi on the western face of Jabal 'Ajlūn to 100 m below sea level at its outfall into the eastern *Ghawr*, giving the wadi system a steep fall over its relatively short length.

This well watered, though remote landscape supports a range of cultivated and natural vegetation. Cereals, olives, and vines can be grown without irrigation on the light soils of the slopes and terraces at the eastern head of the wadi, while its drier southwestern tail is suitable for grazing. A secondary mixed forest of pine, pistachio and scrub oak cover the ridges that dominate the valley above the zone of cultivation.

These factors — rainfall and soils suitable for the dry cultivation of cereals, a year-round wadi flow over a relatively steep gradient and numerous, scattered small patches of arable land in a regionally isolated setting —

**Table 1.** Water mills located by the 'Ajlūn-Kafranja Survey 1986.

| *No.* | *AKS Site No.* | *Extant Remains* | *Wadi Bank* |
|---|---|---|---|
| 1) | 011 | Tower, complete mill house | north |
| 2) | 009 | Arch with channel | - |
| 3) | 010 | Tower | south |
| 4) | 008 | Tower, partial mill house | north |
| 5) | 093 | Tower | north |
| 6) | 007 | Tower, partial mill house | north |
| 7) | 091 | Tower, complete mill house | north |
| 8) | 092 | Tower | north |
| 9) | 006A | Tower | north |
| 10) | 006B | Tower | north |
| 11) | 005 | Tower | north |
| 12) | 018 | Tower | north |
| 13) | 026 | Tower | north |
| 14) | 027 | Tower | north |
| 15) | 030A | Tower | north |
| 16) | 030B | Tower | north |
| 17) | 031 | Tower, partial mill house | north |
| 18) | 033 | Tower | north |
| 19) | 034 | Tower | north |
| 20) | 045 | Tower | south |



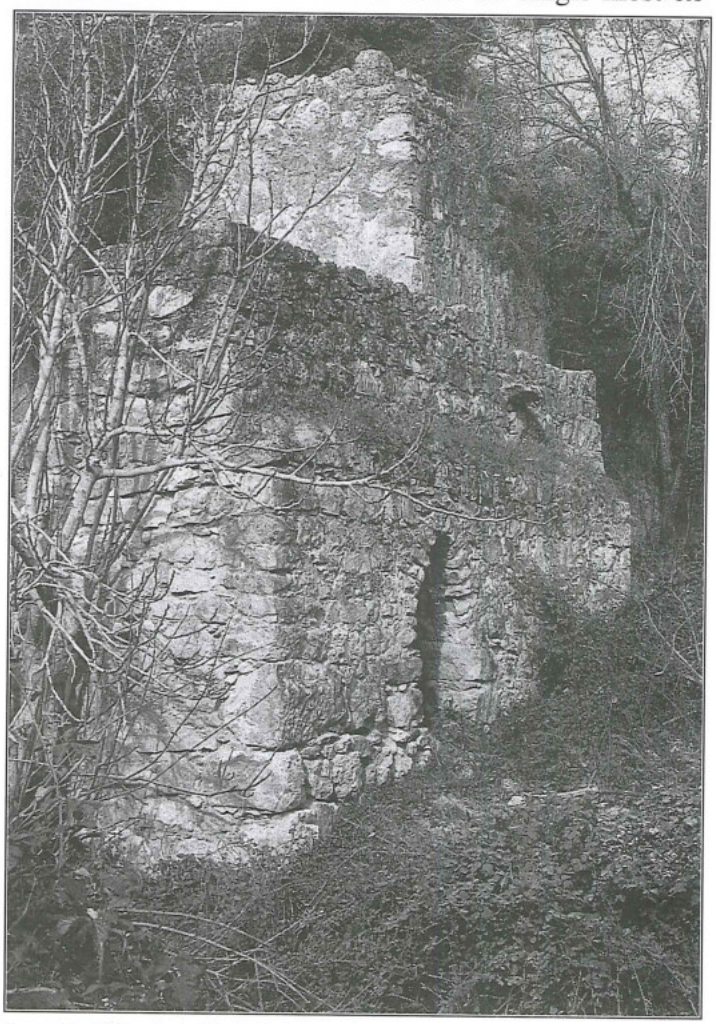
2. AKS 008: A typical mill in the ʿAjlūn-Kufranja valley, the so-called "Qidādī mill" perhaps identified by Schumacher in 1897-98.

combined to create conditions both favorable and necessary for the location of water-driven grist mills in the ʿAjlūn-Kufranja valley.

## The Water Mills

There are remains of twenty water mills in the valley (FIG. 1, TABLE 1). All are built of local limestone blocks, roughly trimmed and mortared together (FIG. 2), in a design described as "raised-tower, horizontal-wheel type" (Gardiner and McQuitty 1987). This design, sometimes called a "Norse mill," is mechanically simple; in contrast to the more complex vertical water mill (Reynolds 1983). The "Norse mill" consists of a horizontal turbine wheel connected by a straight shaft to grinding stones lying in the same plane. A flow of water, its fall sometimes enhanced by a tower, is directed onto the turbine. Each revolution of the turbine wheel causes a single revolution of the grinding stone. Since the mill lacks gearing, its efficiency — the ratio of power input to work output — is low. Only five to fifteen percent of the energy applied to the turbine wheel by running water is transformed into power used to turn the millstone (Reynolds 1983: 14, 103-108). Its simplicity, however, make it economical to build and easy to maintain. Further, the design is ideally suited to streams with low volumes of relatively rapid flow over steep gradients, exactly the conditions found in the wadis of northern Jordan.

Most of the mills discovered were in an advanced state of decay, though in a majority of cases the most solidly constructed part of the mill, the tower, remained intact. At five sites (AKS 007, 008, 011, 031 and 091) the mill houses were wholly or partially preserved (see an example in FIG. 3), but all of the internal elements — millstones, turbine wheels, shafts, controls — were missing (for a contemporary description of these elements, see Wilson 1906: 249-250; for a detailed example from Turkey, see Sadler 1988). These mainly wooden components had been removed, either for reuse in other mills or for recycling into other applications. No intact or even fragmentary millstones were discovered in or around the mill structures. The millstones were the single most ex-



3. AKS 011: A mill with intact mill house, perhaps the so-called "Rabaḍī mill" identified by Schumacher in 1897-98.

pensive part of the mill apparatus, as the documentary evidence cited by Rogan (in this volume) suggests, and were therefore probably worth salvaging after the mill itself was abandoned. These millstones were perhaps removed to nearby villages and recut into smaller hand mills for household use or, much later, re-fitted onto the gasoline-powered mills introduced in the valley after World War II.

An intriguing feature associated with the mills is an aqueduct supported on stone-built arch (AKS 009, see FIG. 4) that carried water from the northern side of the wadi to the southern side. The aqueduct is located on Wādī ʿAjlūn downstream from the first mill (AKS 011) below ʿAjlūn town. The arch, constructed in masonry in the same style as the mills themselves, carried an open channel c. 50 cm wide that connected similar channels, partially rock-cut and partially built, on either side of the wadi. This system of water channels delivered water to a mill, AKS 010, located on the south side of the wadi. The extant tower of this mill had been neatly cross-sectioned in a road building operation sometime in the recent past, revealing its internal structure (FIG. 5; regrettably, this tower was completely destroyed in 1987 during construction of a new sewerage system in the valley).



4. AKS 009: Aqueduct across Wādī ʿAjlūn between mills AKS 010 and 011.



5. AKS 010: Cross section of a mill tower. Scale: 1.0 m.

**Distribution of Mills**

The mills in the ʿAjlūn-Kufranja valley are concentrated between a point upstream just above the confluence of Wādī ʿAjlūn and Wādī Ḥijla, and downstream at the southward bend in Wādī Kufranja about a kilometer below the modern village of Kufranja. None are located on tributary wadis. This distribution seems to depend on two factors:

1) Mills had to be located far enough down the wadi to guarantee a sufficiently strong flow of water to drive the turbine wheel. This consideration tended to place the mills are far downstream as possible to assure a continual flow powerful enough to turn the mill. A second factor, however, worked against this.
2) Mills could not be sited so far away from the grain fields and threshing floors as to make prohibitive the costs in time and effort of transporting the threshed grain down to the mills and the ground flour back up to the villages.

This may explain the concentration of the mills in a zone on the valley floor between the villages of ʿAjlūn and Kufranja. Emplacements higher upstream, though closer to concentrations of population, would have yielded too little head of water to drive the mills, especially in seasons of low flow. Though the flow further downstream would have been stronger, the precipitous drop in the valley floor below Kufranja village would have made the transport of grain to the mills and flour from them difficult and costly. For as-yet undetermined reasons, all but two of the mills (AKS 010, 045) are located on the north bank of the wadi.

**Dating**

The ʿAjlūn-Kufranja Survey recovered no datable pottery from in or around any of these mills. In fact, no surface pottery at all was associated with them, and no excavations were conducted at the mill sites. All of the mills were located in the valley bottom and the extant structures were thickly overgrown with shrubs and brush. This, no doubt, affected the visibility of any surface artifacts that may have been present. Even if surface artifacts had been visible and had been collected, it is by no means certain that they would have been chronologically indicative of the use phases of the mills, much less of their foundation dates. These structures were after all not inhabited or even in continuous use. While an artifact scatter might have accumulated in and around a mill during its active lifetime, the density and variety of such a

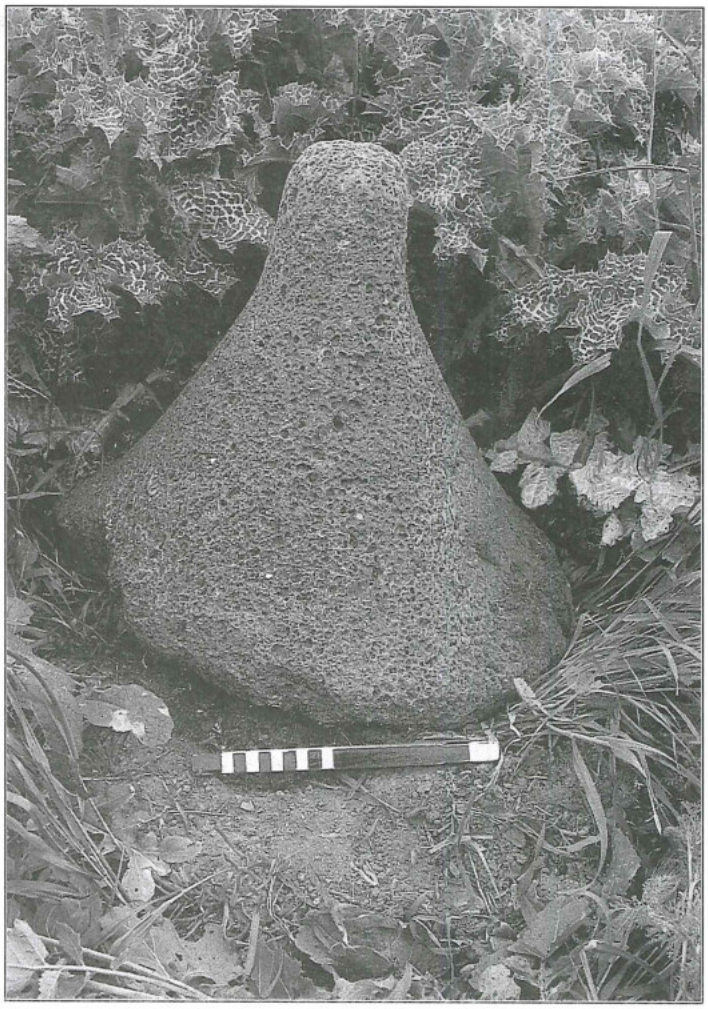
scatter, especially of its ceramic component, would probably have been quite limited. None of these structures then can as yet be conclusively dated from associated archaeological artifacts.

The suggestion that the initial phase of mill construction in Jordan may have occurred in the Mamluk period (Rogan, this volume; Malkawi 1994) is certainly plausible for the 'Ajlūn-Kufranja valley in light of the archaeological settlement evidence from the region. There are thirty settlement sites in the valley occupied in the "Ayyubid-Mamluk" period (TABLE 2), representing a 50 percent increase in site numbers over the preceding Abbasid/Fatimid phase. These sites are concentrated in the upper, eastern end of the valley and include settlements that continued into the Ottoman period: 'Ajlūn (AKS 004), Qal'at ar-Rabaḍ and its outliers (AKS 070-073), 'Ayn Jannā (AKS 088), 'Anjara (AKS 089) and Kufranja (AKS 090). This also coincides with the initial construction of the castle known today as Qal'at ar-Rabaḍ (Johns 1931: 21-25). The imprecision of the ceramic chronology for this horizon makes firm connection between the settlements and the mills difficult to establish. A Mamluk dating does however accord with the chronology of sugar production in the Jordan Valley, which employed a related technology of water-driven mills to grind the cane for the extraction of sugar (Ibrahim *et al.* 1976: 61-63; Hamarneh 1977-78).

Evidence of the medieval Arabic sources make even earlier datings feasible. There were water mills in greater Syria by the eleventh century AD: near Antioch (Ibn Buṭlān, AD 1051), in Damascus (al-Idrīsī, AD 1154), and at Imm between Antioch and Aleppo (Yāqūt, AD 1225) (Reynolds 1983: 117; citing Le Strange 1890: 375, 240, 457, respectively). Still earlier is the documentary evidence for water mills in Jordan itself. Writing c. AD 985, al-Muqadassī says of the al-Balqā' district, "[I]t also has many streams, the waters of which work the mills" (Le Strange 1890: 392-393, cited by Bennett 1982: 1). In all instances, however, technical details are lacking and no extant remains are known with certainty.

The connection between medieval Islamic water mill technology and that of late classical antiquity is more difficult to demonstrate (Reynolds 1983: 117-121; Yassin and Hill 1988: 52-54). It is unlikely that any of the mills in the 'Ajlūn-Kufranja valley represent survivals from the pre-Islamic period. Though Roman, Byzantine and transitional late Byzantine/early Umayyad settlement is well represented there (Greene forthcoming), commercial-scale grain milling in these periods was probably accomplished by large animal-driven mills of basalt. The conical bottom portion (*meta*) of such a mill was found at Mabarra (AKS 055, see FIG. 6; for intact examples, see Moritz 1958: 74-96; White 1975: 13-18).

The water mills recorded archaeologically in the 'Ajlūn-Kufranja valley can be connected very directly with one body of well dated documentary evidence derived from the region itself. Ottoman tax registers (*deftarlar*) from the end of the 16th century offer good evidence that certainly eight (and perhaps as many as sixteen) of the mills recorded in the 1986 survey were in operation c. 1596-97 (Hütteroth and Abdulfattah 1977: 162-163). The total is based on aggregate taxes imposed on mills in the valley and an estimate of the probable tax rate per mill. The aggregate taxes are given in TABLE 3.



6. Conical lower member (*meta* ) of a large basalt mill from Mabarra (AKS 055). Scale: 25 cm.

The exact number of mills is not stated and it is not clear how many individual mills the total taxes represent. Issawi, citing evidence from a *deftar* for *liwā'* Ṣafad (also dated AD 1596-97) puts the tax rate at 60 *aqja* per annum per pair of millstones, supposing one set of stones per mill; or 30 *aqja* per half year, supposing that mills operated only during the winter, high water season (1991: 284; see also Hütteroth and Abdulfattah 1977: 72). While Issawi assumes average rate of 45 *aqja* for *liwā'* Ṣafad, the rate cited for *Manṣūr* in *nāḥiyāt 'Ajlūn*

**Table 2.** Ayyubid-Mamluk sites and water mills in the ʻAjlūn-Kufranja Survey area.

| *AKS Site No.* | *Name* | *Surface Remains* |
|---|---|---|
| 1) 004 | ʻAjlūn | modern town |
| 2) 005 | *none* | mill tower |
| 3) 006A&B | *none* | mill towers (2) |
| 4) 007 | *none* | mill tower, partial mill house |
| 5) 008 | *none* | mill tower, partial mill house |
| 6) 009 | *none* | arch with channel |
| 7) 010 | *none* | mill tower |
| 8) 011 | *none* | mill tower, complete mill house |
| 9) 012 | Khirbat Qidādī | settlement ruin |
| 10) 014 | Abū Hāshim | settlement ruin |
| 11) 015 | Khirbat Abū Ḥāmid | settlement ruin |
| 12) 016 | Safit | settlement ruin |
| 13) 018 | *none* | mill tower |
| 14) 019 | Sālūs I | settlement ruin |
| 15) 020 | Khirbat Khamad | settlement ruin |
| 16) 021 | Sālūs II | sherd scatter, terrace walls |
| 17) 024 | *none* | field tower |
| 18) 026 | *none* | mill tower |
| 19) 027 | *none* | mill tower |
| 20) 029 | Mshayrfa | settlement ruin |
| 21) 030A&B | *none* | mill towers (2) |
| 22) 031 | *none* | mill tower, partial mill house |
| 23) 032 | Brādiya | sherd scatter |
| 24) 033 | *none* | mill tower |
| 25) 034 | *none* | mill tower |
| 26) 035 | Sidr Smīn | settlement ruin |
| 27) 041 | *none* | field tower |
| 28) 045 | *none* | mill tower |
| 29) 047 | Stura | cistern, rock cuts |
| 30) 060 | Khirbat Qāfṣa | settlement ruin |
| 31) 063 | Khirbat az-Zaytūna | settlement ruin |
| 32) 068 | Khirbat an-Nimr | settlement ruin |
| 33) 070 | Qal'at ar-Rabaḍ | castle |
| 34) 071 | Qal'at ar-Rabaḍ I | settlement ruin |
| 35) 072 | Maqām al-Khaḍr | settlement ruin |
| 36) 073 | Qal'at ar-Rabaḍ II | settlement ruin |
| 37) 074 | Khirbat al-'Uqda | settlement ruin |
| 38) 076 | Khirbat al-'Āmiriya | sherd scatter |
| 39) 077 | Khirbat Manṣūra | settlement ruin |
| 40) 079 | Dabat Kannas | sherd scatter |
| 41) 080 | Khirbat al-Jubb | settlement ruin |
| 42) 083 | ʻAlī Mashhad | saint's tomb |
| 43) 084 | *none* | settlement ruin |
| 44) 088 | ʻAyn Jannā | modern village |
| 45) 089 | ʻAnjara | modern village |
| 46) 090 | Kufranja | modern village |
| 47) 091 | *none* | mill tower, complete mill house |
| 48) 092 | *none* | mill tower |
| 49) 093 | *none* | mill tower |

**Table 3.** Water mill taxation in nāḥiyāt 'Ajlūn* (AD 1596-97).

| *Name in deftar* | *AKS Site No.* | *Aggregate Tax* |
|---|---|---|
| *'Ajlūn* | 004 | 300 *aqja* |
| *Kufranji* (Kufranja | 090 | 140 |
| *Manṣūr* (Kh. el-Manṣūra) | 077 | 30 |
| Totals | | 470 *aqja* |

* *nāḥiya 'Ajlūn*: one of six administrative subdivions of *liwā' 'Ajlūn* (hutteroth and Abdulfattah 1977:17-20; FIG. 1).

(30 *aqja*) suggests that in this case the semi-annual rate prevailed. Applying this assessment to the entire valley, the total tax for *'Ajlūn* represents ten mills, that for *Kufranji,* approximately five, and that for *Manṣūr*, one; yielding a total of sixteen mills. Rogan (this volume) cites differential rates for milling flour in high-water versus low-water seasons, suggesting that milling went on year-round. If the *Manṣūr* mill was an exception, in use only half the year, and the *'Ajlūn* and *Kufranji* mills operated year round (and were taxed accordingly), this would cut the total in half, from sixteen to eight mills.

For subsequent centuries such detailed information is lacking, though travelers' accounts from the late nineteenth and early twentieth century do supply some data. In his visit to the valley in 1897-98, Gottlieb Schumacher reported only two mill sites, though he was able to identify them by name: "*ṭāḥūnet er-rabaḍīje*" (the Rabaḍī mill) and "*ṭāḥūnet ḳedādi*" (the Qidādī mill). He located the Rabaḍī mill opposite a ruined settlement named "*ḳedādi*" (called Khirbat Qidādī [AKS 012] in 1986), while placing the Qidādī mill 300 m farther downstream (Schumacher and Steuernagel 1925: 313). The names given are presumably those used locally at the time. The Qidādī mill is so-called perhaps for its association with a named ruin and the Rabaḍī mill either for its proximity to Qal'at ar-Rabaḍ or its possession by a local clan of the same name. Schumacher gives no other description and he does not say if the mills are still functioning. The details he does provide, however, make it likely that the Rabaḍī mill is to be identified with the complex of remains recorded in 1986 as AKS 009, 010 and 011 while the Qidādī mill is probably AKS 008.

Other accounts are far less detailed and much more impressionistic than Schumacher's. Still, it is certain that some of these mills were in use early in the twentieth century. Wilson, in addition to his detailed written description of a water-powered grist mill, publishes a photograph showing a mill in operation (1906: facing p. 260). The caption reads: "A Water-Mill, Jebel Ajlun." Whether this particular mill is actually in the 'Ajlūn-Kufranja valley is unknown.

There is ethno-historical evidence for modern use of water mills in the valley. In the course of the 1986 survey, elderly residents were questioned who recalled accompanying their fathers down to mills on the wadi floor to have threshed grain ground into flour. Though they were not specific as to which mill or mills they visited in their childhood, they did state that there were four mills in operation in the valley in the 1920s and 1930s and at that time a further twelve existed but were not in active use. (The total is sixteen, comparable to the higher number derived above from the Ottoman *deftarlar.* Compare also the numbers of derelict mills given by Selah Merrill, cited below). According to these informants, during World War II, one mill was still working and it processed all of the flour needed in the valley. Shortly after World War II, this mill ceased to function and was replaced by gasoline-drive models located in the villages.

These informants added that the millstones for the old water-driven mills were made of basalt and were brought by camel from Ḥawrān in southern Syria. This corresponds exactly with the account of basalt mill stone quarries in Ḥawrān given by J. S. Buckingham, a nineteenth-century traveler in Syria (1825: 166-167, 283-284; cited by Rogan, this volume). The millstones were brought into the valley as rough cut blanks and finished by a local mason before installation. Furthermore according to these men, the mill wheels required redressing every three to four months and replacement every four to five years. For his labors, the millstone mason was paid in cash (if possible) but might also be compensated in ground floor.

It is unlikely that all twenty mills in the valley were ever in simultaneous use. The cereal producing capacity of the valley and the demand for ground flour (even if external demand is taken into account) would not have called for so many mills. It is doubtful that the mills in the 'Ajlūn-Kufranja valley served anything but local needs, though local demand in an era of high population (as in the Mamluk period) could have been considerable. At other time, factors of location and landscape militated against regular trafficking of grain and flour into or out of the valley. The valley is isolated both from the rest of the surrounding 'Ajlūn highlands and the Jordan Valley to the west. The route of the ancient road from Jarash to Ṭabaqat Faḥl passed east and north of the valley, in the vicinity of modern Sūf and into the neighboring Wādī al-Yābis. At the other end of the drainage, the outfall of Wādī Kufranja into the Jordan Valley is a small gorge, too narrow and steep-sided to permit easy access from the *Ghawr*. Even the modern asphalt curves away to the south and enters the Jordan Valley well below the wadi mouth.

In the middle 1870s Selah Merrill noted a mixture of working and abandoned mills, counting at least a dozen flour mills in the 'Ajlūn-Kufranja valley, not all of which

were in active use (1883: 373-374; cited by Rogan, this volume). Such a situation arose from a variety of reasons. Merrill (1883: 395) attributed abandonment to such causes as insecurity or "unprofitability." The latter cause may be a case of "surplus capacity," i.e., more mills built or restored in a given producing region than could be supported by local demand for ground flour or justified by external traffic. Rogan (this volume) make the useful distinction between commercial-scale milling for towns and local-scale milling for villages. The later condition certainly prevailed in the 'Ajlūn-Kufranja valley.

**Future Investigations**

The immediate need is to record fully the extant remains of the mills in the 'Ajlūn-Kufranja valley, as well as those in other wadis throughout northern Jordan, before they are damaged or destroyed by modern development or further deteriorate of their own age (see now Malkawi 1994). But this is only a first step. One or more of the better preserved examples ought to be investigated archaeologically. Soundings sunk against mill house or mill tower foundations could yield ceramic data that would help date the tower's original construction. This assumes, of course, that the sounding would recover pottery, that the pottery would be diagnostic and datable, and finally that the ceramic datings would be more precise that merely "Ayyubid-Mamluk" or "Ottoman." Clearly, the ceramic chronological tools for the likely periods of mill construction and use require refinement.

Better ceramic chronologies would also make it worthwhile to undertake intensive, complete and carefully controlled surface collections in and around mill structures. Such controlled collections would help define the correlation between the history of a mill's use, abandonment and reuse and any detectable surface artifact scatter. The phenomenon of mill repair and reuse detected by Rogan in the late Ottoman court records is particularly important. Once built, a mill might go out of use, fall into disrepair and then be restored some years, even decades, after its original construction. Though the documents cannot be conclusive on this point, such a sequence of abandonment and reuse might have been repeated more than once.

Complete recording of extant structures will make it possible to document archaeologically a mill's construction history (so Gardiner and McQuitty 1987: 31), potentially yielding evidence for periodic rebuildings and restorations referred to in the sources. It may be possible eventually to identify the very mill structures whose rebuilding or restoration is recorded in the written sources. Closer dating may also help clarify the technological patrimony of horizontal water mills in greater Syria, their relationship to similar hydraulic devices of classical antiquity (see Reynolds 1983: 117; Yassin and Hill 1988: 31-35) and the role of the Crusades and their aftermath in the transmission of technical innovations back and forth between Christian Europe and the Islamic Near East (see von Wartburg 1983: 313).

Ultimately what is required is a comprehensive research strategy that integrates archaeological investigation and recording of the mills themselves and of their settlement contexts, thorough analysis of the documentary and ethno-archaeological sources and ingenious use of environmental data to reconstruct the social, economic, and technological systems of which these mills were a part.

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# Traditional Systems of Water Conservation in the Eastern Bādiya of Jordan

This paper is concerned with the conservation of groundwater resources in the eastern Bādiya in the past and their management by local populations. Our knowledge of them comes from work with the present users of the area, through our research carried out in cooperation with Dr. Alison Betts' Burqu'–Ruwayshid Survey; from information in the volumes of Musil collected in the early years of this century; from the archaeological work of Dr. Betts and her team in the same area; and from Mr. Neil Munro of Hunting Technical Services and the Jordanian Soil and Land Use Survey. We would like to thank all those mentioned, as well as the Higher Council for Science and Technology, the Department of Antiquities, Dr. Elias Salameh of the Water Resources Department of the University of Jordan, Dr. Daud Eisawi Professor of Botany at the University of Jordan, and the Shurṭat al-Bādiya.

The ground water comes from rainfall. This can be as rain falling on and soaking into suitable soils, or as stored water collected on the surface from runoff, or deeper within the earth's crust where pockets of water collect having passed through particular soil and rock types. The rainfall in the Bādiya is by definition not high, varying between 200-100mm in a wet year to 50-25mm in a dry one (*National Atlas of Jordan,* Part 2: 13, 16). The effect of this variable rainfall for groundwater resources is exacerbated by the time of the year when it fell, and the weather conditions following the rainfall, as losses due to evaporation are greater if rain falls in hotter times of the year or is followed by hot dry winds. Such conditions not only affect the vegetation but also the period that surface water in pools remains, and the amount of sunsurface recharge which can take place. Nor is the rainfall uniform over the whole area; it is possible for there to be heavy rain in one place and somewhere a few kilometres away to be completely dry. Thus the rainfall is limited, irregular, unpredictable and spasmodic.

This rainfall produces water and grazing that are of use to people, thus allowing hunting, gathering, herding and the provision of services to people living outside the Bādiya but who need its products. It is also of importance to those who travel across the area for a variety of purposes, usually trade, pilgrimage or administration. Differences in soils and rock formations, between limestone and basalt, and between salts in the soils, as well as amounts of rain and temperature, produce a varied if patchy vegetation. In favourable years, this vegetation produces good grazing in perennials and annuals and supports the animal and human populations that use the area in conjunction with other regions. The eastern Bādiya is environmentally part of the wider region of Bādiyat ash-Shām or the Northern Arabian desert, whichever nomenclature is preferred.

People and their domestic animals need water. As there are no springs in the immediate area, all water traditionally available was stored rainfall. The differences in rock formation and soil types permit a variety of storage facilities, of which the users of the area were well aware; for example, Musil (1928: 676-684) gives a list of some seventy terms concerned with water and water storage used by the Rwāla Bedouin using the eastern Bādiya in the early part of this century. Some of the systems were natural, some natural but enhanced, and some entirely artificial. We would like to concentrate on those types of water conservation that have been either enhanced by man or are entirely manmade. These fall into four categories; rock basins and *birak* (sing. *birkah*), wells, *ghudrān* (sing. *ghadīr*) and *maḥāfir* (sing. *maḥfūr*).

To consider the rock basins first; it may be said that these are essentially natural phenomena, and are simply used by people. However, to take the best known rock basin first, that of Burqu'; it seems that this has been, at various dates, enhanced by the work of man. Dr. Salameh considers that some enlargement may have taken place in the Neolithic. According to Helms (1990: 59) further developments were made in the Byzantine/ Ghassanid period with the building of the first dam together with the building of the "Qaṣr". Wisād, some 35kms to the south, is a smaller version of Burqu', being a series of linked pools, at least one of which, in the

opinion of Dr. Salameh, appears to have been enlarged artificially, possibly in the Neolithic. There is nothing technologically difficult about this; stones appear to have been removed from the bottom of the pool to deepen it. Both sites are within al-Ḥarra, the black basalt area, but near its eastern edge, and as would be expected, rock basins are more commonly associated with basalt formations. Rock basins need not be the size of Wisād or Burqu', which are exceptional, for there are many small rock basins whose stored water was used and which appear to have been enlarged for that purpose. Also, of course, there are a myriad of rock basins that have not been enhanced and which are still used on occasion. At Luthayma, in Tulūl al-Asqaf, there is a birkah which appears to be wholly artificial: it consists of an excavated pool lined with stones and enclosed by a stone wall. It is filled by channelling water runoff from nearby slopes. We have included it here because it was referred to by the people using the area as a birkah, although we would regard it more as an enhanced ghadīr; but the purpose of the structure is more relevant to its users than our regard for its form.

The only traditional wells in the Jordanian eastern Bādiya are those in al-Ḥarra, like Bi'r Ghuṣayn. Before the development of new wells using new technology and financed by governments or shaikhs, people using al-Ḥamad (the limestone area to the east of al-Ḥarra) used wells further into Syria, Iraq and Saudi Arabia for watering their animals. The nearest wells in present-day Jordan available to the tribes who normally used al-Ḥamad were the wells at al-'Umarī, southeast of al-Azraq. The wells in al-Ḥarra are not very deep, and exploit rainfall trapped underground by particular geological conditions. As they are entirely dependent on rainwater for their recharge, a series of poor rain-years cause some or even most of these wells to run dry; but traditionally users of al-Ḥarra moved northwest to the slopes of Jabal ad-Drūz or the Ḥawrān for the summer, thus reducing the pressure on the wells. In the late 1980s, when the movement of herds to the northwest became more difficult, both because of the increase in cultivated land and for political reasons, members of the local tribe dug new wells at Bi'r Ghuṣayn to replace those which had gone dry or fallen into decay. It was a swift process which we observed: one summer the well was being dug, by the next summer it was neatly lined with stones and fully operational. The reason for developing water conservation systems will be considered later, but given the particular geological and hydrological conditions in the area, neither birak nor traditional methods of well digging are possible in many places.

Ghudrān are probably the most commonly used water sources in the Bādiya, particularly in al-Ḥamad. Ghudrān are the places where water collects along the natural wadi beds. The topography of al-Ḥamad is such that the groundrock appears to be relatively level. The rain runs off the slopes into the wadi beds which become scoured down to rock by the flow of water over the years. If the amount of water is sufficient, these wadis run with water and the flow is strong enough to carry the body of water past and over any obstacles in its course. But as the flow lessens, much of the water is trapped in basins in the wadi bed. These basins are ghudrān, and while undoubtedly they have their foundation in natural phenomena, it is also quite clear that many of them have been enhanced by the work of man. Sometimes these basins are deepened and widened; sometimes artificial blockages are made either to divert or trap water. Ghudrān are most noticeable in al-Ḥamad, particularly in the Ruwayshdāt where the topography seems to be especially suited to their formation, but there are also ghudrān in the shu'ub in al-Ḥarra. They vary a great deal in size and capacity: some are only 50 metres long while others may be up to several kilometres in length, although this enormous variation probably reflects the conditions under which they are seen. If they are visited after rain they are easy to spot, but if little or no rain has fallen they can easily be overlooked and appear as mere pockets of water in an otherwise dry wadi bed. Whatever their size, whether full or empty, artificially enhanced or not they are all referred to as ghudrān for, again, their function for users takes precedence over their form.

The maḥāfīr are wholly artificial and are constructed in areas where there are no other water storage facilities possible. Not surprisingly they are found in areas which people wish to use for grazing or, possibly, along routes used for other purposes as well. Essentially they are artificial ghudrān, excavated basins with the displaced earth piled around. The exact intention of their design is not easy to determine: in some cases they appear to have earth (or stone-reinforced walls) to raise the water level artificially; in others the excavated hole appears sufficient. Some have low artificial walls to divert water into the excavated basin. In one case the maḥfūr is a mere semicircular hook at the edge of a khabrah which traps water as it flows slowly past. Most maḥāfīr are built along the edges of khabrāt, the natural mudflats (playa in technical terms) where much rainwater ends up. Unless the water is stored in maḥāfīr it spreads itself over the entire area, often only a few centimetres deep and is fairly useless for watering stock. As a point of interest these playas are called khabrāt when filled, but qī'ān (sing. qā') when dry. Because of their size, the water is always shallow and evaporates quickly. The construction of maḥāfīr enables a greater depth of water to be collected so that evaporation is slowed down and watering animals is made easier. Maḥāfīr may be dug *impromptu* and only be of a size for an individual animal, or they may be up to

50 metres across with the excavated earth piled two to three metres high. These are for large numbers of animals and for repeated use over the years; several appear to have been rebuilt or modified at different times. While most maḥāfīr are built on the edge of khabrāt, some are built along the edges of shu'ub or areas of vegetation collecting the runoff from surrounding slopes.

All the areas where these methods of conserving water have been practised also show evidence of use by man in the form of carvings of animals and patterns on rocks (where suitable rock exists), inscriptions, structures for storage or administrative purposes like the qaṣr at Burqu', the "markaz" type of layout in the Basātīn and the "White Mounds", the "quṣūr" at Dumaythat Umm Qṣayr, the old "village" at ar-Rīsha, and the enigmatic structures at Wisād. Pottery may be found at sites of all types (but not at all sites), along some of the ghudrān, around some of the birak, some of the wells and some of the maḥāfīr. While such evidence gives clear indications of human use, absolute dating is not possible. Some of the inscriptions are dated, such as the two at Burqu', one to AD 700 and the other to AD 1409-10 (Helms 1990: 57-58), but this only indicates the time of a visit. The Safaitic and Greek inscriptions are seen as indicative of dates between the second century BC and the sixth-seventh centuries AD. The occasional early Arabic inscription found at some of the conservation systems do not apparently indicate a date except on somewhat controversial stylistic grounds. Some of the animal carvings, for example those at Wisād, seem to be of considerable antiquity as they portray animals, such as cattle, which are no longer found in the region. The majority of animal carvings, however, could, in our opinion, be of almost any date. The pottery from surface collections is all in tiny sherds too small to be of much use for even indicating dates; it all appears to be domestic wares (Dr. Cherie Lenzen, Ms. Alison McQuitty and Mr. Rob Falkner, pers. comm.). However, the excavation at the old "village" at ar-Rīsha produced pottery ascribed predominantly to the seventh and ninth centuries AD (Lenzen 1990: 156).

We know from the work of Dr. Betts and Dr. Garrard that the Jordanian Bādiya has been inhabited since very early times, and that these populations depended to a large extent on animals, either hunting wild ones or herding domestic ones. Taking the environmental constraints into account, the conservation of water would seem to be for animals and people and not for cultivation (though spasmodic rain-fed cultivation may have been carried out under favourable conditions). Looking at what the present users of the Bādiya say about the construction and use of water conservation areas, the emphasis is on individual decision and action in construction and maintenance. Use is primarily for the constructor and those who are related or connected to him. This applies particularly to wells which represent a considerable investment by an individual or family. The ghudrān, like the khabrāt and the rock pools, are more open to use, and anyone in the area uses the water for his family and flocks, except where the individual who has improved the water catchment is in the area: he then has first call on that water. The same principle applies to the maḥāfīr as indeed, it appears to apply to any enhanced natural resource all over the Arabian peninsula.

Who enhanced and/or constructed the large scale water catchments is not known. Nor is the exact method of construction known to the present day users of these ancient systems. However, every Bādiya user assumes he could enhance or construct a small scale *impromptu* catchment area, and has little doubt about his ability to make a large one. As they point out, everyone knows how to dig a well and the principles are not very different. Still nobody has suggested creating a new maḥfūr of any size and the construction of a really large scale one is a matter of hypothesis for them. Some, working on the analogy of wells, see no inherent reason why Bādiya users could not construct a large maḥfūr for themselves if they saw a need for such conservation. For example, the Maḥfūr ash-Shaykh near Anka' is said to be so called because it was made or cleaned out by the Sha'lān family, although present members of the family have no memory of this (it may, of course, be a metaphorical statement rather than one of historical accuracy). Others attribute the construction of most of these systems to the agency of some central administration, again in response to a specific need. This may well be true for some of them. The obvious needs that they mentioned were an increase in the number of animals, either for trade or administrative purposes, or a need for increased numbers of animals to stay in the Bādiya for longer periods of the year due to a loss of access to land further west. A series of different causes can be hypothesized, an increase in the cultivated areas (as is the case in the present), or because of political loss of territory (for example in the Mamluk and Ayyubid periods). However, more positively, the Bādiya users may have been responding to an increased demand for animals and animal products by town-dwellers (be they consumers or traders) or by the administration themselves, e.g. animals for warfare. Since these water systems are in the eastern Bādiya we would see them as essentially indigenous systems, developed by themselves for their own use, the systems being taken up and increased subsequently by more centralised administrations.

These Bādiya water conservation systems appear to complement those discussed by Betts and Helms at Ibn al-Ghazzī in al-Ḥarra, and by Gilbertson and Kennedy to the north of al-Azraq. In neither case have firm conclu-

sions as to dates been adduced for the structures, although there are possible indications that some may date from the PPNB period, others from late Roman-Byzantine or early Islamic times, while still others may be of a more recent date. While archaeological evidence, if available at these sites, will help, we feel that a close study of commercial history in conjunction with the political relationships between the Bādiya-users and centralised administrations at all periods represents the most likely path forward.

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# On-Site Water Retention Strategies: Solutions from the Past for Dealing with Jordan's Present Water Crisis

## Introduction

A common sight throughout Jordan today is the water truck hauling its life-sustaining contents from pumping stations to agricultural fields and buildings throughout the country. Also hard to miss as one travels throughout the country are the water pipes which criss-cross and dissect villages and the agricultural lands which surround them.

As settlement and plow agriculture has expanded over the past half century in Jordan, so has dependence on deep-drilled wells, water pipes and trucks for obtaining water. *Herein lies a very significant and unprecedented break with the past.* Until this century, it would have been inconceivable to hope to expand settlement and plow agriculture without automatically also expanding on-site facilities for collection and storage of rainwater and surface runoff. Yet, today, this is precisely what has happened!

In light of the fact that, despite modern technology, water supply continues to be one of Jordan's most pressing problems, another look at how previous generations of Jordanian citizens coped with this problem is warranted. Thus, an opportunity has arisen for archaeologists to contribute information which may benefit today's and tomorrow's generations in their search for a solution to this problem. We can contribute information, for example, about how very intensive forms of agriculture were possible during Nabataean and Roman times in the absence of modern technology.

In this paper my goal is to build a case for incorporating archaeological inquiry into the search for solutions to deal with Jordan's current water crisis. I will support my case with four arguments:

First, that the status-quo is not sustainable over long-term.

Second, that archaeological inquiry focuses attention on indigenous time-tested solutions.

Third, that archaeological inquiry can aid in developing solutions that are sustainable over long-term.

And fourth, that yesterday's technology, when wedded to today's technology, may provide a *blended technology* solution for tomorrow.

## The Status Quo is not Sustainable

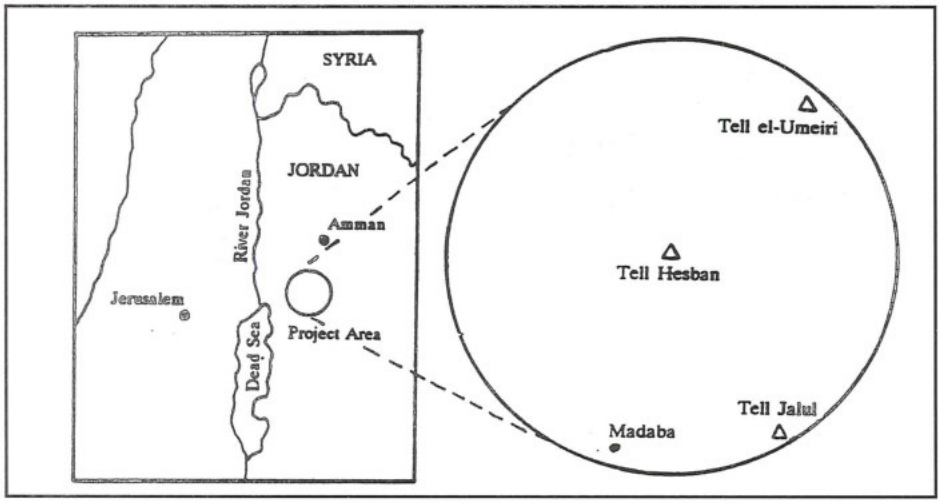
As already indicated, the status-quo in Jordan today as far as water supply is concerned involves reliance on underground sources of water accessed via deep-drilling of wells. This practice was apparently first introduced in the Qaṣr al-Ḥallābāt area circa 1962 by a woman remembered today as "Miss Coats" (Bert De Vries, personal communication). Her purpose in introducing deep well drilling was as a means to help resettle Palestinian refugees from the az-Zarqā' refugee camp.

Since its initial introduction almost three decades ago, deep drilling of groundwater wells has spread to most areas of Jordan. From pumping stations built above the more productive wells, water is transported, as mentioned above, to agricultural fields, villages and towns via water pipes and trucks. The consequences of this practice have only recently begun to be fully comprehended. Among them are the following:

First, it has allowed landuse and settlement to intensify without concomitant grass-roots development of surface water harvesting facilities. As already indicated, in past centuries, this would simply not have been possible.

Second, it has contributed to loss of interest in and widespread devaluation of time-tested indigenous methods of water collection. Thus, today, more and more houses, which do not include in their design the traditional roof catchment structures and sub-basement cisterns which were an integral part of traditional buildings, are being built.

Third, overpumping is making replenishment increasingly impossible in many underground aquifers, making their depletion more imminent. A case in point is the underground "river" which runs from Jabal ad-Drūz to al-Azraq. This aquifer is replenished by precipitation which seeps down between the cracks in the basalt overlayment to pools on the waterproof limestone below. The




1. Location of Tall Ḥisbān.



2. Tall Ḥisbān with modern village in foreground.

problem today is that the rate at which this aquifer is being replenished by precipitation is not keeping up with the rate at which it is being pumped (Bert De Vries, personal communication).

Fourth, in terms of energy efficiency, reliance on fossil-fuel powered pumps and trucks is much less efficient. There is more loss of water due to evaporation and unmanaged runoff, and water has to be transported much longer distances than was the case with traditional methods.

Fifth, because of the larger quantity of dissolved solids in groundwater, the increasing salinity of soils irrigated with such water is becoming a serious problem.

For these reasons, the status quo is not sustainable over the long-term. What then, can archaeology contribute to the search for new solutions to the present water crisis?

## Archaeology Focuses Attention on Time-Tested Indigenous Solutions

A central tenant of twentieth century Western culture has been the belief that "modernity" is the infallible standard against which all other practices, whether past or contemporary, may safely be compared and judged. It has been assumed, for example, that if a technology embodies the most recent techniques, methods and ideas, it is somehow intrinsically superior and therefore represents a worthy goal to be striven after.

A frequent consequence of this striving after modernity has been a contemptuous attitude toward things and practices which are "out of date." Indeed, the very expression "out of date" connotes irrelevance, not useful, not of value any more.

There can be little doubt that the rapid spread of deep drilling and reliance on groundwater in Jordan occurred because this "modern technology" was assumed to be superior to the suddenly out-of-date "indigenous technologies" it replaced. By indigenous technology I mean the techniques and practices which have been developed and perfected over centuries and millennia by the local population, by past inhabitants of Jordan.

Now that the limitations of over-reliance on groundwater sources have begun to come to light, the search is on for new solutions. Surely, the accumulated experience of Jordan's past inhabitants must count for something in this search. As an example, I would like to focus attention on what our excavations at Tall Ḥisbān have brought to light in regard to how water was collected and stored throughout three millennia of human occupation at this Central Jordanian site (FIGS. 1 and 2).

Not unlike other villagers in Jordan, the fundamental problem which has challenged those who made Tall Ḥisbān their home in the past has been coping with six months of practically no rain during the months of April through September. In the absence of modern techniques for pumping up groundwater, the ancients of Tall Ḥisbān had to cope by relying on on-site collection of rainwater and surface runoff. As our excavations have covered all periods of human occupation of this site, from 1200 BC up to the present, we are in a position to study long-term changes in the site's water system as it correlates with cycles of intensification and abatement in occupation of the *tall*. Six findings are of particular interest in this regard:

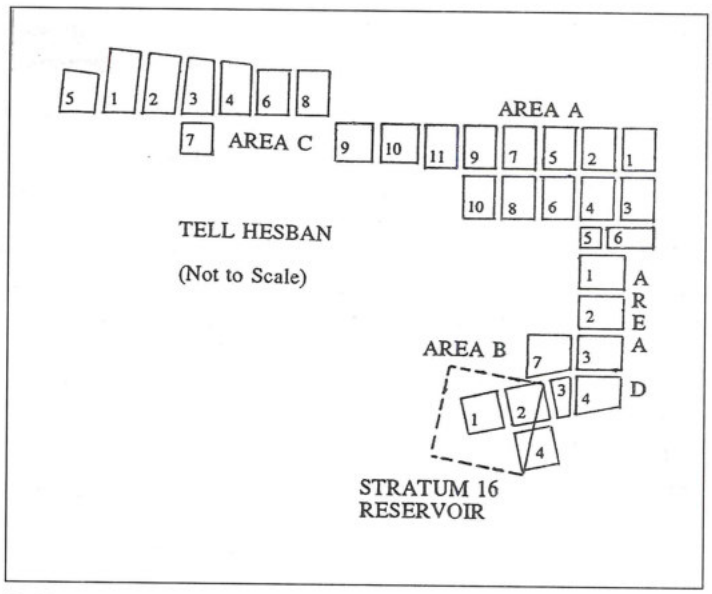
First the use of catchment channels and cisterns for collecting and storing rainwater goes back to the earliest period of occupation of the *tall*, namely to the Iron I period or circa three thousand years ago. Evidence for this is a cistern located in Area D (D.4), and the remains of several water channels (B.2; B.3; D.4), all of which were dated by the excavators to Iron I strata (c. 12th-10th century BC) (FIG. 3).

Second, with intensification of settlement on the *tall* came enlargement of the capacity for collecting and storing rainwater and surface runoff. This is powerfully illustrated in the Iron II period, when the Iron Age occupation cycle reached its highest intensity. During this period a large plaster-lined water tank or reservoir was constructed on the southwestern slope of the *tall* (B.2). The installation measured 7m deep and the distance from its southeastern corner to its northeastern corner was roughly 17m. According to Larry Herr (n.d.), who has computed the tank's capacity on the assumption that it was a square, it would have had a capacity of slightly over 2,000,000 liters. Three layers of plaster were found at the bottom of it and along its sides. Rainwater was fed into it by means of various channels carved out of the bedrock (B.4).

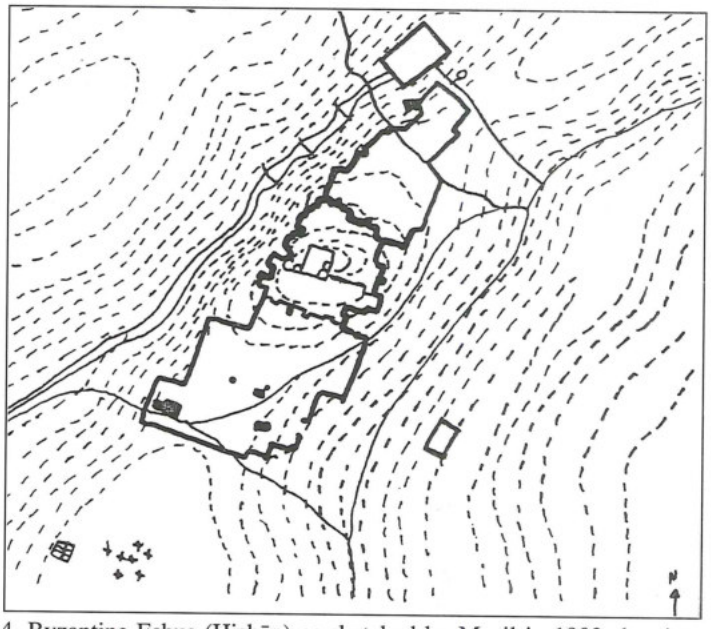
Third, when the *tall* was resettled following periods of occupational abatement, facilities for collecting and storing rainwater built during earlier periods of occupation were as a general rule brought back into use. There are at least two instances of the same two cisterns having been used during all three succeeding millennia of human occupation of the *tall* (D.6 and G.12). In the case of the large number of water channels, cisterns and reservoirs constructed during the Roman period, the majority of them were brought back into use during the Ayyubid-Mamluk period, almost a millennium after they had been originally constructed.

Fourth, during the Roman period, when the greatest expansion of the capacity for harvesting rainwater and surface runoff occurred at Tall Ḥisbān, buildings, courtyards and streets all appear to have been constructed with water catchment in mind. For example, roofs were made so they would catch the rain like a pan. Water thus collected was led via drains to cisterns submerged below the buildings or below adjacent courtyards. Similarly, paved courtyards and streets also doubled as rainwater catchments, as is evidenced by the numerous street level water channels which were built and maintained during this period. Finally, at the base of the *tall* were two large reservoirs, one in Wādī Maj'ar to the west of the *tall* and the other in Wādī Muḥtariqa to the east, each of which no doubt added enormously to the water storage capacity of this Roman town (FIG. 4).

Fifth, the water collected in these large reservoirs was distributed by means of gravity to cultivated fields below




3. Layout of excavated areas (Letters A-D) and their respective squares (numbers).



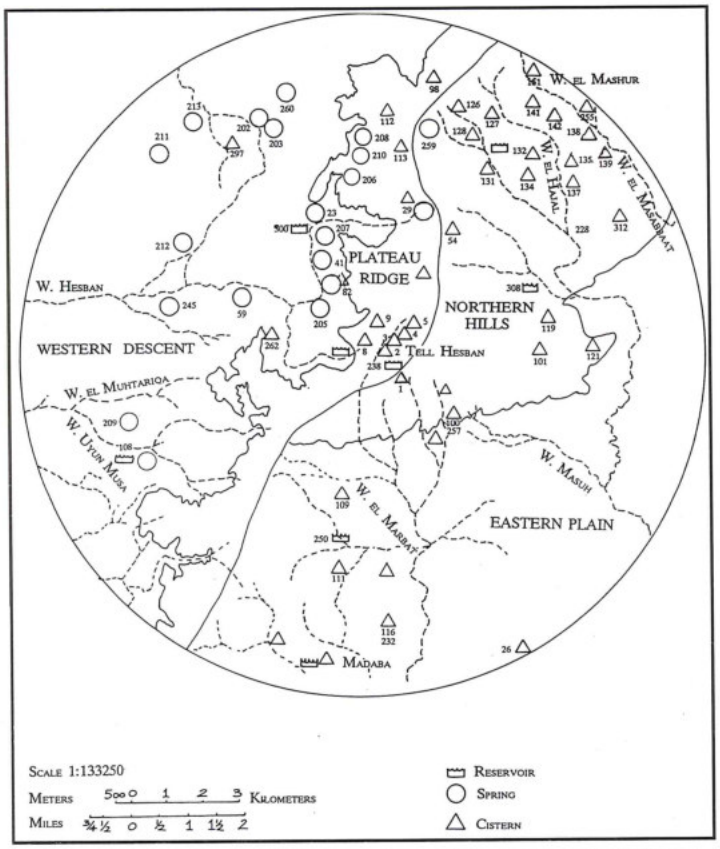
4. Byzantine Esbus (Ḥisbān) as sketched by Musil in 1902 showing location of two large reservoirs (see LaBianca 1990: 186).

them via diversion dams and terraces. The reservoir in Wādī Maj'ar, for example, had a step-wise series of shelves below it, each shelf being held in place by a retaining wall of stones. In this manner plants were irrigated and soils prevented from eroding away.

Sixth, the basic elements of Tall Ḥisbān's water system as outlined above are by no means unique to this site. They are typical of many other *tall* sites in our project area and of *tall* sites spanning the same millennia throughout all of Jordan. Just to give an idea of how common reservoirs were in the Roman period in this region, we have counted 19 of them within a radius of 10km of Tall Ḥisbān (LaBianca 1990: 189) (FIG. 5). The

largest of these reservoirs is one found in Mādabā, which measures 330 feet long, 312 feet broad and 15 feet deep (Thomson 1880: 637). These reservoirs were either recorded by our own survey (Ibach 1987) or by Conder's survey (1889). No doubt, both surveys missed many others which today have been either destroyed, built upon or otherwise escaped detection.

While our excavations and surveys in the Ḥisbān region have provided a baseline of information about the nature and extent of indigenous Jordanian solutions to the problem of water supply, we have really only just touched the surface of what remains to be learned. There remains a vast variety of practices and technologies which still await documentation and study. This is particularly true for other drier and wetter parts of Jordan, for while there are some practices, such as construction and use of cisterns, which can be found almost anywhere, many others exist which represent more specialized adaptations to specific environments and locations. Surely such specialized practices deserve to be studied and to be brought to the awareness of those who are seeking alternative solutions to Jordan's water situation.




5. Reservoirs, springs, and cisterns within 10km radius of Tall Ḥisbān (see LaBianca 1990: 188).

## Archaeology Can Aid in Developing Sustainable Technologies

What archaeology can contribute to the search for sustainable methods for meeting Jordan's future water needs are two things: First, information about indigenous technologies that have proven to be sustainable over the long-term. And second, information about technologies, policies and practices that have had a destructive effect on the environment. To amplify these two points, I turn again to finding and insights emerging from our research at Tall Ḥisbān and vicinity.

The first point I would like to emphasize in this regard is that the way water was obtained by past inhabitants of this region has always been intimately related to how food was obtained. In other words, arrangements for managing water needs have always been an integral part of arrangements for managing food needs. They constitute an integral part of the same system, namely the *food system*, by which I mean all of the purposive, patterned and interconnected activities carried out by a group of individuals in order to procure, process, distribute, prepare or consume food, and dispose of food remains.

Elsewhere (LaBianca 1990), I have described in some detail how changes in water management arrangements have been tied to changes in patterns of settlement, land use and diet at Ḥisbān and vicinity. A striking feature of the local food system is its resilience. In other words, in response to changing political and economic winds over the past three millennia, it has survived repeated oscillations between low and high levels of intensity. The key to its survival has been the flexibility of Jordan's population, their apparent ability to convert back and forth between sedentary and nomadic lifestyles by means of the processes of sedentarization and nomadization.

A consequence of this is that a very impressive array of variously sustainable indigenous strategies for coping with water needs have been experimented with over the centuries by Jordan's past inhabitants. A measure of the sustainability of these strategies is the extend to which they were utilized under varying food system intensity levels, in other words, their resilience.

On this measure, none surpass the strategy of maintaining cisterns for collecting and storing water (FIG. 6). This strategy appears to have served equally well the sedentary and nomadic phases of the food system cycle for at least the past three thousand years. For example, even during periods when Ḥisbān was abandoned as a year-round settlement, it was used as a seasonal camping ground because, no doubt, of its cisterns.

Another strategy which has stood the test of time is, of course, the practice of maintaining terraces and retention dams to prevent soil erosion and facilitate distribution and retention of rainwater and surface runoff to cultivated hillside shelves. This strategy, I believe, has been utilized more or less continuously in our project area for at least the past four thousand years. Of course

the areal extent under such management expanded and contracted greatly depending on the cyclic shifts in food system intensity levels over the centuries. By far the greatest expansion occurred during Roman-Byzantine times.

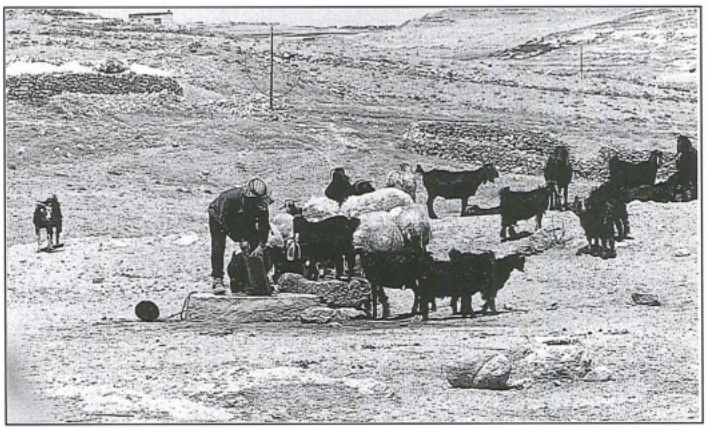
As a method for collecting and storing large quantities of water, the maintenance of reservoirs dates back, as we have seen, nearly three thousand years in our project area. It was not until about two thousand years ago, however, or during the Roman period, that they came into widespread use in this region. Significantly, reservoirs were constructed and maintained primarily during the more intense phases of the food system cycle, such as during the Iron II, Roman, Byzantine and Ayyubid-Mamluk times. This was, no doubt, because they required much more labor and cooperation to maintain and were more difficult to repair in the wake of major earthquakes. Although less resilient than the preceding strategies, their critical role in facilitating intensification of the food system during these periods make them an important strategy to consider today, however.

The above strategies represent only a few examples of the wide array of sustainable methods of water management which our archaeological research has brought to light. Others which have not been touched on include a variety of cooperative arrangements which entailed, on the one hand, strategies involving various forms of kinship-based cooperation, and on the other hand, strategies involving various forms of bureaucratic control. Since our research along these lines is still in its infant stages, I have deliberately limited the discussion here to the consideration of the findings about which we feel the most certain.

As important as what archaeology can tell us about the sustainability of various indigenous methods of water procurement is what it can tell us about the accumulative impact of these methods on the natural environment over the long-term. In other words, while the methods themselves may have stood the test of time, their cumulative impact on the environment is only today beginning to come to light. As an example of this, I would like to end this section by setting forth a proposal regarding the relationship between cycles of food system intensification and abatement and deforestation in our project area.

Briefly stated it is that denudation of the landscape in this region is accelerated in the wake of each intensification phase of the food system cycle. As trees were cleared to open up more land for cultivation during successive intensification phases, soils were initially protected from erosion by terraces and retention dams. Denudation occurred, however, as a result of failure to maintain these terraces and dams during successive abatement phases of the food system cycle.

The reason for this failure, I believe, was increasing



6. Shepherd watering flock of sheep and goats near village of Ḥisbān.

insufficiency of people to do the necessary maintenance work. This, in turn, resulted from a general decline in the population occupying the area during each abatement phase and increasing seasonal migration of the population which did survive.

It is my opinion that the most devastating blow to the environment of our project area came in the wake of the Roman-Byzantine intensification drive, during which most of the forested areas remaining from earlier centuries were cleared and converted to terraced agricultural lands. I base this proposal primarily on the evidence for widespread distribution of agricultural sites and installations all over our project area during this period.

**Blended Technologies: Wedding Old and New for Best Results**

On the strength of the findings presented above, I would urge that more attention be given to incorporating yesterday's concern with rainwater and surface runoff collection in providing for tomorrow's water needs in Jordan. As an example of this, I will refer briefly to a proposal which we have developed on behalf of ACOR for submission to USAID (United States Agency for International Development).

Entitled "Project Rainkeep" (LaBianca 1992), the proposal entails excavating and restoring cisterns and reservoirs and putting them to use in collecting and storing water for use in irrigating crops. But instead of relying on traditional methods for distributing the water to crops, the proposal entails installation of subsurface microporous tubes for distributing it. To this end, solar powered pumps will be used to lift the water up and push it through the tubing to the plants.

The reason for thus wedding old and new technology is that while yesterday's technology — especially the use of cisterns — reduces significantly the amount of water lost due to unmanaged runoff and evaporation, modern technology assures that the water is distributed and utilized in the most efficient manner possible. The use of

microporous tubes also makes supplying fertilizer and pesticides to the plants much easier.

When compared with the status quo, this blend of old and new technology is vastly more efficient. Whereas the status quo involves relying on large quantities of groundwater being pumped and distributed via fuel-consuming trucks, pumps and pipes to irrigated areas, this *blended technology* relies primarily on on-site collection of rainfall and surface runoff, small solar-powered pumps, and rows of buried plastic tubing for distributing water to the plants.

If Project Rainkeep is funded as a demonstration project, and if it is successful and should lead to widespread implementation throughout Jordan, it will provide an opportunity for archaeologists to work side by side with village farmers and agricultural engineers in addressing one of Jordan's most pressing problems. Their role will include helping to identify possible sites for such installations, surveying and recording them, and, where appropriate, carrying out salvage archaeology as a preliminary to their restoration.

I would like to conclude this paper by coming back to the bigger issue of long-term environmental impact as it related to this blended technology. Even though it would help reduce the current threat of depletion of groundwater sources and help reduce the loss of rainwater to unmanaged runoff, if implemented in the absence of other effects to protect the environment, particularly afforestation efforts, it would be a short-sighted solution.

The reason for this is that, as our long-term scenario involving Ḥisbān's environmental history suggested, deforestation occurred as an unintended consequence of unbridled expansion of intensively managed terrace agriculture. To prevent this from occurring again, it will be important that the momentum already underway, thanks to the visionary leadership of King Hussein, to restore Jordan's forests be continued. Forest, after all, is the ultimate solution not only to storing rainwater and managing surface runoff, but to sustaining indefinitely the process whereby soils, plants and animals are produced on-goingly for the benefit of future generations of Jordanian citizens.

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# ARABIC SECTION

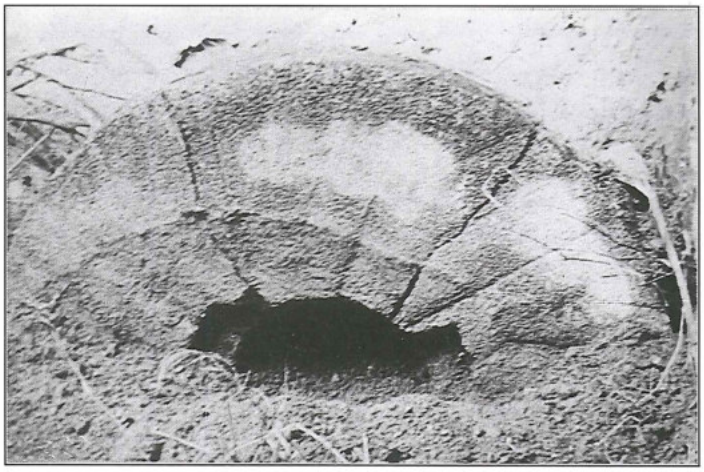
تلتقي الشعبتين بخشبتين عاموديتين في رأسهما شعبتان صغيرتان تقطعهما خشبة أخرى على شكل جسر يتدلى من وسطها جنزير على شكل حلقات أدخل فيه خشبة رافعة لخشبة العصر، وترفع خشبة العصر بواسطة الخشبة الرافعة وذلك بشدها بالأيدي نحو الأسفل.

وبهدف زيادة الضغط على القفاف المملوءة بالزيتون المهروس يتم شد الشعبتين نحو الأسفل بوساطة حجر يسمى (القلع).

وتجري عملية العصر بوضع الزيتون المهروس بقفاف ترتب عامودياً على حجر يوضع عند رأس خشبة العصر، ثم يعمل على شد الخشبة التي تضغط على القفاف فينساب الزيت عبر قناة حفرت على الحجر حيث يوجد مزراب ينقل الزيت إلى إناء خاص (شكل ٨).

وقد أعفت حكومة شرق الأردن بموجب الفقرة (أ) من المادة الثالثة من قانون رخص الصناعات لسنة ١٩٣٣، هذه المعاصر من دفع الرسوم(١٣).

(١٣) المصدر نفسه.



٦ . منظر لطرف حجر الرحى العلوي لطاحونة مائية في وادي زقلاب.



٧ . منظر لبد روماني قديم في قرية عنبه.

## ٥- تقنية إنتاج زيت الزيتون

امتازت منطقة الكورة بكثرة أشجار الزيتون، مما دفع بالأهالي إلى الاهتمام باستخراج الزيت من حبات الزيتون بوساطة أدوات حجرية وخشبية وهي:

### أ - الأدوات الحجرية (البد)

شاع استخدامه في معظم قرى الكورة منذ عهد قديم لهرس الزيتون، يدلنا على ذلك كثرة الآثار الباقية لهذه الأدوات الحجرية المعروفة عند الأهالي (بالبد) (شكل ٧).

ويتألف البد من قسمين رئيسيين هما:

١- الحوض ويسمى (القصعة)، وهو دائري الشكل يرتفع عن الأرض حوالي ٧٠سم مبني من الحجارة المنحوتة المنسقة بقطر ٢م، وله حافة جانبية بارتفاع ٢٠سم، تتوسطه قاعدة حجرية دائرية قطرها ٤٠سم وعرضها ١٢سم تقريباً يتوسطها عامود من الحديد طوله حوالي ٣٥سم يشكل نقطة ارتكاز دوران حجر الرحى الموجود داخل الحوض.

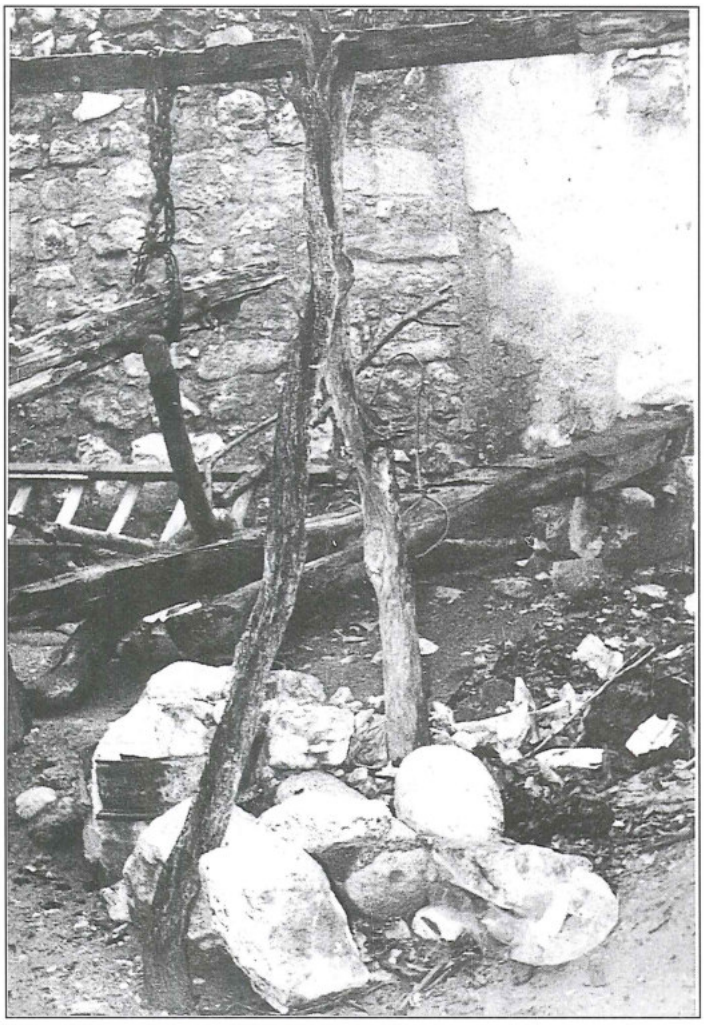
ويستخدم الحوض لنثر حبات الزيتون بداخله، حيث يتم هرسها بواسطة الحجر الدائري.

٢- الحجر وهو عبارة عن قرص دائري منحوت سمكه حوالي ٤٥سم وقطره حوالي ١٣٣سم، وفي وسطه فتحه مربعة طول ضلعها حوالي ٢٤سم. ويوضع الحجر بشكل عامودي بين حافة الحوض والقاعدة الحجرية حيث يثبت في وسطه خشبة اسطوانية طولها حوالي ٥م وقطرها ٢٤سم تمتد أفقياً قاطعة الحوض ومرتكزة على قاعدة وسطه، وتربط الخشبة بحبل، وتجرها دابة تدور بشكل دائري حول الحوض، والهدف منها هو تحريك الحجر بما يشبه حركة العجلة فوق حبات الزيتون لهرسها.

### ب - المعصرة

وتتألف من قطع خشبية وحجرية هي:-

خشبة العصر ويبلغ طولها - قبل تفرعها إلى شعبتين - حوالي مترين ونصف المتر، وعرضها من ٢٤-٤٠سم، وسمكها من ١٨-٢٠سم، تتفرع إلى شعبتين طول كل منهما حوالي ١٨٠سم، وعرضها من ١٢-١٤سم، وسمكها من ١٠-١٥سم ويثبت رأس الخشبة من فتحة داخل سور بيت أو صخرة، وتمتد أفقياً حتى



٨ . منظر يمثل معصرة خشبية في دير أبي سعيد.

أ- الحبوب وتشمل القمح والذرة والشعير والعدس حيث عمل الأهالي على تخزينها مدة عام كامل، وينتفع منها في توفير الآتي:-
- انتاج رغيف الخبز من القمح والذرة والشعير.
- انتاج البرغل من القمح المسلوق المجفف والمجروش، ويستفاد منه في انتاج الأكلات الشعبية مثل الكباب والمجدرة والمفتول.
- القمح المجروش ويستفاد منه في صنع الأكلات الشعبية مثل الرشوف والدحاريج أو الزقاريط والكشك.
- العدس ويضاف العدس المسلوق إلى بعض الأكلات الشعبية مثل المجدرة والرشوف، أو يجرش ويصنع منه شوربة العدس.
- القلية من القمح والفريكه.
- اللزاقيات والزلابية.
- الكراديش وهي الخبز المصنوع من الذرة أو الشعير.

ب- كشك البندورة ويصنع بشق حبة البندورة إلى نصفين وتجفيفها.

ج- رب البندورة ويتم تصنيعه عن طريق عصر حبات البندورة وغليها على النار.

د- الحليب ومشتقاته مثل صنع اللبن الرايب والمخيض واللبنة والجميد والزبدة والسمن البلدي والجبنة.

هـ- تجفيف الفواكه والخضار مثل ثمار التين لإنتاج القطين، وتجفيف البندورة والعنب.

و- تربية الدواجن لإنتاج اللحم والبيض.

ز- تربية النحل لإنتاج العسل.

## ٤- تقنية طحن الحبوب

شاع في منطقة الكورة استخدام نوعين من الطواحين لطحن الحبوب هما:

### أ- الطواحين اليدوية

وهي عبارة عن قرصين دائريين يبلغ قطر الواحد منهما ٤٠-٥٠سم من الحجر الأسود الخشن، ويوضعان فوق بعضهما بشكل أفقي، ويتم وضع الحبوب المراد طحنها بين القرصين، وتقوم المرأة بإدارة القرص العلوي بواسطة مقبض، ويخرج ما يتم جرشه أو طحنه على جانبي القرصين (شكل ٥).

### ب- الطواحين المائية

قام الأهالي بتركيب عدد من الطواحين على ضفاف وادي زقلاب ووادي اليابس، وقد بلغ عددها في النصف الأول من هذا القرن سبع طواحين، أربع منها في وادي زقلاب وثلاث في وادي اليابس، وقد قمنا بزيارة ميدانية لهذه الطواحين أثناء تجوالنا في المنطقة، فعثرنا على آثار بناء متهدم لطاحونة في وادي زقلاب تسمى (طاحونة أبو شقير)، وتتألف الطاحونة من الآتي:

١- البناء: ويتكون من غرفة يبلغ طولها عشرة أمتار وعرضها ستة أمتار، بنيت جدرانها من الدبش والطين، وأقيمت من جهتها الجنوبية بجانب طور حاد يبلغ ارتفاعه حوالي ١٢ متراً أنشيء عليه بشكل عامودي بئر الطاحونة، الذي صمم على شكل مخروط قاعدته من الأعلى ورأسه من الأسفل، ووضع بداخله مزراب مصنوع من خشب الحور على شكل صندوق محكم الاغلاق، وذلك من أجل التحكم بتساقط المياه عامودياً على فراش الطاحونة.

٢- الفَرَاش: ويتكون من إطارين دائريين أحدهما خارجي والآخر داخلي يفصل بينهما ما يسمى (بالريش)، ويتركز بداخله أربعة قضبان متعامدة في وسطها فراغ يمر من خلاله عمود خشبي ثبت في رأسه الأسفل «الصوص» ويلتقي من الأعلى بالعمود الحديدي.

٣- العمود الحديدي: وهو مفرغ من الداخل، اسطواني الشكل يبلغ قطره ١٠سم، يثبت رأسه السفلي داخل شق في رأس العمود الخشبي بينما ينتهي رأسه العلوي الذي يشكل حرف (T) بالوجه السفلي لحجر الرحى العلوي.

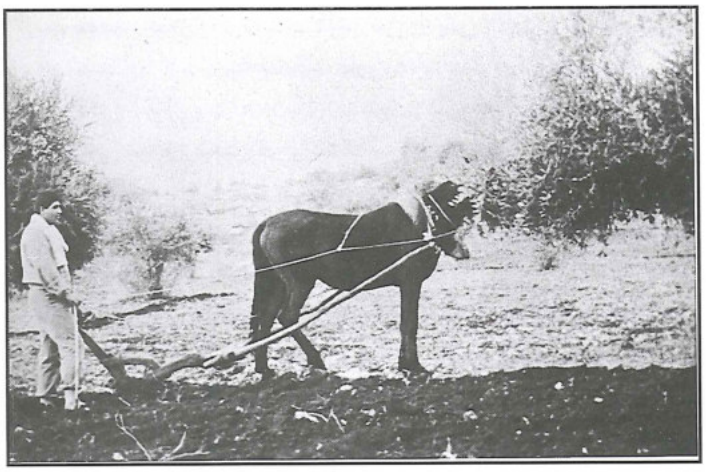
٤- حجري الرحى: وهما عبارة عن قرصين دائريين متساويين، قطر الحجر الواحد ١١٠سم وعرضه ٣٠سم، وفي وسطه فتحة دائرية قطرها ٣٠سم، والحجر السفلي ثابت بينما العلوي متحرك، ويتقابلان بشكل أفقي بطبقة من الحجر الأسود الخشن، ويعلو الحجر العلوي ما يسمى بمخزن الحبوب مخروطي الشكل في نهايته جارور ينزل منه الحب بشكل منتظم من فتحة الحجر العلوي فيتم طحنه بواسطة الحجرين (شكل ٦).

ويذكر أن حكومة شرق الأردن استوفت من أصحاب الطواحين المائية بموجب المادة الثالثة من قانون رخص الصناعات لسنة ١٩٣٣ رسماً مقداره ٢,٥٠٠ ليره فلسطينية(١٢).

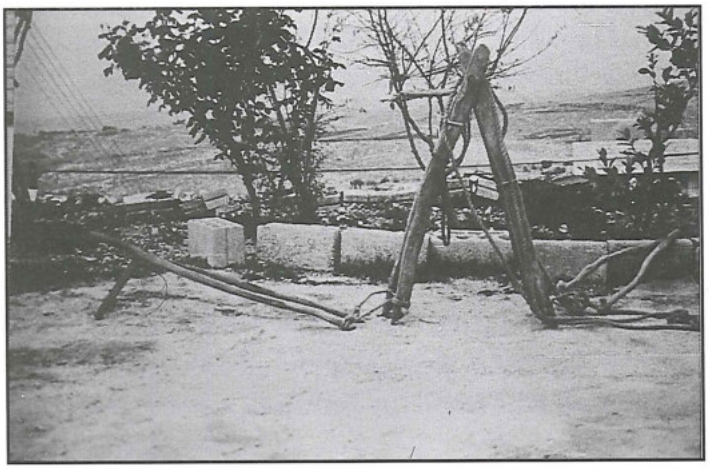


٥ . طاحونة يدوية رفعت إحدى البدويات قرصها العلوي لاستخراج الجريش.

(١٢) **الجريدة الرسمية**: السنة العاشرة، ٣٨٤ (نيسان ١٩٣٣).



٢ . محراث بلدي تجره دابة واحدة تتوسط شعبتي العود.



٣ . القادم وتظهر فيه أجزاؤه الرئيسية.

ويتألف من الأجزاء الرئيسية التالية (أنظر شكل ٣):-

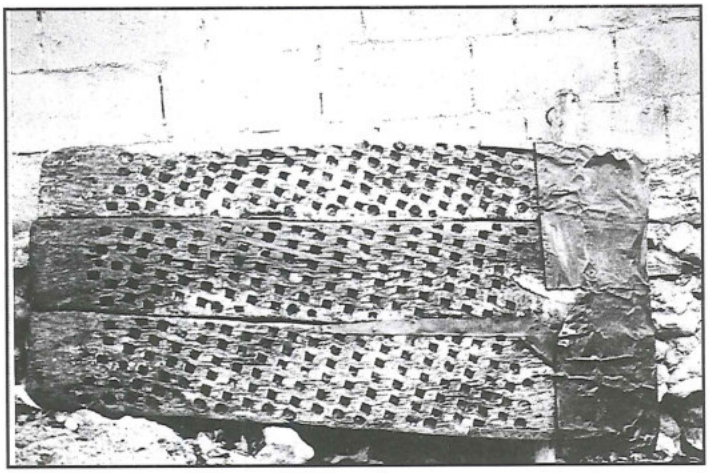
١- المغزل وهو عبارة عن خشبة اسطوانية طولها حوالي ٣٨سم في طرفيها خصران يدخل فيهما فردتي القادم بشكل متعاكس مما يسهل حركته في حالتي الفتح والضم.

٢- الفردتين وتتألف الفردة من قطعتين خشبيتين تصنعان على شكل سلم قصير يبلغ طوله حوالي ١١٠سم وعرضه حوالي ٢٤سم، ويثبت أعلاه بخصري المغزل، ويشد من الأعلى والأسفل بسلك معدني يسمى (ملوي) بغرض تدعيم قوته.

٣- الفرشيات وهي عبارة عن شعبتين خشبيتين فيهما إنحناء نحو الداخل، يبلغ طولهما حوالي ١٠٠سم، ويبرز عند رأسهما قطعة خشبية تسمى إصبع، ويتم وصل نهاية الشعبتين بأسفل الفردتين بواسطة حبل يبلغ طوله ٢٠سم.

ج- اللوح (شكل ٤)

وهو عبارة عن زحافة من الخشب حفرت على وجهها السفلى مئات الحفر الصغيرة التي ركزت فيها أضراس من الحجر الأسود الخشن، ويبلغ طوله حوالي ١٢٠سم وعرضه من الأعلى حوالي ٨٠سم ومن الأسفل حوالي ٥٠سم،



٤ . اللوح الدارس يظهر فيه بطن اللوح الذي يحتوي على مئات الحفر التي توضع فيها حجارة سوداء خشنة.

واستعمل اللوح لهرس القش وتنعيمه.

٢ - تقنية الوقود

كان الوقود المستعمل عبارة عن الحطب والفحم الذي كان السكان يحصلون عليه من الأشجار الحرجية المحيطة بقراهم، هذا بالاضافة إلى استغلالهم لمصادر وقود أخرى متوافرة مثل روث الحيوانات والجفت المستخلص من بقايا حب الزيتون المهروس بعد عصره، واستخدمت مصادر الوقود لأغراض طهي الطعام، وانتاج رغيف الخبز في الطابون (الأفران) والتدفئة في الشتاء. وعملت النساء على جمع الحطب من الغابات وتخزينه، كما قام بعض الأهالي بصنع الفحم من خشب الأشجار، وتمر صناعة الفحم في عدة مراحل هي:

١- تحضير كمية مناسبة من الحطب اليابس ثم تقطيعه إلى قطع يتراوح طولها من ٥٠-٦٠سم.

٢- صف الحطب بشكل أفقي وعامودي، وترك فراغ في وسط الكوم على شكل فوهة.

٣- تغطية الحطب بورق الشجر ثم بالتراب بشكل محكم لمنع دخول الهواء.

٤- إدخال كمية من الحطب بعد حرقها من فوهة الكوم ثم إغلاقها.

٥- ترك الكوم مدة تتراوح ما بين ٤-٧ أيام يتم خلالها مراقبة عملية التفحم، ثم يتم اخراج الحطب المتفحم عن طريق فتحات جانبية في الكوم.

### ٣- تقنية انتاج الطعام

تعتبر الزراعة وتربية الحيوانات عماد الحياة الاقتصادية لأهل الكورة، حيث اتجه الناس إلى التركيز على المنتوجات التي يحتاجونها ضمن اقتصاد طبيعي قائم على الاكتفاء الذاتي يجري تخزينه لمدة عام كامل دون التفكير في رسم خطة يطور فيها الفلاح زراعته. وفيما يلي وصفاً لتقنية انتاج الطعام في الكورة بالاعتماد على المقابلات الشخصية مع كبار السن.

معظمها موجوداً حتى وقتنا الحاضر.

ونظراً لطبيعة المنطقة الجغرافية نجد درجة من التشابه والتماثل في طرق المعيشة التي يزاولها الناس في قرى الناحية التي تتميز بصغر المساحة، وتجمع المباني المندمجة مع بعضها والمبنية غالباً من الحجر والطين، كما نجد شعوراً قوياً بالتماسك الجماعي داخل القرية حيث يربط السكان ببعضهم البعض العرق الواحد، والحياة غير المعقدة، والتقنية البسيطة التي تعتمد أسساً تقليدية موروثة من عهود ماضية لتوفير ما هو ضروري لحياتهم البسيطة البعيدة عن التعقيدات، وسنتحدث فيما يلي عن أهم التقنيات في الناحية.

## ١- تقنية جمع مياه الأمطار

لعب موقع ناحية الكورة في الهضاب الشمالية من الأردن دوراً مهماً وحيوياً في استقبال كميات من الأمطار التي قطعت الهضاب إلى أودية وشعاب كثيرة، وتسرب بعضها إلى باطن الأرض، وظهرت على سطحها على شكل ينابيع تزود بها السكان للاستعمال المنزلي وري الكروم والبساتين، ولا تزال العيون موجودة حتى وقتنا الحاضر، وهي عين دير ابي سعيد وعيون الحمام وعين المخشة وعين التيس وعين البيضا وعين الدالية وعين سيرين وعين زوبيا وعين عميره وعين خشيبات وعين معقر الثور وعين التينه وعين الجرم وحمام أبو ذابله وخلة العين(٦).

أما الأودية الجارية فهي وادي زقلاب، وادي أبو زياد، وادي المادوي أو نبع الجرم ووادي اليابس (الريان حالياً)(٧).

عمل الأهالي على تجميع مياه الأمطار في البرك والآبار التي انتشرت بكثرة في المنطقة من أجل التزود بمياهها في أيام الجفاف، وقد بلغ عدد البرك تسعاً، في حين بلغ عدد الآبار المستخدمة حوالي ٢٨٤ بئراً(٨) لا يزال معظمها موجوداً حتى وقتنا الحاضر.

## ٢- استغلال الثروات الحرجية والصناعات الخشبية

امتازت ناحية الكورة بوجود حراج كثيفة جداً من أشجار السنديان والبطم والخروب والزيتون في قرى تبنة وجنين وكفر الماء وجديتا وبيت ايدس وكفر راكب وعنبه وارحابا وزوبيا(٩)، واعتاد الأهالي استغلال الأشجار الحرجية المحيطة بقراهم لصنع أدواتهم الزراعية، وبناء بيوتهم، وتوفير ما يحتاجونه من الوقود ولكن حكومة شرق الأردن سنّتْ في شهر تشرين الأول/اكتوبر ١٩٢٤ قانون الحراج والغابات للمحافظة على الثروات الحرجية. وصيغ القانون في ٥٠ مادة موزعة على ستة فصول تضمنت تعيين حدود الحراج والغابات التي تشرف عليها دائرة الزراعة والحراج، وعدم السماح بقطع الأشجار أو الرعي في الحراج، أو أخذ النباتات والأحجار والتراب والمواد المعدنية إلا بإذن من إدارة الزراعة والحراج، ومعاقبة كل من يخالف أحكام هذا القانون بالحبس من شهر إلى سنة، أو يغرّم من جنيه إلى خمسة جنيهات عن كل شجرة(١٠).

وسمحت الحكومة بموجب هذا القانون، والقانون الصادر في شهر تموز (يوليو) ١٩٢٧ حول الحراج والغابات(١١) بقطع الأشجار بعد الحصول على رخصة من إدارة الزراعة والحراج وذلك للغايات التالية:

١- صنع الأدوات الزراعية

أ- المحراث البلدي

نصت المادة ١٢ من قانون الحراج والغابات لسنة ١٩٢٧، على أن يتقدم الأهالي بطلب إلى ادارة الزراعة والحراج في حالة حاجتهم لقطع الأشجار لعمل آلات وأدوات زراعية مقابل دفع رسم مقداره ٥٠ ملا لقطع خمس قطع من الحطب لصنع محراث، وقد وجد في الكورة أشخاص متخصصون في صنع المحراث البلدي من خشب البلوط، ولا يزال بعضهم يقوم بصناعته حتى وقتنا الحاضر (انظر شكل ١). والمحاريث نوعان منها ما تجره دابتان (شكل ١)، ومنها ما تجره دابة واحدة (شكل ٢) ويتكون المحراث من الكابوسه والذكر والسكة والناطح والعود والنير والشراع والحواه.

ب- القادم

ويستخدم في نقل المزروعات إلى البيدر بعد حصدها، وخاصة القمح والشعير، وقد صنعه الفلاح بنفسه من خشب الأشجار،



١ . محراث بلدي تجره دابتان يظهر فيه الكابوسه/الذكر، النير، العود، الحواه والشرعة في وسط النير.

(٦) **لوحات دائرة الأراضي والمساحة لناحية الكورة في الفترة ١٩٣٠-١٩٤٠** وهذا لا يشمل بعض الآبار الموجودة داخل القرى لكونها مستثناة من التسوية، كما أنه لا يشمل الأودية الجارية.

(٧) اللوحات رقم ٢٤ تاريخ ٧ كانون ثاني ١٩٤٠؛ رقم١٠ و١١ تاريخ ٢-٥ تموز ١٩٣٩؛ ورقم ١ تاريخ ٢ كانون ثاني ١٩٣٠؛ ورقم ١٩ تاريخ ١ آب ١٩٤٠؛ ورقم ١٧ تاريخ ١٤ آب ١٩٤٠. مديرية تسجيل أراضي اربد.

(٨) المصدر نفسه.

(٩) أُنظر لوحات دائرة الأراضي والمساحة في مديرية تسجيل أراضي اربد.

(١٠) **الشرق العربي:** السنة الثانية، ٧٣ (تشرين أول ١٩٢٤) ص٣؛ ٧٤ (تشرين أول ١٩٢٤) ص٤.

(١١) **الشرق العربي:** السنة الخامسة، ٦١(تموز ١٩٢٧) ص ٥-١٠.

# التقنية الصناعية في الكورة في النصف الأول من القرن العشرين

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## تمهيد

شهد الأردن الحديث في النصف الثاني من هذا القرن تقدماً ملحوظاً في الاعتماد على التكنولوجيا في مختلف النواحي الاجتماعية والمعيشية، حتى بات أبناء هذا الجيل لا يعرفون إلا القليل عما كان عليه الأردن في النصف الأول من هذا القرن، ولا يدرك مظاهر هذا التغيير إلا اولئك الذين عرفوا أحواله في تلك الحقبة الماضية.

ولإعطاء فكرة عن التقنيات في الأردن في تلك الفترة سنتناول فيما يلي ما كانت عليه هذه التقنيات في إحدى مناطقه، وهي منطقة الكورة، معتمدين الأسلوب العلمي في تتبع وسائل الحياة المعيشية لمن عاشها وشكلت جزءاً من صميم حياته، وخصوصاً أن قسماً كبيراً منها هو في طريق الزوال لا بل زال بعضه بالفعل، ولم يعد موجوداً إلا في بعض الآثار الخربة أو على ألسن الكبار.

تناولت الدراسة موضوعات رئيسة هي التعريف بالمنطقة جغرافياً وطبيعياً وإدارياً، ومصادر المياه، واستغلال الثروات الحرجية لصنع الأدوات الزراعية والوقود والبناء، وتقنية انتاج الطعام، وتقنية انتاج الزيت بواسطة أدوات حجرية وخشبية، وتقنية طحن الحبوب بواسطة طواحين يدوية وأخرى مائية وغيرها من التقنيات الأخرى.

وتعد لوحات دائرة الأراضي والمساحة المحفوظة في مديرية تسجيل أراضي اربد للأعوام: ١٩٣٠، ١٩٣٩، ١٩٤٠، ١٩٤٢، والجريدة الرسمية لحكومة امارة شرق الأردن، والمخلفات الأثرية، والجولات الميدانية، من أهم المصادر الأولية التي اعتمدت عليها هذه الدراسة حيث تتمتع هذه المصادر بأهمية كبرى من الوجهتين التاريخية والتقنية.

## الطبيعة الجغرافية

يقع لواء الكورة في المنطقة الشمالية من المملكة الأردنية الهاشمية بين خطي عرض ٣٢,٢٣ - ٣٢,٣٢ شمالاً، وخطي طول ٣٥,٣٥ - ٣٥,٥٠ شرقاً، وتشمل هذه المنطقة الأراضي الواسعة الواقعة ما بين وادي الطيبة ووادي الغفر ووادي الخربة من الشمال، ووادي اليابس ووادي عبدالعزيز ووادي عين البيضا في الجنوب، وبمحاذاة الأغوار في الغرب، والتوغل في الهضاب الشرقية حتى قرى عفنا وسامتا ووادي التفنه ووادي الجرون التابعة لقضاء عجلون في الشرق(١).

ويبلغ طول الناحية من الشمال إلى الجنوب في أقصى اتساع له حوالي ٤٤كم، ومن الشرق إلى الغرب حوالي ٥١كم،(٢) ومن الواضح أن هذه الحدود التي تم تخطيطها للناحية عام ١٩٣٤، هي الحدود نفسها التي حُددت في القرن التاسع عشر والتي تبعت تقسيماتها الادارية قضاء عجلون إبان الحكم العثماني، وشملت الأجزاء الشمالية من جلعاد القديمة -كما أشار إلى ذلك الرحالة يوهان بيركهارت الذي زار المنطقة عام ١٨١٥- واشتملت على مجموعة من القرى المأهولة بالسكان وهي تبنة وعنبة ودير أبو سعيد وزمال وكفر ابيل وكفر عوان وبيت راس وخنزيره (الأشرفية) وكفر راكب وكفر الماء(٣).

تبدأ المنطقة بالارتفاع من الناحية الغربية حوالي ٦٠م عن سطح البحر عند قرية طبقة فحل، ثم تتدرج بالارتفاع كلما اتجهنا شرقاً حتى تصل إلى أقصى ارتفاع لها حوالي ٩٣٥م عن سطح البحر في مرتفعات زوبيا(٤)، وهي بصفة عامة شديدة الوعورة، كثيرة الهضاب والأودية، تغطي معظمها غابات كثيفة جداً من شجر البلوط والسنديان واللوز البري والخروب والبطم والزيتون، كما اشتهرت بسهولها الخصبة التي اعتبرت أساس محصولها الشتوي وخضارها الصيفية، وكثرة ينابيعها الجارية طيلة شهور الصيف، حيث يتحول بعضها إلى أودية جارية(٥) يُستفاد منها في ري بساتين الكرمة والرمان والتين، وإدارة الطواحين المائية ولا يزال

(١) **خارطة دير أبو سعيد ٤**: رسم محمد علي الكردي، طبعت عن خارطة سوريا وفلسطين عام ١٩٣٤، مساحة فلسطين، محفوظة في متصرفية الكورة.

(٢) المصدر نفسه.

(٣) يوهان بيركهارت: **رحلات بيركهارت في سوريا الجنوبية**. ترجمة أنور عرفات، المطبعة الأردنية المجلد ٢ (١٩٦٩) ص٤٢.

(٤) **خارطة دير أبو سعيد.**

(٥) أُنظر **لوحات دائرة الأراضي والمساحة الخاصة بناحية الكورة في الفترة ١٩٣٠-١٩٤٠**، محفوظة في مديرية تسجيل أراضي اربد؛ سليمان الموسى: **في ربوع الأردن: من مشاهدات الرحالة ١٨٧٥-١٩٠٥**. عمان: ١٩٧٤، منشورات دائرة الثقافة والفنون،الطبعة الأولى، ص ١٦٥.

أوراقه قفاف مشبكة الأسافل والجوانب.
**الأفراد:** وهي أوعية تتخذ من الخوص، وهو لفظ شائع الاستعمال بين العامة في مصر.
**المنخل:** ويستخدم لتصفية عصير العنب.
**البهو:** وهو حوض مبني ينزل فيه ما يستخلص من عصير القصب.
**اليقاطين:** وهي ثمار مستطيلة أو مستقيمة أو منحنية إذا نضجت، تستعمل قشرتها أوعية للسوائل وتوضع في كل قرعة خشبة منجورة طويلة كالساعد نافذة من جانبي القرعة بداخلها أكسية للصوف لتصفية السكر.
**الدسوت النحاسية:** أواني واسعة الفوهة، أغلبها بدون رقبة وقد تكون له عروتان ويطبخ فيها عصير القصب بعد تصفيته.
**الكرانيت:** وهي المغارف، وهي لفظ عامي شائع الاستعمال في مصر. والكرانيت في اللغة مفردها كرنية وتعني المغرفة المصرية.

الحجر العلوي بشكل عمودي، بحيث يكون الحجر السفلي افقياً وثابتاً بينما يتحرك الحجر العلوي الذي يكون في وضع عمودي. وفي كثير من الأحيان يوضع حجرين عموديين بدلاً من حجر واحد.

ويستقبل العصير الناتج من هذه العملية في أوعية مخصصة له. ثم ينقل بإحدى الطريقتين اللتين سبق ذكرهما الى قسم آخر من أقسام المصنع، حيث يطبخ ويغلى ليصب في النهاية في قوالب مخروطية ليصبح على شكل أقماع من السكر.

أما الأواني التي استخدمت في صناعة السكر والتي أطلق عليها مصطلح «أواني السكر» (Suger Pots)، فمن خلال الأعمال الأثرية التي سبقت الاشارة اليها تم العثور على أعداد كبيرة من الفخار الذي اقترنت تسميته بصناعة السكر في عدد كبير من المواقع التي جرت بها حفريات أو مسوحات اثرية. وقد أشير الى هذا الفخار، سواء عثر عليه كسراً أو كاملاً على أنه أوان للسكر دون دراستها بشكل مستقل، وقد تمت دراستها كنوع من أنواع الفخار، وساعد على عدم الاعتناء بدراسة هذا الفخار تشابهه في الاماكن المختلفة وقد أشار الباحثون عند تناولهم لتقنية صناعة أواني السكر إلى أنها مصنوعة بواسطة الدولاب أو اليد والدولاب معاً، وتأخذ شكلاً موحداً يؤدي غرضاً وظيفياً هو تصنيع السكر، لذلك فقد خلت سطوحها من أي زخارف بسبب طبيعتها الوظيفية وتعرضها للكسر والتلف، وقد أمكن التعرف على نوعين رئيسين من هذه الأواني: الأولى المخروطية، وتتخذ شكل القمع (Bell Shape)، ويتسع هذا الاناء في أعلاه بقطر يتراوح بين ٣٠-٤٤ سم ويضيق باتجاه القاعدة لينتهي بثقب مستدير في قاعدته يتراوح قطره بين ١,٥-٤سم وتتراوح سماكته جدرانه بين ٢-٣سم، وهي خشنة من الخارج وملساء من الداخل، ويتراوح ارتفاعها بين ٢٠-٣٠سم. واحتوى سطح الإناء في كثير من الأحيان على خطوط متموجة ومستقيمة، ظهرت على شكل مضلعات على جسم الإناء الداخلي والخارجي من فوهته إلى قاعدته، واحياناً تظهر هذه التموجات في بعض أجزاء الجسم الأمر الذي يدل على أن الصانع قد استعمل الدولاب كما استخدم يده في الضغط على جدران الإناء لوجود علامات الأصابع على سطحية. أما النوع الثاني فهو الأواني التي تتخذ شكل الجرار بدون العراوي (Bag Shape)، ذات قاعدة مسطحة أو مضغوطة الى الداخل بقطر يتراوح بين ٨-١٠ سم، منتفخة البطن، ولها رقبة وعنق دقيق بقطر يتراوح بين ١٠-١٤ سم، ويتسع أسفله ويضيق باتجاه الحافة، وتتراوح سماكة جدرانها بين ٢-٣سم، ويبلغ ارتفاعها بين ٢٥-٣٥سم، ولقد احتوى سطح الاناء في كثير من الاحيان على خطوط متموجة ظهرت بشكل مضلعات على جسم الإناء الخارجي من فوهته وحتى قاعدته، واحياناً تظهر في بعض انحاء الجسم الداخلي والخارجي، وشكل وعجينة هذه الانواع متشابهة وحوافها مختلفة، فاحياناً تكون مستقيمة أو مثنية الى الخارج أو دائرية.

وهكذا، فإن المسوحات الأثرية، إضافة الى العمل الميداني فيما يخص أواني السكر، يوضح تعدد أشكال الأواني الفخارية التي استخدمت في هذه الصناعة، ولا بد أن ندعم ما سبقت الاشارة اليه ببعض مما أوردته المصادر التاريخية عن هذه الأواني. ولعل أول ذكر لها ولاستعمالها في تلك المصادر قد جاء من قبل المؤرخ النويري عام ١٣٣٢م، حيث ذكر نوعين من الأواني التي استخدمت في المراحل النهائية في عمليات التصنيع وهي:

**الأباليج:** الكلمة المرادفة لـ (Bell Shape)، وهي أوان مصنوعة من الفخار ضيقة من الأسفل ومتسعة من الأعلى، مثقوبة في قاعدتها بثلاثة ثقوب، وتختلف من حيث الحجم والسعة، ووظيفتها هي تقطير ما يتخلص من عصير القصب.

**القواديس:** الكلمة المرادفة لـ (Bag Shape) وهي جرار فخارية استخدمت لجمع عصير القصب بعد تصفيته، بحيث يتم وضع الابلوجة فوق القادوس لتقوم بعملية التقطير. كما استخدمت القواديس لاخراج الماء من السواقي، ووظيفة القواديس واحدة وان إختلفت الأسماء وتعددت بين المصادر التاريخية والأثرية، حيث يوضع الإناء المخروطي الذي يأخذ شكل القمع ليقوم بتقطير ما يتخلص من عصير القصب، وتجميد ما يتبقى ليخرج على شكل مخروطي فوق الجرار، ويصب السكر المطبوخ فيه (شكل ١٢). وهذه الأواني لها وظيفتان الأولى: دعم الاناء المخروطي (الذي يقوم بوظيفة القالب) اثناء عملية التقطير والتجميد. والثانية: جمع عصير القصب أثناء التقطير أو الترشيح، وهذا النوع يستخدم لأغراض أخرى غير أغراض تصنيع السكر كأن يجمع بها الماء أو تخزين الحبوب، ويعود هذا الشكل بتاريخه الى الفترات الكلاسيكية ولكن لأغراض أخرى غير إستخدامه لتصنيع السكر(٢٩) بينما لا تستخدم الأواني المخروطية إلا لأغراض هذه الصناعة التي لا تدوم طويلاً بسبب تعرضها للكسر أثناء إستخلاص السكر المتجمد منها، ولقد زودنا النويري بمعلومات كثيرة عن أدوات كانت تستخدم في صناعة السكر إضافة الى الأدوات السالفة الذكر، ومن بينها:

**الخابية:** وهي جرار من الفخار تختلف أحجامها وتعتبر الوعاء الذي يصب فيه عصير القصب بعد تصفيته.

**الدنان:** وهي الأواني التي يستقر فيها عصير القصب بعد تصفيته للمرة الثالثة من اليقاطين. وقد عرّفها العش بأنها نوع من أنواع الجرار كبيرة الحجم ومنتفخة البطن ولها رقبة وعروتان أو أكثر، وقد كانت مخصصة لحفظ الخمر أو الخل.(٣٠) بينما يذكر جيرار في موسوعة الحياة الاقتصادية في مصر أن الدنان جرار كبيرة الحجم مخصصة لصنع النيلة والسكر.(٣١).

**السكاكين:** وهي كبيرة الحجم مصنوعة من الحلفاء، والحلفاء نبات محدد الأطراف كأنه سعف النخيل أو الخوص، وتصنع من

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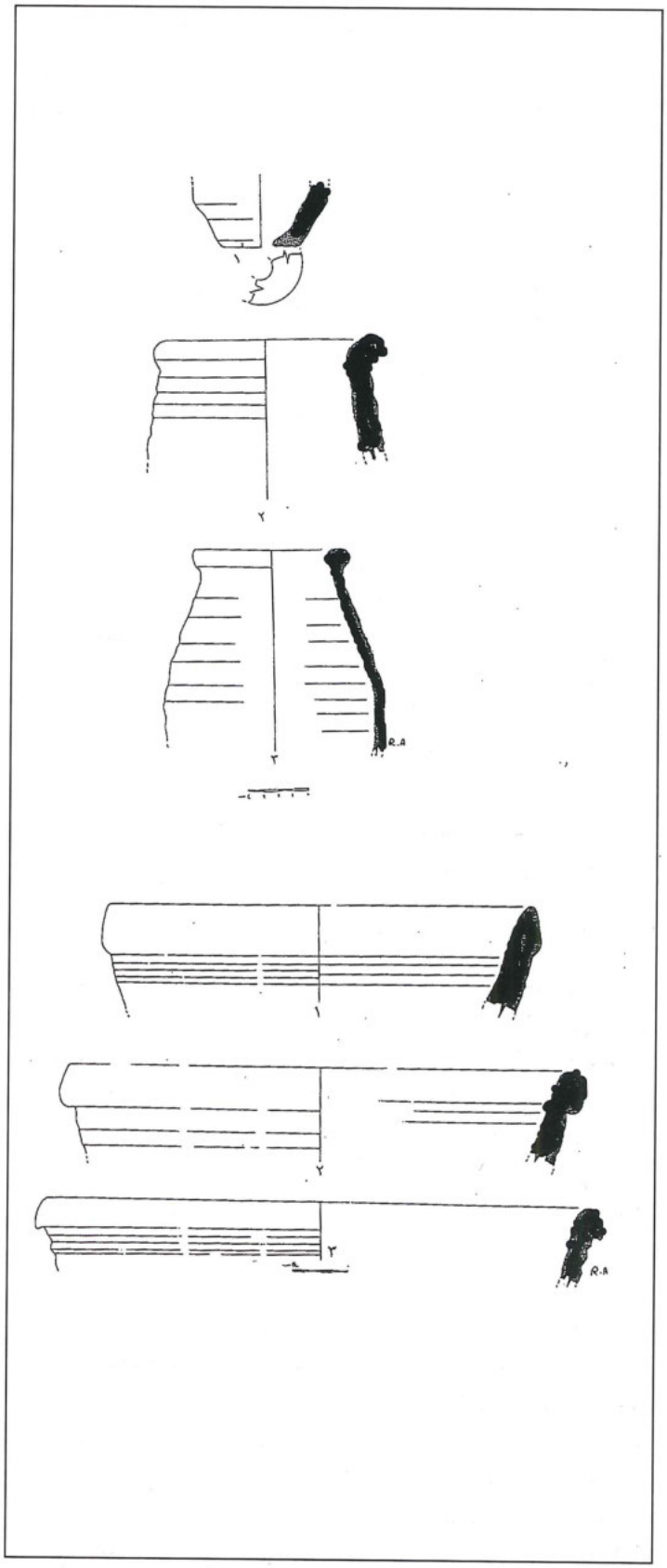
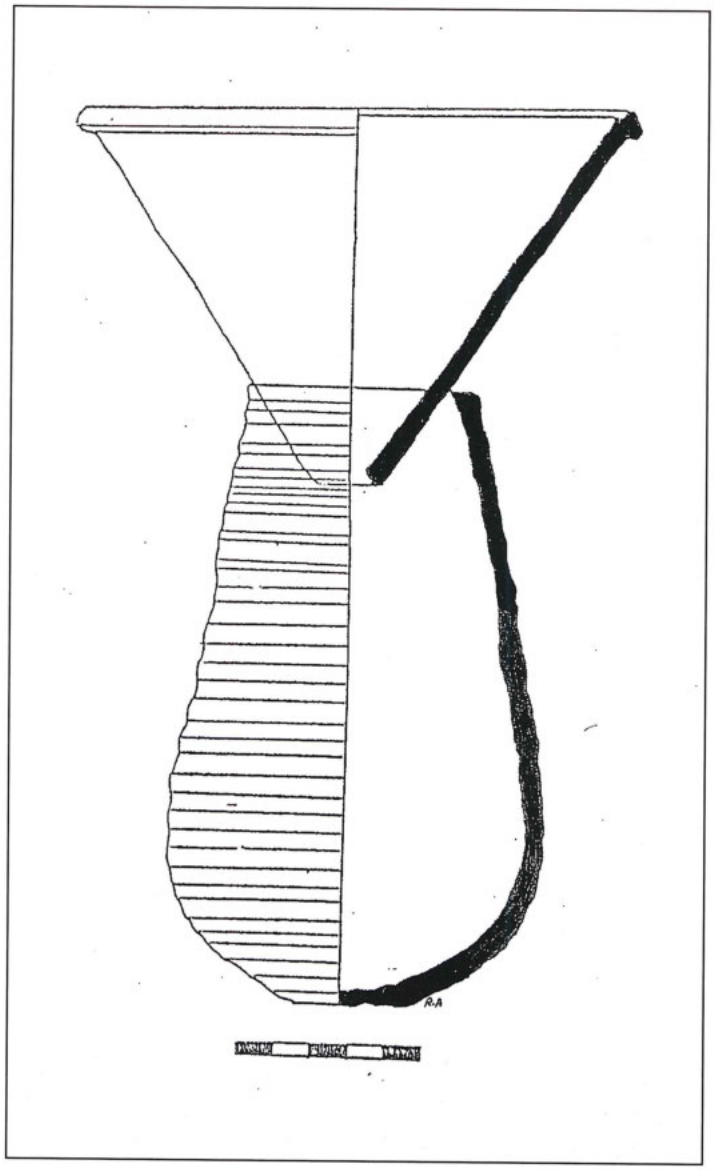
(٢٩) T. Schioler, *Roman and Islamic Water Lifting Wheels*, (Odenese, 1973).

(٣٠) أبو الفرج العش، «الفخار الغير مطلي في العهود الاسلامية»، **حولية دائرة الآثار السورية** ١٠ (١٩٦٠)، ص ١٤٨.

(٣١) س. جيرار، **موسوعة الحياة الاقتصادية في مصر في القرن الثامن عشر هجري**، ترجمة زهير الشايب، (مصر، ١٩٧٥)، ص ١٦٧.



١١ . كسر لأواني السكر من ضرار.



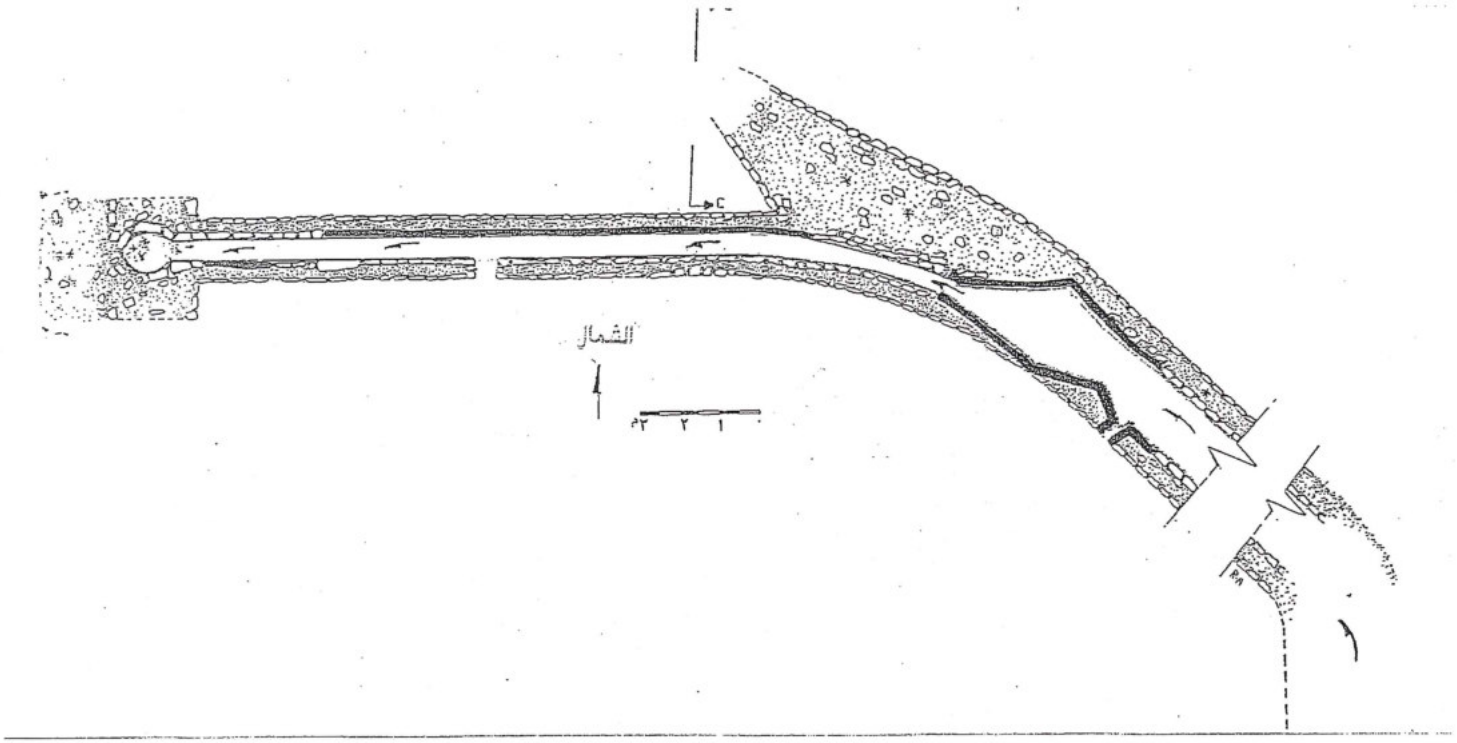
١٢ . وظيفة أواني السكر.

المياه المثبت بشكل عمودي.(٢٨)

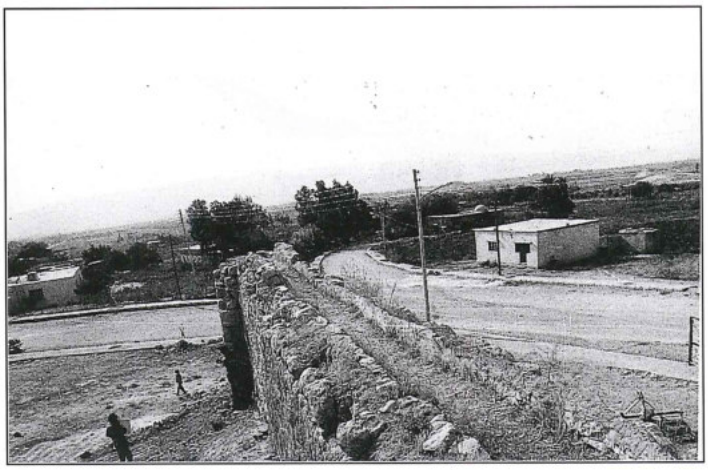
أما قوة المياه المتدفقة في الحالة الثانية والثالثة فهي قوة غير مباشرة، حيث تقوم المياه بتحريك الدولاب العمودي الذي يقوم بدوره بتحريك حجر العصر عن طريق الدواليب المسننة، وتعتمد سرعة حجر العصر على كمية المياه، وقوة دفعها وسرعتها، وعلى دواليب المياه ونوعها، ووزن حجر العصر أو الطحن.

وحجر العصر أو الطحن عبارة عن حجر دائري من البازلت أو الصخر المنحوت مثبت إما بشكل أفقي، حيث يوضع الحجران فوق بعضهما والحجر الموضوع في الأسفل يبقى ثابتاً بينما يتحرك الحجر العلوي وتدخل اعواد القصب فيما بين الحجرين، ويتفاوت مقدار الضغط أو العصر الذي تتعرض له الأعواد تبعاً لتفاوت درجة إقتراب هذين الحجرين من بعضهما. وفي بعض الأحيان يوضع

(٢٨) R. J. Forbes, 'Sugar and its Substitutes in Antiquity', in *Studies in Ancient Technology*, vol. V, pp. 78-103.




٩ . المخطط الأفقي لمعصرة ضرار.



١٠ . القناة والبرج في ضرار.

وجود بقايا معمارية في الموقع مثل دير علا، وتل الشونه الشمالي، وتل فندي، وتل الأربعين، وتل أبو صربوط.

٣- أعمال التجريف الزراعي وفتح الطرق والبناء الحديث التي قضت على الكثير من هذه المعاصر.

٤- إعادة بناء بعض هذه المعاصر لإستخدامها في استعمالات أخرى مثل طحن الحبوب.

وبالرغم من أن هذه العوامل تجعل من الصعب تحديد عدد هذه المعاصر، الا أن المحاولات قد نجحت وحدد حمارنة عددها بـ ٣٢ معصرة(٢٥) وقد أُخذ بهذا الرأي العديد ممن جاؤوا بعده،(٢٦) أما خوري فقد حدد عددها بحوالي العشرين على الأقل.(٢٧)

**ما بينته المواقع التي تم العمل بها**: لما كانت المعاصر المدروسة موجودة على ضفاف الأنهر وبجانب الينابيع والوديان فإن مبدأ عملها كان يعتمد على المياه التي تقوم بتحريك الدواليب الأفقية أو العمودية لتشغيل حجر الطاحون أو العصر المثبت بها إما بشكل مباشر أو عن طريق المسننات، وهذا تحدده قوة دفع المياه وسرعتها. فحجر الطحن أو العصر يتحرك بواسطة دولاب المياه المصنوع من الخشب الصلب والحديد الذي يتحرك بدوره بواسطة المياه التي تصله بواسطة ثلاث طرق:

١- الماء المتدفق من فوهة قناة أفقية مرتفعة تختلف إرتفاعاتها باختلاف مستوى منسوب المياه الذي يأتيها من النبع أوالوادي، وقوة المياه المتدفقة تكون مباشرة على حجر الطحن أو العصر، وإرتفاع منسوب المياه يتناسب تناسباً طردياً مع قوة دفع المياه.

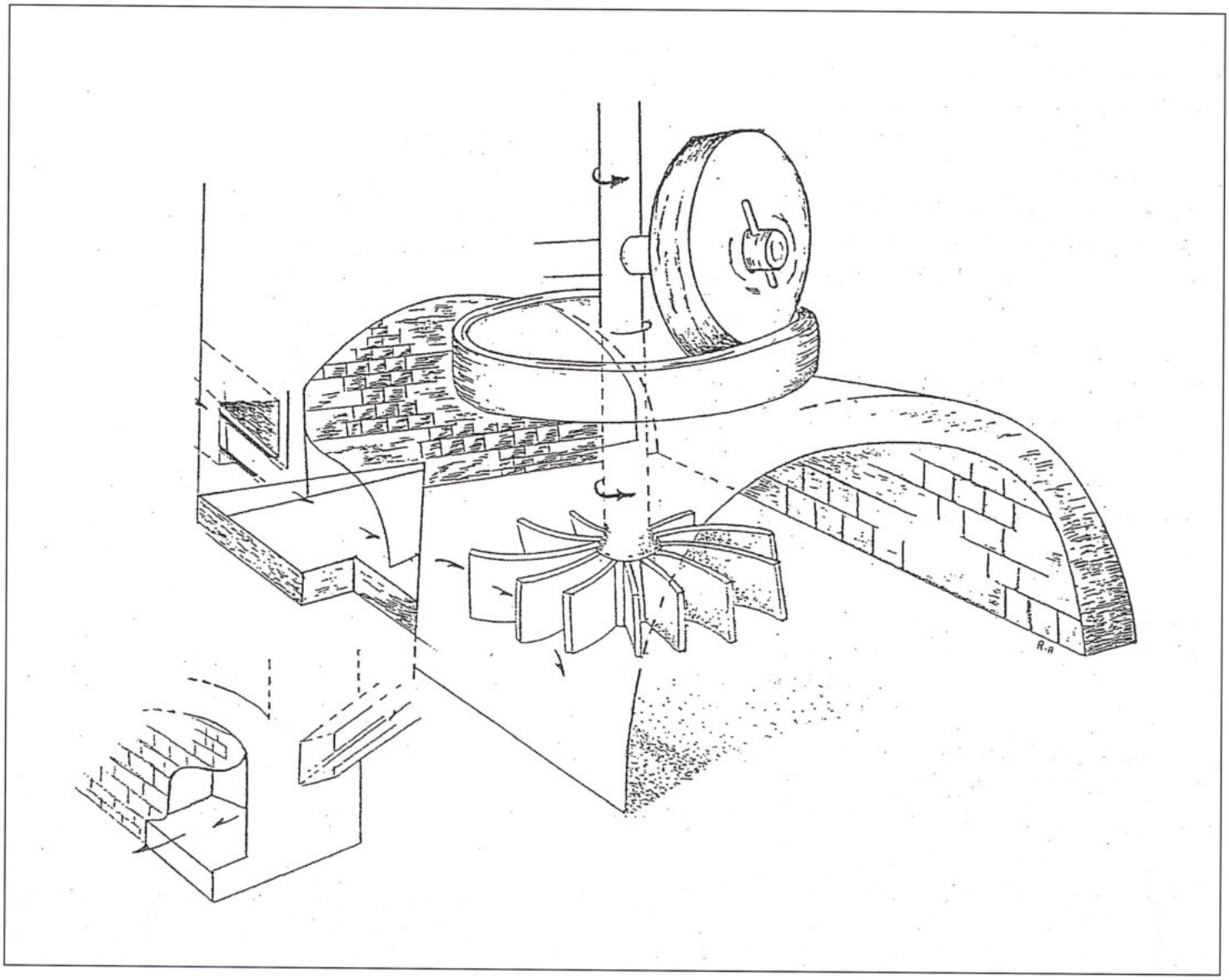
٢- المياه المتدفقة من مرتفع ليمر عبر قناة معلقة لتنزل من فوهة القناة مباشرة فوق دولاب المياه المثبت بشكل عمودي.

٣- المياه الجارية بقوة عالية في النهر أو الوادي من أسفل دولاب

(٢٥) حمارنة، «صناعة السكر عند العرب»، ص ١٥.

(٢٦) A. Hassan and D. R. Hill, *Islamic Technology: An Illustated History*, (New York, 1988); J. Kareem, *Evidence of the Umayyed Occupation in the Jordan Valley as Seen in Jiser Sheikh Hussein Region.* Unpublished M.A. Thesis, Institute of Archaeology and Anthropology, Yarmouk University 1987, p. 47.

(٢٧) R. Khouri, *The Jordan Rift Valley and Society Below Sea Level*, (New York, 1981).



٨ . الافتراض الأول: رسم توضيحي يبين آلية العمل في معصرة تل السكر.

الأجنحة يدير حجر العصر بصورة أفقية.

بالإضافة الى المواقع التي سبق ذكرها، هناك مواقع اخرى تمت زيارتها، الا ان دراستها بشيء من التفصيل لم يكن أمراً سهلاً بسبب إختفاء الكثير من معالمها وقد اقتصرت نتائج زيارتها على ملاحظات عابرة، ومن هذه المواقع: الراسية الجنوبية موقع (٢٨)، تل أبو البسة موقع رقم (٩)، تل أبو القوس موقع رقم (٢٩)، الساسية موقع رقم (٨)، خربة المرقعة موقع رقم (١٤)، خربة سليخات موقع رقم (٢٥).

## تحليل تقنية الصناعة

من خلال البقايا المعمارية التي تمت دراستها في كل من تل السكر وضرار وكريّمة، واعتماداً على ما توفره المصادر التاريخية والمكتشفات الأثرية القليلة أمكن التوصل الى أن معاصر السكر بنيت على ضفاف الأنهار أو بجانب الينابيع وذلك لما تحتاجه هذه الصناعة من مياه ري القصب وتحريك الدواليب، لذلك نرى على امتداد وادي الاردن ٣٤ موقعاً عرفت حتى الآن ووجدت فيها معاصر للسكر، اعتماداً على نتائج المسوحات الاثرية السابقة (شكل ١) الا أن عدد المعاصر يبقى غير معروف على وجه التحديد وذلك لاسباب أهمها:

١- هناك العديد من المواقع تم ذكر وجود أكثر من معصرة فيها دونما تحديد لعددها، ومن هذه المواقع تل أبو القوس،(٢٣) وفي منطقة وادي اليابس موقع رقم ٣٢.(٢٤)

٢- ذكر العديد من المواقع التي عثر فيها علي أواني السكر دون

(٢٣) Glueck, *Explorations in Eastern Palestine IV*, p. 235.

(٢٤) Marby and Palumbo, 'The 1987 Wadi el-Yabis Survey', p. 95.

الشرقية ويقع جزء منها على وادي كفرنجة، ويتكون من بناء حجري مع أقواس إضافة الى معصرة في الجهة الشمالية مبنية بحجارة تظهر مشذبة في أسفلها، وقد رممت فيما بعد بالاسمنت في محاولة لاصلاح ما تهدم أو بناء ما هو ضروري من خدمات حديثة مما شوه طابع البناء وطمس معالمه ولم يبق واضحاً سوى قنوات المياه التي تستمر باتجاه الشرق على الجهة الجنوبية من وادي كفرنجة، ولكن آثارها غير واضحة بسبب البناء الحديث في المنطقة والذي غطى على معظم آثارها، لذلك كان من الصعب تتبعها لمعرفة طولها.

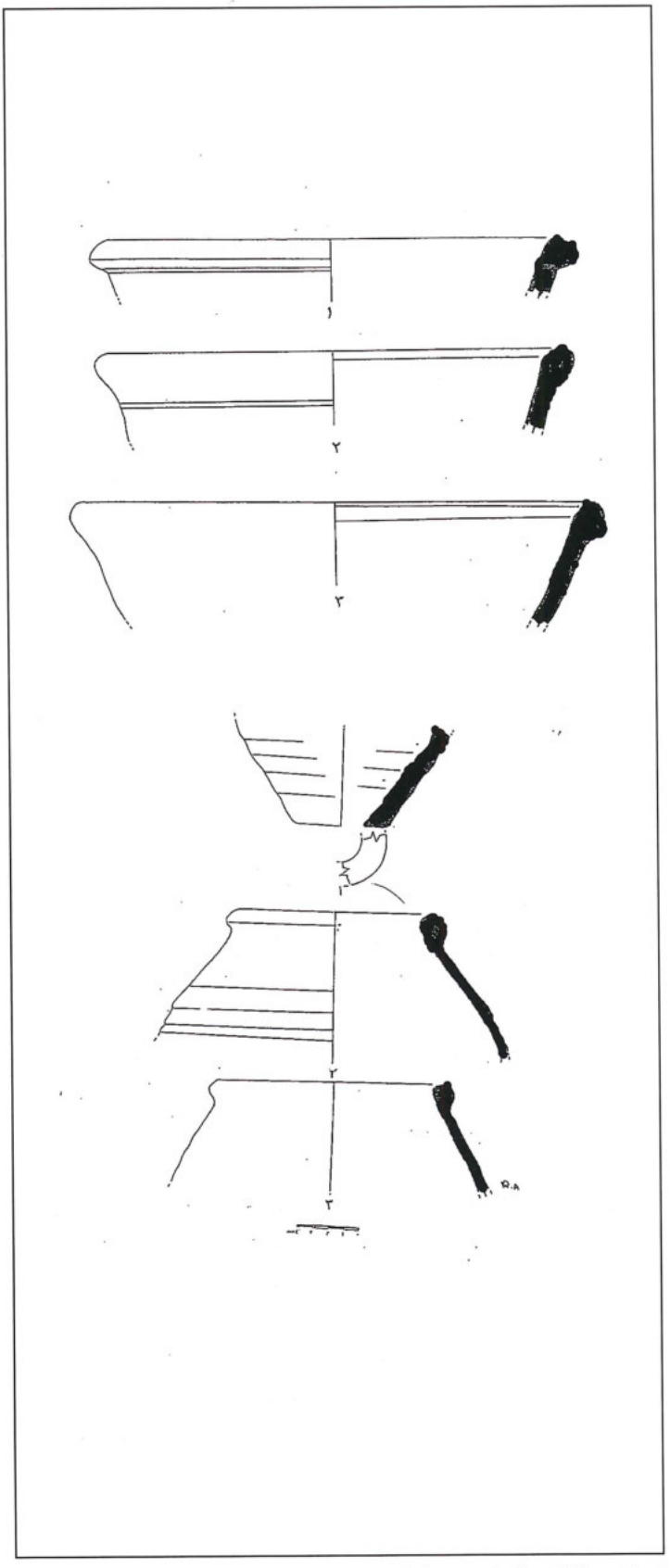
**المخلفات الأثرية:** تتوزع قطع من حجر العصر المكسّر الذي نحت بالصخر في جهات مختلفة، ولقد وجدت كسرتان من حجر العصر الأفقي، واحدة في الجهة الشمالية الشرقية والأخرى في الجهة الغربية من المعصرة، أما حجر العصر العمودي فقد وجد كاملاً ما بين المعصرة والقناة المحمولة على قناطر، وتم العثور على بعض الأواني التي تم استخدامها في عمليات تصنيع السكر وقد اتصفت بالعجينة الخشنة والجيدة الشيّ المحتوية على شوائب متوسطة وكبيرة الحجم.

أما طريقة عمل المعصرة فمن الصعب تتبعها وذلك بسبب ضياع الكثير من معالمها، وأما مجرى المياه فقد كان تتبعه سهلا وهو ما سبقت الاشارة اليه.

**ضرار:** موقع رقم (٣٠): تقع قرية ضرار الى الجهة الشمالية من دير علا، وتبعد ٢كم الى الشرق من الشارع الرئيسي، وقد ذُكر الموقع لأول مرة اثناء المسح الأثري الذي قام به ابراهيم وساور وياسين عام ١٩٧٦حيث تم تأريخه الى الفترة الأيوبية–المملوكية.(٢٢)

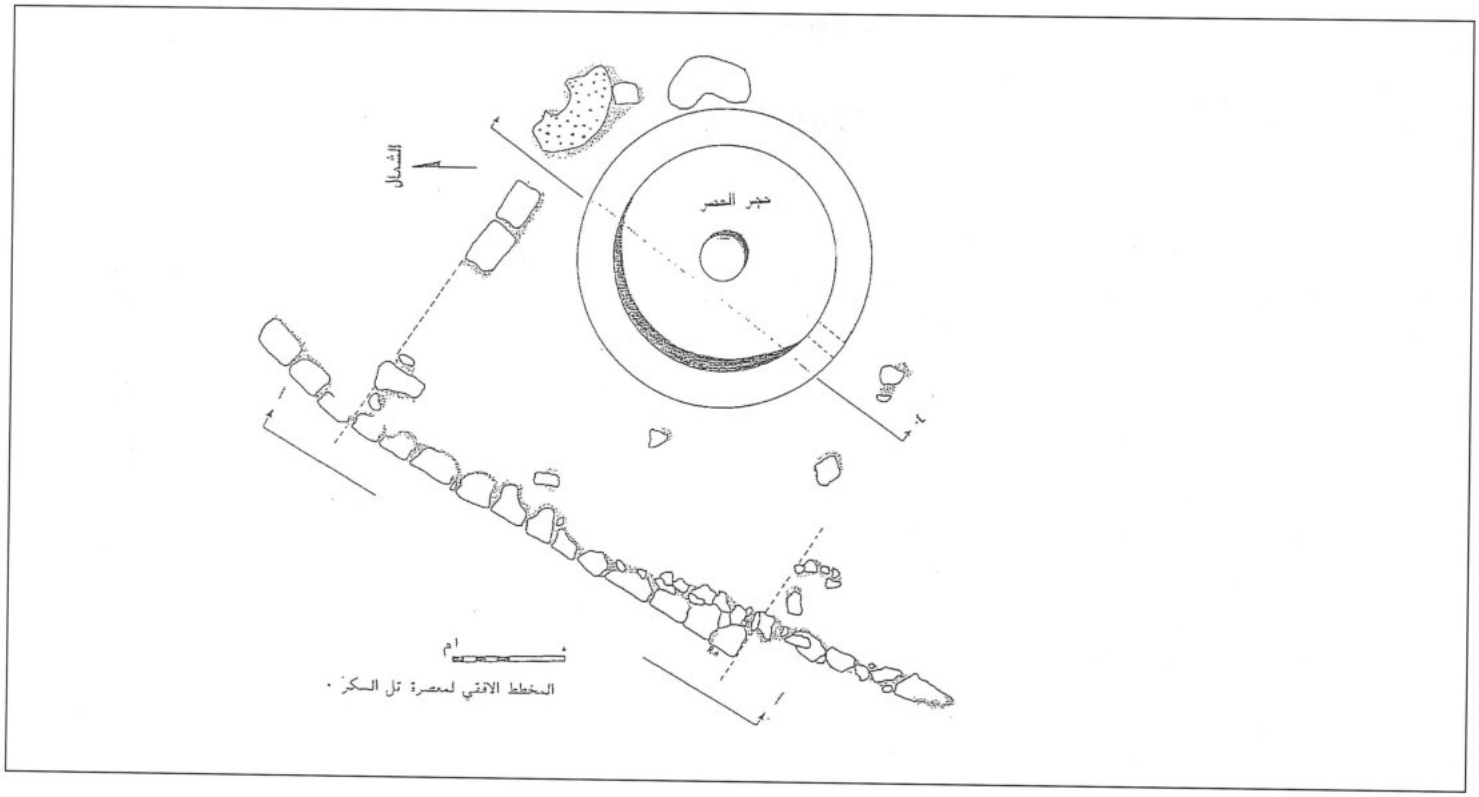
وقد وجدت في وسط القرية معصرة قديمة تدار بواسطة شلال من الماء يأتيها من سفح الجبل (شكل ٩) ولم يبق من آثارها سوى قناة المياه التي بنيت بشكلٍ منحنٍ من الحجارة الجيرية بطول حوالي ٤٥م (شكل ١٠) لتصب المياه المتدفقة عبر قناة داخلية الى بناء واسع معقود غير واضح المعالم بسبب ردمه واختفاء الكثير من آثاره، وذلك أثناء القيام بعمليات فتح الطريق في المنطقة، التي اضاعت الكثير من المعالم وخاصة المعاصر، حيث ذكر أهل القرية وجود ثلاث معاصر في الموقع لم يبق منها سوى معصرة واحدة مع بعض الآثار المتبقية، التي يعتقد انها تعود الى بقايا المصنع، وقد استمر إستخدامها حتى سنة ١٩٦٧م، لكن كمطحنة للقمح.

**المخلفات الأثرية:** تم العثور على العديد من القطع الفخارية من النوع المعروف بأواني السكر، تم توثيق بعضها بالرسم (شكل ١١) وكان واضحاً أنها لا تختلف عن النماذج السابقة التي تمت الإشارة اليها، اما طريقة عمل المعصرة فهي مشابهة لطريقة العمل في معصرة تل السكر، إلا ان قناة المياه والبرج قد اختلفت، وبالتالي فإن قوة دفع المياه كانت أكبر بسبب ارتفاع منسوب المياه الذي ينزل عبر قناة أفقية من فوهة ضيقة الى دولاب مياه أفقي



٧ . كسر لأواني السكر من تل السكر.

(٢٢) Ibrahim *et al.*, 'The East Jordan Valley Survey 1976', p. 169.




٦ . المخطط الأفقي لمعصرة تل السكر.

البازلتية التي انتشرت في أنحاء متفرقة من المعصرة. أما عن طريقة عمل هذه المعصرة فهناك احتمالين.

الاحتمال الأول: حيث يوضع القصب المقطع تحت الحجر، ويدور عليه الحجر الموضوع بشكل عمودي بواسطة قضيب يصل حجر العصر بدولاب المياه فيعصره لينزل من ثقب في جانب حجر العصر المثبت على البناء المعقود (شكل ٨)، أما المياه فتنزل عبر قناة داخل البناء المعقود لتصل الى المزارع المجاورة.

الاحتمال الثاني: عن طريق جوز من التروس المسننة متصلة بدولاب عمودي بواسطة قضيب أفقي يصل الدولاب بالترس المسنن الأفقي، ليتصل بدوره مع الترس المسنن العمودي الذي يحرك حجر العصر. ويبقى الاحتمال الأول هو الأقرب للصحة، ويعود ذلك لعدد من الأسباب أوضحتها البقايا المعمارية في الموقع وهي:

١- وصول المياه الى المعصرة عن طريق نبع الى الغرب من الموقع ونبع آخر في طبقة فحل لتجري عبر قناة ما زالت بعض بقاياها واضحة، وهذه القناه موجودة داخل البناء المعقود الذي لا يمكن وضع دولاب أفقي في داخله، أما إمكانية وضع الدولاب خارج البناء فلا يوجد من البقايا المعمارية ما يدل عليها.

٢- وجود الترسبات الكلسية المتكونة من جراء جريان المياه داخل البناء المعقود وبالتحديد على الجدار الشرقي الذي هو امتداد لمجرى المياه بسمك يتراوح بين ٥ - ١٧ سم، دليل على سقوط المياه داخل المبنى وليس خارجه، والبناء لا يتسع لوجود دولاب مياه أفقي.

٣- القناه الموجودة داخل البناء هي قناة مائلة ذات فوهة ضيقة تسقط المياه منها على دولاب أفقي، بسبب انخفاض مستوى منسوب المياه.

**كريّمة الجنوبية:** موقع رقم (٢٧): تقع بلدة كريّمة على الشارع الرئيسي عبر الضفة الشرقية لوادي الأردن، على بعد حوالي ٣ كم شمال مقام الصحابي أبي عبيدة وتغذي المنطقة مياه وادي كفرنجة بواسطة قنوات الى الجهة الشمالية.

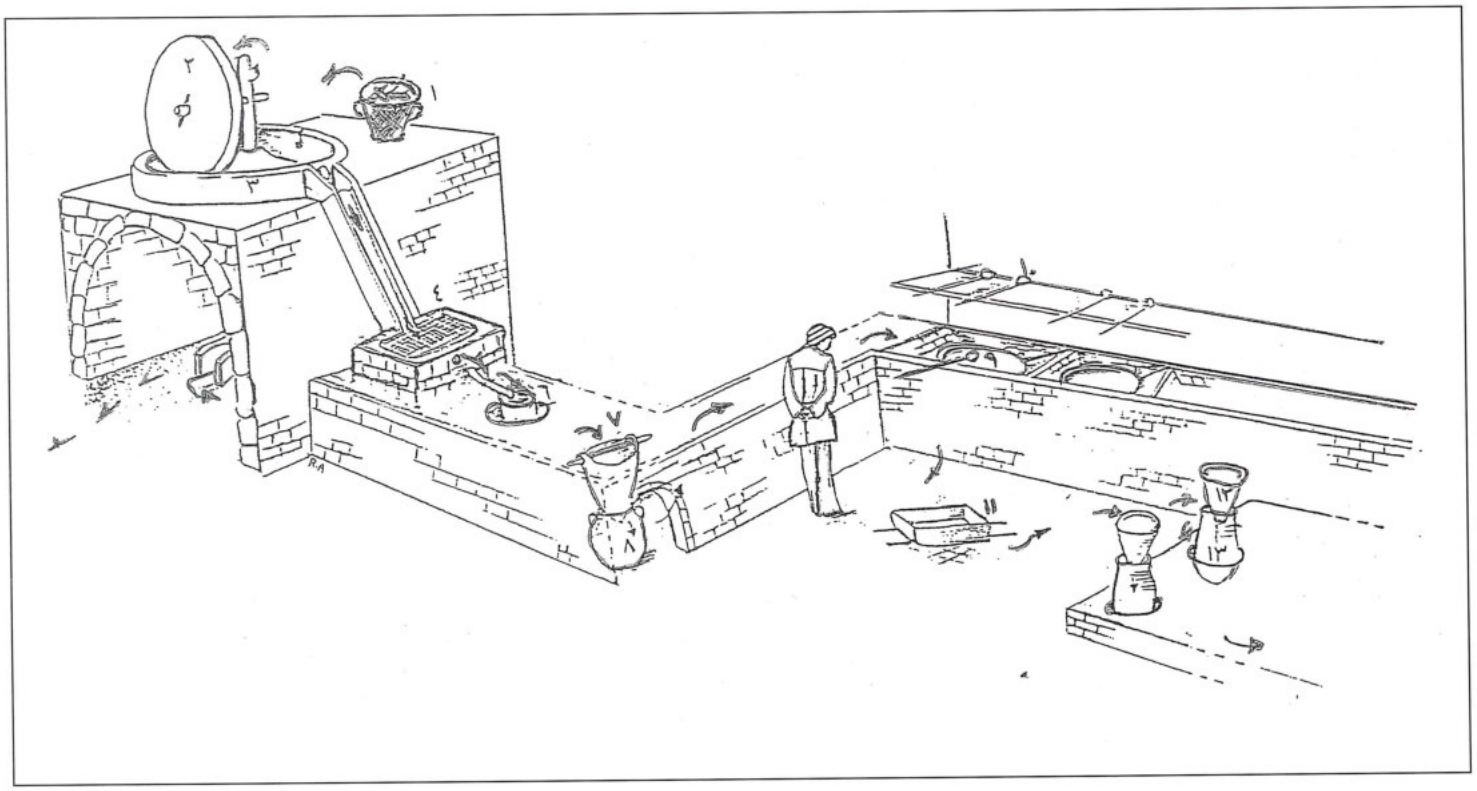
وقد ذكر جلوك هذا الموقع وأرجعه الى الفترات الإسلامية دونما تحديد، واكتفى بذكر مصطلح (Medieval period)، أما ابراهيم وساور وياسين(١٩) ومن خلال مسحهم لمنطقة وادي الأردن فقد أرخوه الى الفترات الرومانية المتأخرة والأيوبية-المملوكية، كما تم تأريخ أواني السكر التي وجدت في الموقع الى الفترات الأيوبية-المملوكية. بينما أعادها مجاهد المحيسن من خلال المسح الذي أجراه الى الفترات الرومانية المتأخرة والبيزنطية والأموية والايوبية-المملوكية.(٢٠) وقد أشار صالح حمارنة الى هذه المعصرة في بحثه عن زراعة قصب السكر وصناعته.(٢١)

**الأبنية الموجودة:** توجد قناة محمولة على قناطر في الجهة الشمالية

(١٩) Ibrahim *et al.*, 'The East Jordan Valley Survey 1976', p. 169.

(٢٠) Muheisen, 'A Survey of Prehistoric Cave Sites'.

(٢١) حمارنة، «صناعة السكر عند العرب»، ص ١٧.



٣ . رسم توضيحي لآلية عمل مصانع السكر كما شرحها النويري.



٤ . معاصر تل السكر.



٥ . البناء المعقود في معصرة تل السكر.

طبقة فحل نابع من وادي الجرم، من بناء واسع معقود على إرتفاع يقارب ٢م مبني من الحجارة بشكل منظم، وتقوم المعصرة الرئيسة في الوسط وتتكون من حجر العصر الدائري الشكل، وفيها ثقب على جانبه لينزل السائل، وآخر في الوسط لتحريك الدولاب، أما بقايا مجرى المياه فقد وجدت داخل البناء المعقود من زاويته الشرقية، حيث توجد ترسبات كلسية على الجدار الشرقي الملازم لمجرى المياه، الأمر الذي يدل على مرور المياه من هذا الاتجاه. ولقد أشار صالح حمارنة لهذه المعصرة والى وجود حوض معصرة من الحجر كان يستخدم لهذه الصناعة، ولكننا لم نعثر على آثاره اثناء قيامنا بالبحث.(١٨)

**المخلفات الأثرية:** تم العثور على العديد من القطع الفخارية من النوع المعروف بأواني السكر والتي اتصفت بسماكة جدرانها واحتوائها على شوائب بحجم متوسط من البازلت والحجر الجيري (شكل ٧).

وقد وجدت بقايا حجر العصر المصنوع من البازلت بجانب حجر العصر المثبت فوق البناء المعقود، اضافة الى بعض الحجارة

(١٨) صالح حمارنة، «صناعة السكر عند العرب»، **حولية دائرة الآثار العامة** ٢٢ (١٩٧٧-١٩٧٨)، ص ١١-٢٢.

ربى أحمد أبو دلو

# تقنية معاصر السكر في وادي الاردن خلال الفترات الاسلامية *

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ناول هذه الدراسة تقنية معاصر السكر التي جرى توثيقها راستها عبر مجموعة من الأعمال الأثرية التي قامت بها بعثات ختلفة في المنطقة الممتدة ما بين نهر اليرموك شمالاً وحتى البحر الميت نوباً، وكذلك تشمل عرضاً للنتائج التي تم الوصول اليها من خلال مل الميداني الذي قامت به الباحثة خلال الفترة ما بين ١٩٨٩-١٩٩٠م في مجموعة من المواقع التي سترد الاشاره الى بعضها.

ولقد كان واضحاً من خلال الأعمال السابقة أن تناول هذا وضوع أثرياً - دون التركيز على ما توفره المصادر التاريخية هو ر متعذر، ومن هنا تقوم منهجية الدراسة على الربط نظرياً ما بين يمكن استخلاصه من المصادر والمراجع التاريخية ونتائج عمال الأثرية، مما يساعد على الربط والتحليل والتفسير.

فمن خلال إشارات وردت في المصادر التاريخية تبين لنا أن المنطقة وضوع البحث قد عرفت كمنطقة زراعية مهمة توفرت فيها كل ومات الإنتاج الزراعي ونجاحهُ من خصوبة الارض وتوفر المياه سلاحية الطقس، ولهذا السبب عرفت منطقة وادي الاردن كمنطقة ستقرار بشري منذ أقدم العصور، وهو الأمر الذي تأكد بصورة جلية خلال المكتشفات الأثرية في مختلف المواقع في وادي الأردن.

وقد لعب النشاط الزراعي دوراً مهماً في تشكيل حياه جتمعات التي عاشت في تلك المنطقة عبر الفترات التاريخية، حيث تمدت الحياة الأقتصادية على الزراعة بصورة أساسية، ومع ية النشاط الزراعي وأثره في تكوين بنية إجتماعية وإقتصادية خصائصها ومقوماتها إلا أننا نجد أنه، وفي بعض الأحيان، قد بط به أو تعتمد عليه أنماط أخرى من الأنشطة الاقتصادية تنمو دهر وتصبح نشاطاً متميزاً في تلك المنطقة الجغرافية.

ولعل من بين تلك الأنشطة التي ترتبط بالزراعة نشاط الصناعة، ني هنا صناعة السكر التي كانت تقوم دائما في منطقة يزرع فيها قصب السكر.

## تاريخ البحث الأثري

جاءت المعلومات الأثرية عن منطقة غور الأردن من خلال المسوحات والتنقيبات الأثرية منذ عام ١٨٨٧م (شكل ١)، عندما زار المنطقة العالم الالماني شوماخر (Schumacher) وقام بتوثيق عدد من المعالم الأثرية مع اعطاء معلومات عنها،(١) ومن بين المواقع التي زارها طبقة فحل موثقاً ذلك برسم خارطة المعالم الطبوغرافية والمعالم الأثرية، وقد اشار الى وجود معصرتين قام بتوثيقهما واكتفى بوصف المعصرة الموجودة في الجهة الغربية.(٢) وقد ذكر معصرة في وادي زقلاب، وفي وقاص،(٣) كما أشار الى معصرة في وادي العرب مشابهة لتلك التي وجدت في طبقة فحل،(٤) مكتفياً بذكر هذه المعاصر دونما تحديد لتاريخها وطبيعتها.

أما جلوك (Glueck) فقد قام بأكبر عملية مسح لشرقي الأردن بين عامي ١٩٣٨-١٩٤٧م، أشار خلالها الى وجود مجموعة من المعاصر التي تدار بواسطة المياه(٥) وفي منتصف السبعينات قامت دائرة الآثار العامة الأردنية بالاشتراك مع الجامعة الأردنية والمركز الامريكي للابحاث الشرقية بعمليات مسح أثري في المنطقة الممتدة من نهر اليرموك شمالا وحتى الزاوية الشمالية الشرقية للبحر الميت، وكان من بين نتائج هذا المسح رصد العديد من المنشآت التي يعتقد أنها معاصر للسكر أو ذات علاقة بها وذلك من خلال البقايا المعمارية التي وجدت في ١٣ موقعاً على طول وادي الأردن، إضافة الى العثور على أوان فخارية أطلق عليها إسم «أواني السكر» في عدد من المواقع، تم تأريخها الى القرنين الثاني عشر والرابع عشر الميلاديين.(٦)

وفي عام ١٩٨٣م قام (Hanbury-Tenison, Hart and Watson)

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) تُعتبر هذه الدراسة ملخصاً لاطروحة الماجستير التي أعدتها الباحثة وهي بعنوان **معاصر السكر في غور الأردن في القرنين الثاني عشر والرابع عشر الميلاديين في ضوء المصادر التاريخية والمكتشفات الأثرية**. رسالة ماجستير غير منشورة. جامعة اليرموك، إربد، ١٩٩١.

·G. Schumacher, *Pella*. (London, 1889)

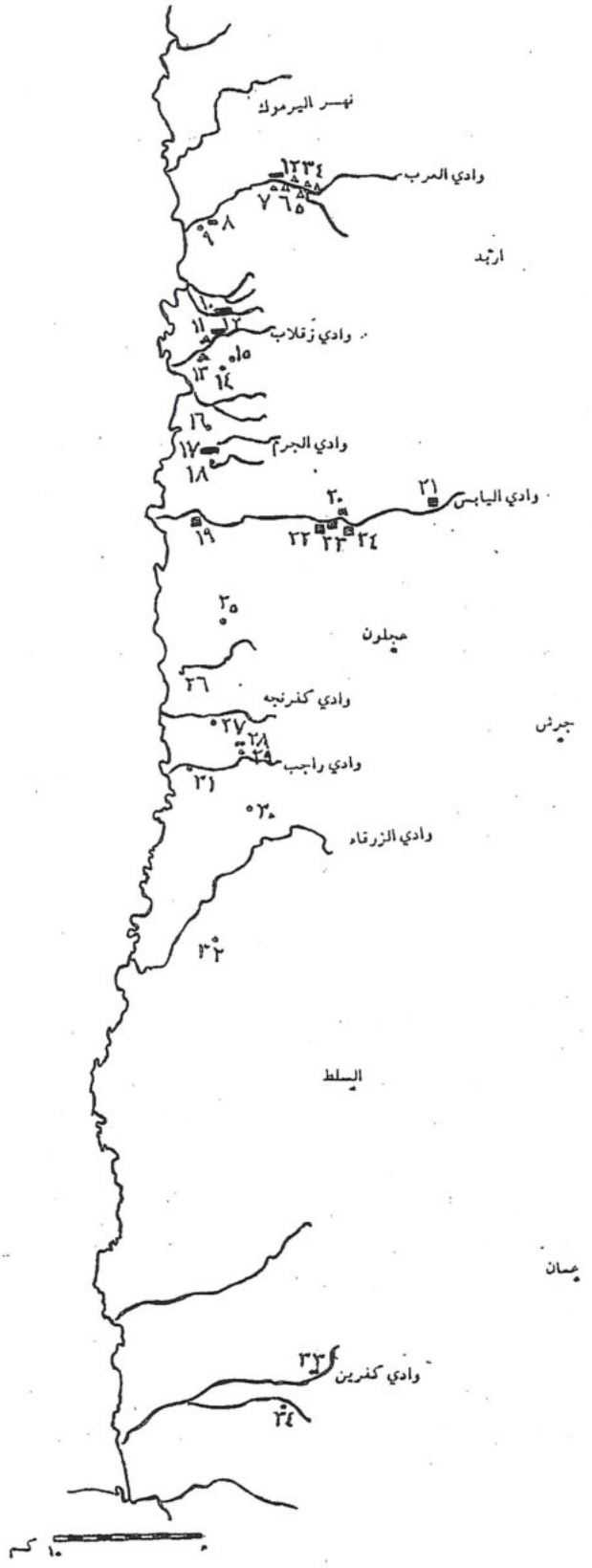
المرجع السابق، ص ٣١-٣٦.

(٣) المرجع السابق، ص ٧١-٧٢.

(٤) المرجع السابق، ص ١٤٩-١٦٠.

(٥) N. Glueck, *Exploration in Eastern Palestine IV, AASOR* 25-28 (1951), pp. 235-318.

(٦) M. Ibrahim, J. Sauer, J. and K. Yassine, 'The East Jordan Valley Survey 1975', *BASOR* 222 (1976), pp. 63-65; 'The East Jordan Valley Survey 1976', in K. Yassine (ed.), *Archaeology of Jordan: Essays and Reports*, (Amman, 1988).




مواقع معاصر السكر حسب المسوحات الأثرية:

- المسح الذي قام به Schumacher —
- المسح الذي قام به Nelson Glueck ••
- المسح الذي قام به Ibrahim, Sauer, Yassine •
- المسح الذي قام به Mabry and Palumbo ■
- المسح الذي قام به Lenzen, Kareem, Thorp ▲
- المسح الذي قام به Hanbury-Tenison, Hart, Waston, Falkner △

١- موقع معصرة على وادي العرب
٢- موقع رقم 017
٣- موقع رقم 019
٤- موقع رقم 061
٥- موقع رقم 062
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٨- الساسية
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١٧- طبقة فحل
١٨- الراسية الجنوبية
١٩- خربة المحروقات (٤١)
٢٠- غير معروف (٣٣)
٢١- غير معروف (٤٤)
٢٢- غير معروف (٣٢)
٢٣- غير معروف (٣٢)
٢٤- غير معروف (٣٤)
٢٥- خربة سليخات
٢٦- سبيرة
٢٧- كريّمة الجنوبية
٢٨- تل أبو القوس
٢٩- تل أبو القوس
٣٠- ضرار
٣١- طواحين السكر
٣٢- العارضة
٣٣- تل الطاحون
٣٤- مصيلحي

١ . خارطة توضح مواقع معاصر السكر في منطقة غور الأردن كما بينتها المسوحات الأثرية.

مسح في منطقة وادي العرب، دلت نتائجه على وجود ست معاصر،(٧) قام (Lenzen, Thorp and Kareem) عام ١٩٨٦م بمسح في نطقة جسر الشيخ حسين، أكتفشت خلاله عشرة مواقع قامت ستة منها على أساسات زراعية وصناعية.(٨)

أما المسح في منطقة وادي اليابس عام ١٩٨٧م والذي قامت به جامعة اريزونا بالاشتراك مع جامعة روما، فقد اسفرت نتائجه عن سجيل عدد من معاصر السكر التي كانت تدار بواسطة المياه في ادي اليابس.(٩)

وقد تبع أعمال المسح حفريات أثرية في عدد من المواقع التي مدتنا بمعلومات جيدة عن هذه الصناعة، ولكنها لم تركز على لكشف عن معاصر السكر، وانما تمثلت في العثور على كسر من وان فخارية إستخدمت لغايات تصنيع السكر وجدت في طبقة حل حيث كانت المنطقة خلال الفترة الإسلامية من أهم المراكز تصنيع السكر، وكان يتم تزويد المنطقة بقصب السكر من المناطق زراعية المجاورة في وادي الاردن. (١٠)

كما عثر على عدد من القطع التي تعود لهذه الصناعة في تل و قعدان في منطقة الأغوار الوسطى، حيث قام فرانكين ومحمد مرة عام ١٩٦٧ بعمل مسح في المنطقة عثرا خلاله على قطع خارية تعود الى الفترات الاسلامية،(١١) وقد قام (Franken and Kalsbeek بدراستها من حيث اشكالها، وطريقة تحضير مادتها عالجتها، وطريقة صنعها، ومن هذه الاشكال التي شملتها دراسة أواني السكر، وقد تم تصنيع نوعين منها وذلك اعتمادا لى شكلها وهما (*Bell Shape, Bag Shape*)، وقد اتصف النوع أول (*Bag Shape*) بأنه واسع في أسفله وضيق في أعلاه، ذو دران سميكة وعجينة خشنة، بدون مقابض، وتم تشكيله بواسطة ولاب واستخدام الأيدي للضغط على سطحي الإناء الخارجي لداخلي، ويرى فرانكين أن هذا الإناء كانت له وظيفة خاصة في صانع السكر، حيث كان معداً لسكب العصير فيه في مراحله نهائية.

أما النوع الثاني (*Bell Shape*) فيتسع في أعلاه ويضيق في سفله، وهو يشبه المخروط، وينتهي في الأسفل بقاعدة مستديرة قوية، وجدرانه سميكة ذات طينة خشنة، وسطحه الخارجي خشن داخلي أملس، ويعتقد أن هذا النوع يستعمل لتجميد ما يتبقى ن عصير القصب.

ولم يتمكن الباحثان من إعطاء تاريخ محدد لهذه الأواني لتنوع شكالها والتطور الذي حصل على تفاصيلها، ووجود هذه الأنواع في جميع الطبقات في الموقع. وقد اكتفيا بذكر الفترة الوسيطة (Medieval period) كتاريخ لها.(١٢)

أما حفريات موقع تل ابو صربوط الى الغرب من دير علا، فقد أظهرت نتائجها العثور على كسر فخارية بكميات كبيرة بينها عدد لا بأس به من أوان استخدمت في صناعة السكر من النوع المعروف بـ *Bell Shape* الذي يتسع في أعلاه ويضيق باتجاه القاعدة وينتهي بثقب واحد مستدير في الأسفل، وإحتوى سطح الإناء في بعض الاحيان على خطوط متصلة تبرز على سطحي الإناء الخارجي والداخلي. والنوع المعروف بـ *Bag Shape* الذي يتسع من أسفله ويضيق باتجاه الحافة، ويحتوي سطح الاناء على خطوط مضلعة من حافته وحتى القاعدة، وقد تمت صناعته بالدولاب (شكل ٢). وجدت مثل هذه الأواني في تل أبو قعدان، حيث تم تأريخها أيضاً الى ما أطلق عليه (الفترة الوسيطة) دون تحديد للفترة.(١٣)

أما المصادر التاريخية، والتي ترجع الى القرن التاسع الميلادي وما بعده، فتشير الى وجود الكثير من المحاصيل الزراعية ومنها قصب السكر، دون ذكر مباشر لوجود معاصر او تحديد عددها.(١٤)

ويعتبر ما كتبه المؤرخ النويري المتوفي عام ٧٣٢هـ/١٣٣٢م في كتابه **نهاية الأرب في فنون الأدب**، شرحاً وافياً عن زراعة وتصنيع قصب السكر، كما قام بشرح مفصل لآلية هذه الصناعة في الأراضي المصرية والشامية، ومما جاء في الوصف:-

«تمر عملية عصر السكر بعدة مراحل، حيث يجلب قصب السكر على ظهور الجمال أو الحمير من الحقول الى المصنع، الذي يبنى عادة من غرف توضح مرافق المصنع، أول أجزاء هذا المصنع دار القصب حيث تجرد الأعواد من أقصابها لينقل الى بيت النوب (وهو المكان الذي يغسل فيه القصب قبل عصره) ثم ينقل الى حجر العصر في أوعية مصنوعة من الخوص تسمى أفراد، وتقوم الأبقار بادارة الحجر أو دواليب المياه، أو الأعواد الخشبية، ويصفى ما يخرج منه في مكان معد له عن طريق ثقوب موجودة في القاعدة التي تحت الحجر، وينتقل بعد ذلك ليلقى تحت حجر التخت (وهو حجر الطاحون الأفقي الموجود على ظهر المعصرة).

وما يخرج من عصير يُصفى في منخل موضوع في قفص لينزل في حوض مبني يدعى البهو، وبعد الانتهاء من عملية

J. Hanbury- Tension, 'Wadi Arab Survey', *ADAJ* 28 (1984), pp. 385-424.

C. J. Lenzen, J. Kareem and S. Thorp, 'Jiser Sheikh Hussein Regional Survey', in D. Homès-Fredericq and J. B. Hennessey (eds.), *Archaeology of Jordan, II. Sites and Surveys, Akkadica Supplementum VII* (Leuven, 1989), pp. 66-67; J. Kareem, 'Tell Fendi: Jiser Sheikh Hussein Project', *ADAJ* 33 (1989), pp. 100. 101.

J. Marby and G. Palumbo, 'The 1987 Wadi el-Yabis Survey', *ADAJ* 33 (1988), pp. 91-97.

J. Hennessy, A. McNicoll, J. Hanbury-Tension, P. Watson, L. Randle ( and A. Walmsley, 'Preliminary Report on the Fourth Season of Excava-

tion at Pella', *ADAJ* 20 (1983), pp. 345-351; D. Homès-Fredericq and H. J. Franken (eds.), *Pottery and Potters: Past and Present*, (Tubingen, 1986), pp. 234.

(١١) H. J. Franken and K. J. Kalsbeek, *Potters of a Medieval Village in the Jordan Valley*, (Amesterdam, 1975), pp. 1-14.

(١٢) المرجع السابق ص ١٤٣-١٤٧.

(١٣) المرجع السابق ص ١٥٣-١٥٥.

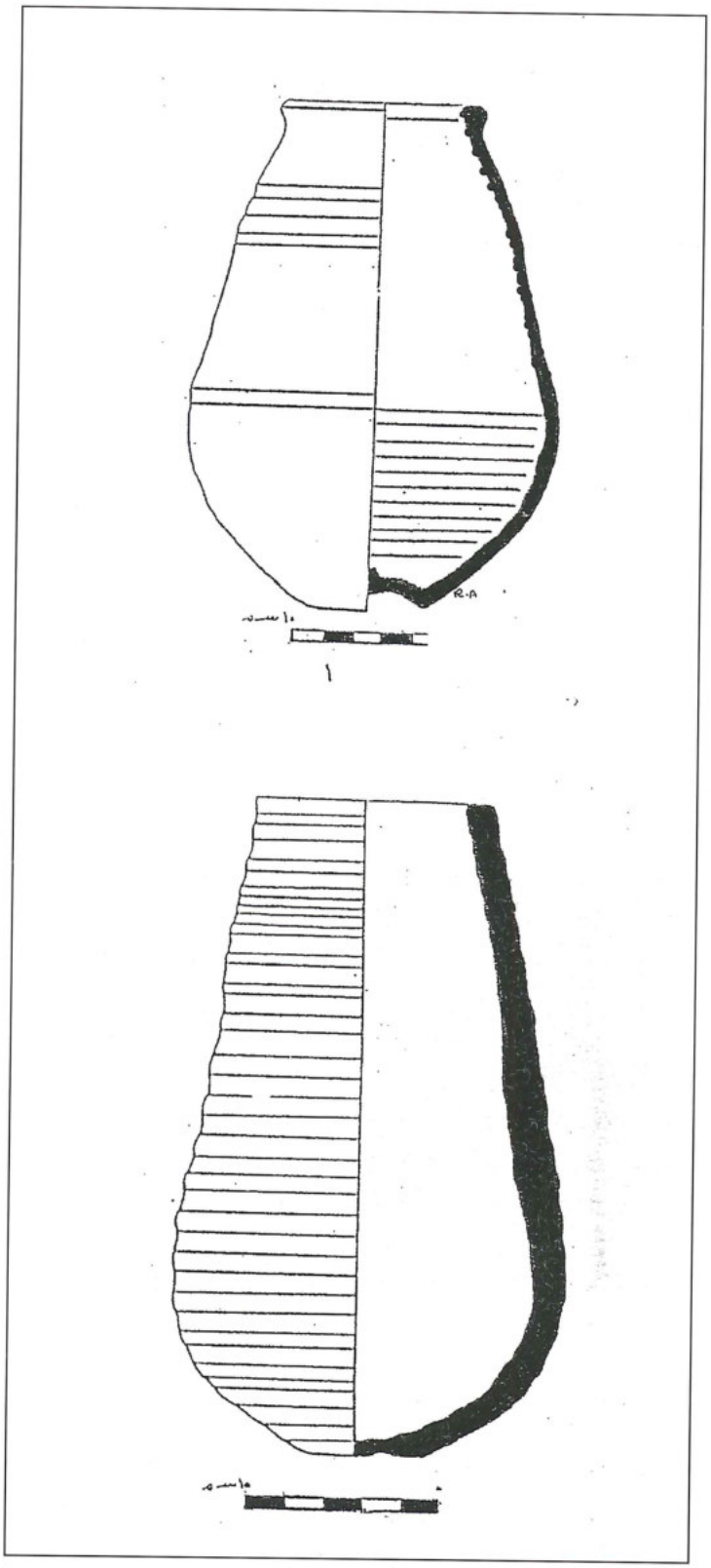
(١٤) محمد بن احمد المقدسي، **أحسن التقاسيم في معرفة الاقاليم**، تحقيق ميخائيل جان دوغويه (ليدن، ١٩٦٧)، ص ١٨٠.

العصر لينزل ما اعتصر الى المطبخ، وفي المطبخ يُصفى ما عصر من القصب في جرار تدعى الخوابي، ثم يوقد تحتها من خارج المعصرة حتى يغلي وينقص نقصاً معلوماً، وينقل في يقاطين كبار في كل واحد منها خشبة منجورة طويلة كالساعد نافذة من الجانبين بها أكياس من الصوف ليتصفى ما بها في دنان كبار، ثم ينقل الى قدور نحاسية ليطبخ فيها، وينقل بعد طبخه بقدور نحاسية لكل قدر منها قبضتان من الخشب في أعلاه، لتقي من حرارة القدر، ويصب عصير القصب المطبوخ في الاباليج المثقوبة في أسفل القاعدة الموضوعة في مكان يسمى بيت الصب الذي يتكون من مصاطب مستطيلة تشبه معالف الدواب، حيث نقلت الى بيت الدفن وهو المكان الذي تخفى فيه الاباليج مدة حتى يقطر ما بقي من أعسالها».(١٥)

وقد وضعت الباحثه تصوراً كاملاً لهذه الآلية ممثلة بالرسـ (شكل ٣).

ويتبين لنا من نتائج المسوحات والحفريات الأثرية السابقة التي جرت على مواقع معاصر السكر في وادي الأردن أن الكثير من الجوانب المتعلقة بتلك المعاصر ما زالت مجهولة وغير واضحة، مما دعا الى الاستعانة بالمعاصر التاريخية التي وضّحت جانباً من هذه الصناعة، والتي قد تكون إستمرارية لتقنية اتبعت منذ القدم ولكون تلك الدراسات والكتابات التاريخية عن تلك الصناعة قليلة في بعضها وغير وافية في بعضها الآخر أو غير متخصصة، والتي لا تعدو كونها إشارات عابرة تطرح من الاسئلة أكثر من الاجابات التي تثيرها، لذلك كان لا بد من القيام بزيارات ميدانية لبعض المواقع ذات المعالم الواضحة من أجل تصور متكامل لهذه المنشأة المعمارية للتمكن من تحليل تقنية هذه الصناعة من خلال ما توفر البقايا الأثرية. ومن أهم المواقع التي اشتملت عليها الزيارات والأعمال الميدانية:

**تل السكر:** موقع رقم (١٦): يقع هذا التل على مرتفع طبيعي شمالي المشارع. وقد ذُكر في المسوحات السابقة التي قام بها جلوك الذي اكتفى بذكر مصطلح (Medieval period) لتأريخه بينما أرخها ابراهيم وساور وياسين في مسح عام ١٩٧٦ الـ الفترة الأيوبية–المملوكية،(١٦) وأما المحيسن (١٩٨٧) فقد أرجعه الى الفترات الاموية والأيوبية–المملوكية وذلك اعتمادا على البقا الفخارية التي وجدت وخاصة أواني السكر،(١٧) وتحتوي المنطق على حقول ترويها مياه نبع الى الغرب من الموقع ونبع آخر في طبـ فحل. ويضم الموقع معصرتين للسكر: الأولى في الجهة الشمالـ والثانية في الجهة الشمالية الشرقية (شكل ٤، ٥)، وتتكو المعصرة (شكل ٦) والتي كانت تدار بواسطة شلال ماء منحدر م



٢ . أواني السكر على شكل جرة (Bag Shape).

(١٥) النويري، أبو العباس أحمد، **نهاية الأرب في فنون الادب**، ( القاهرة، ١٩٧٦).

(١٦) Ibrahim *et al.*, 'The East Jordan Valley Survey 1976', p. 169.

(١٧) . Muheisen, 'A Survey of Prehistoric Cave Sites in the Northern Jordan alley (1985)', in A. N. Garrard and H. Gebel (eds.), *The Prehistory of rdan: The State of Research in 1986,* (Oxford, 1987), pp. 503-523.

المختصين في الآثار والمهتمين بالدراسات الأثرية والبيئية التي تتعرض لبيئة المنطقة ونشاط سكانها عبر العصور خاصة خلال العصرين الروماني والبيزنطي صورة عن آلية عمل احدى المنشآت الزراعية الانتاجية كمعاصر العنب وما تحمل كثافة انتشارها من دلالات على ازدهار زراعي واقتصادي في المنطقة.

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المستقلة – وأبرز الأشكال الأخرى التي أمكن التعرف اليها معصرة ذات أحواض هرس مربعة صغيرة تتصل بأحواض ترسيب مربعة ثم يسيل العصير الى حوض تخمير أقرب للشكل البيضوي، ومعاصر بسيطة مكونة من حوض هرس وأقرب للشكل المثلثي وبحوض صغير لتجميع العصير، ويحتمل استخدام هذه المرافق في الفترات الرومانية والبيزنطية والأسلامية المبكرة نظرا لشهرة هذه المنطقة بانتاج الخمر عبر هذه الفترات.

فقد ذكر ياقوت الحموي في معجم البلدان أن بيت راس اسم لقريتين في كل واحدة منهما كروم كثيرة ينسب اليها الخمر، احداهما تقع في البيت المقدس وقيل بيت راس كورة في الأردن والأخرى تقع في نواحي حلب، وقال حسان بن ثابت يمتدح خمرة بيت راس :

كأن سبيئة من بيت راس يكون مزاجها عسل وماء
فنشربها فتتركنا ملوكا وأسدا ما ينهنهنا اللقاء

(الحموي – بدون تاريخ: ٥٢٠).

هـ- *معاصر الحصن* : تقع بلدة الحصن جنوب مدينة إربد على بعد ٥ كم، وتم للباحث تمييز ثلاث معاصر عنب في موضع يدعى (مراح أم الغزلان) جنوب بلدة الحصن، احدى هذه المعاصر تكون من حوض هرس مستطيل وحوض تجميع العصير مربع الشكل، والثانية والثالثة لكل منهما أرضية هرس متصلة بحوض دائري لتجميع العصير، وفي ذات الموقع تم ملاحظة آبار مياه وأحواض مقصورة وكهوف بها آبار تخزين، وتنتشر كسر الفخار الروماني والبيزنطي في أنحاء من الموقع ( ملحم ١٩٩٢: ١٨٤ –١٨٦).

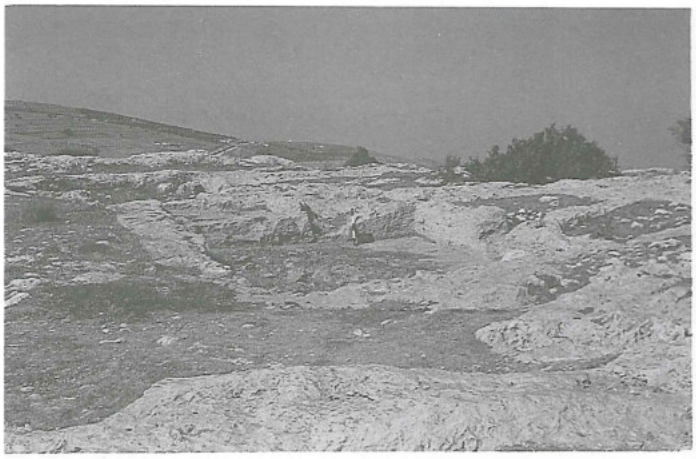
وفي الحصن موضعان يدعيان «حديجاء» و «مقبية (مقدية)»، وورد ذكرهما في الاشعار والمعاجم العربية، ووصفا بانتاج الخمور، فيذكر البكري في (معجم ما أستعجم) مقدية بأنها من قرى البثنية، وهي أطيب بلاد الله خمرا، ومنها كانت تصطفى ملوك غسان الخمر، وتقع البثنية جنوب حوران ومدينتها أذرعات، أما (معجم البلدان) لياقوت الحموي فيذكر أن مقدية قرية بناحية دمشق من أعمال أذرعات تقع في طرف حوران، وقد نسب الشاعر عدي بن الرقاع العاملي الخمر المقدية الى حديجاء بقوله :

مقدية صهباء تثخن شربها إذا ما أرادوا أن يروحوا بها صرعى
عصارة كرم من حديجاء لم تكن منابتها مستحدثات ولا قرعى

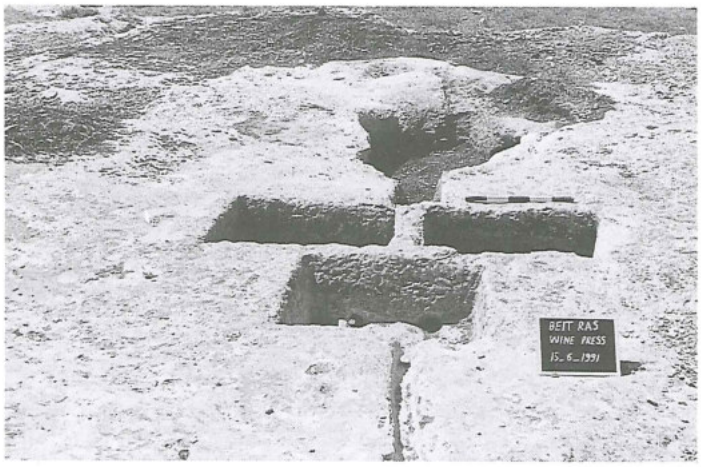
وحديجاء هي حوض من أراضي بلدة الحصن الحالية، كما أن (مقبية) حوض مجاور لها، وأغلب الظن أنه تحريف لكلمة المقدية (الحموي ١٩٧٩ ج٥: ١٦٥؛ البكري – بدون تاريخ – ج٢: ١٢٥٠–١٢٥١؛ نصير ١٩٩٠: ١٧–١٨).

يلاحظ أن المكان الذي تم تمييز معاصر العنب فيه من قبل الباحث يقع في موضع يدعى مراح أم الغزلان الى الشرق من حديجاء، وبناء على ذلك فإن هذه المعاصر تثبت صحة الكتابات التاريخية والأشعار في أهمية بلدة الحصن في انتاج الخمور الجيدة التي ذاعت شهرتها، وفي ازدهار المنطقة بكروم العنب (أنظر الشكل ١٣).

وبعد، فإن دراسة تقنيات عمل معاصر العنب في منطقتنا يعطي



١١. معصرة عنب (بركة الدير).




١٢. معصرة عنب ذات حوض هرس وحوضي ترسيب وحوض تجميع العصير (بيت راس).



١٣. معصرة عنب (الحصن).

(هاردنج ١٩٧١: ١٠١).

وضمن الدراسة الميدانية فقد أمكن للباحث الكشف عن معصرة



٨. معصرة عنب ذات حوضين للهرس وحوضين لاستقبال العصير (دير أبي سعيد).



٩. معصرة ذات حوض هرس وحوض تجميع العصير (دير أبي سعيد).

عنب منحوتة في الصخر كانت مطمورة بالكامل في حي يدعى ظهر السرو على طريق بلدة سوف الى الغرب من سور جرش حيث تم حفر مقاطع فيها، وتوضيح معالمها وتوثيقها، وهي معصرة ذات أرضية هرس مربعة الشكل تقريبا (٣٠٠ × ٣٧٠سم) قصرت ارضيتها وجوانبها بالجص، وفي جانبها الغربي يوجد كوة مربعة، وتتصل ارضية الهرس بحوض ترسيب ينفذ على بئر تجميع العصير أعمق منه، وهو مقصور أيضا وله درج، وعلى الأغلب أن هذه المعصرة القريبة من الآثار الرومانية ربما ترتد الى الفترة الرومانية أو البيزنطية كما أن كسر الفخار المنتشرة في المنطقة تعزز هذا الاحتمال (ملحم ١٩٩٢: ١٨٠-١٨١) (أنظر الشكل ١٠).

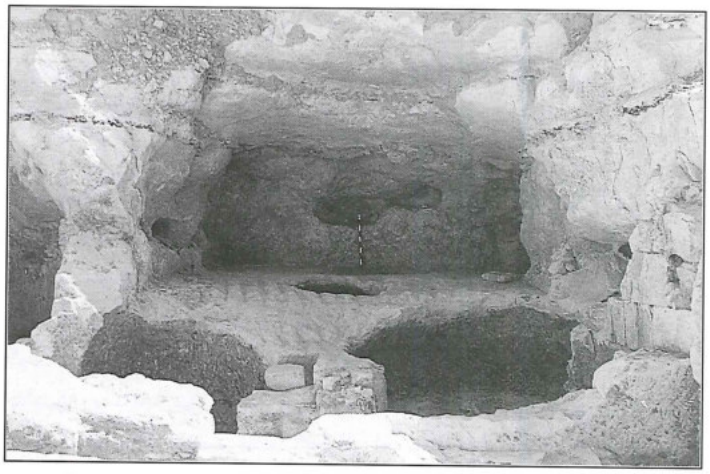
جـ- *معاصر بركة الدير*: تقع بركة الدير الى الشمال من عجلون، وقد أمكن للباحث ضمن الدراسة الميدانية تمييز (١٠) معاصر عنب متجاورة جميعها نحتت في الصخر، وهي معاصر كبيرة الحجم نسبيا، وتتكون من أرضيات هرس مربعة ومستطيلة الشكل يحيط بها أحواض نشر مربعة ومستطيلة الشكل، وتتصل أرضيات الهرس بآبار أو أحواض تخمير، وهي على الأغلب ذات مسقط دائري ويجاور هذه المعاصر مقابر منحوته في الصخر، وجدران لمبانٍ مهدمة على الارجح أنها رومانية أو بيزنطية وذلك بناءً على كثّافة الفخار من هذه الفترات (ملحم ١٩٩٢: ١٨١-١٨٣).

د- *معاصر بيت راس*: تقع بيت راس الى الشمال من إربد على بعد ٥ كم. وتقوم القرية الحديثة فوق مدينة (كابتولياس) إحدى المدن العشر الرومانية وأشارت عمليات المسح اعتمادا على الكسر الفخارية والبقايا الأثرية أن المدينة شهدت استيطانا منذ (١٠٠ ق.م.) من أواخر الفترة الهللنسية حتى الآن (Lenzen and McQuitty 1988: 268-269).

وتم التعرف على معاصر هذا الموقع من خلال الدراسة الميدانية للباحث، حيث أمكن تمييز عدة معاصر عنب تتركز في الجهة الجنوبية من البلدة بعضها من نمط (Cup-Holes) -الحفر



١٠. معصرة عنب (جرش).



٦. وحدة الكهف C في اليصيلة. يشاهد في صدر الكهف الكوة موضع تثبيت العارضة الخشبية الضاغطة.



٧. أحواض المعصرة في وحدة الكهف C اليصيلة.

معاصر عنب في جرش –حي ظهرالسرو، وفي موقع بركة الدير الى الشمال من عجلون، حيث عملت الكوات الخلفية التي تثبت بها العارضة الخشبية الضاغطة على جانب خلفي من أرضيات الهرس (ملحم ١٩٩٢: ١٥٤).

ويفترض أن أكوام العنب المجلوبة من الكروم توضع في طبقات مفصولة بأقمشة أو سلال خاصة لتسهل عملية العصر، ونزول السائل دون اختلاطه بالقشور الى أرضية الهرس ثم الى مواقع تجميع العصير. ويذكر أن عددا من معاصر الزيتون في أنحاء متفرقة من الأردن حتى سنوات قليلة كانت تستخدم هذه التقنية، كما في قرية تبنة في لواء الكورة، وفي مدينة الطفيلة جنوب الأردن، حيث يوضع الزيتون في أكياس تحت ضغط الثقل المربوط الى العارضة الخشبية المتحركة للأعلى وللأسفل.

*٣و٤– طريقة عصر العنب بالأرجل في أرضيات تتصل بأحواض تخمير وترسيب والتطورات التقنية على هذه الطريقة، وطريقة العصر في حفر منفصلة*

تعتبر طريقة عصر العنب بالأرجل في أرضيات خاصة بأحواض تخمير وترسيب الأكثر شيوعا في معاصر العنب عبر العصور التاريخية المختلفة، نظرا لفاعليتها وبساطتها حيث يستخدم فيها بشكل رئيسي الأرجل لدوس العنب في أرضيات هرص خاصة يسيل منها العصير الى أحواض ترسيب وتخمير وقد شاع هذا النمط من المعاصر في العصرين الروماني والبيزنطي، وتؤرخ غالبية معاصر العنب من هذا النوع الى هذين العصرين، وقد طرأ تطور نوعي على هذه المعاصر منذ حوالي القرن الخامس الميلادي بإضافة العمود اللولبي الضاغط لعصر العنب، ورصف أرضيات المعاصر بالفسيفساء.

وقد أمكن للباحث تمييز عدد من معاصر العنب في بحث ميداني استكشافي، لم يسبق لباحث آخر أن نشر عنها وتم اجراء مسوحات جزئية في المواقع المدروسة وحفر مقاطع في بعض المعاصر لغايات توثيقها بالتصوير والرسم وأهم هذه المعاصر :

*أ– معاصر عنب دير أبي سعيد* : تقع دير أبي سعيد الى الجنوب الغربي من مدينة إربد على بعد حوالي ١٥كم، ودلت المسوحات التي اجريت في حوض وادي زقلاب على أن الاستيطان فيه بلغ ذروته في الفترة البيزنطية، وشهد استيطانا في اواخر العصر الروماني، وظهرت آثار زراعية من هذه العصور كأقنية وخزانات المياه، كما ظهرت بقايا معمارية لمباني عامة (Banning and Fawcett 1983: 302-305).

وقد أمكن للباحث بالدراسة الميدانية في دير أبي سعيد تمييز عدد من معاصر العنب لا يقل عن (١٥) معصرة جميعها نحتت في الصخر الكلسي الصلب وهي معاصر هامة في الكشف عن الطبيعة الزراعية والتصنيعية للمنطقة وأغلبها بحالة جيدة، ويغلب على أصناف معاصر العنب النماذج التالية :

- معصرة عنب ذات حوض هرس مستطيل الشكل يرتبط بحوض استقبال العصير ذو شكل دائري مزودة بمصفى.
- معصرة عنب ذات حوض هرس مربع الشكل، يرتبط بحوض استقبال العصير ذو شكل مربع مزود بمصفى.
- معصرة عنب ذات حوضي هرس مستطيلين مع سطح مستطيل الشكل لنشر العنب ويتصل حوضا الهرس بحوضين لاستقبال العصير، وكلاهما ذو شكل دائري (ملحم ١٩٩٢: ١٨٠–١٧١) (أنظر الشكل ٨، ٩).

ب – معصرة عنب في جرش : شهدت جرش استيطانا عبر العصور الهللنستية والرومانية والبيزنطية وكان اكبر ازدهارها في العصر الروماني حيث شُيدت المدرجات والمسارح والميادين والشوارع المعمدة والمعابد الرومانية والمدافن والحمامات والمباني المختلفة، كما شهدت ازدهارا في العصر البيزنطي دلت عليه كثرة الكنائس والمباني من هذه الفترة (Zayadine 1986: 7-20; Barghouti 1982: 218-222).

وقد ذكر الكاتب (أبيفانيوس) من كتاب القرن الرابع الميلادي أن معاصريه شربوا من نافورة جرش التي كانت مياهها تتحول الى خمر كل سنة يوم الاحتفال بذكرى اعجوبة قانا الجليل

الموسمي، وتغلق أثناء فترة التخزين لمنع تغلغل الهواء الحار (Pritchard 1964: 26; Negev 1986 : 403-404).

ويشترط في مواضع التخمير ان تكون باردة نسبياً ومظلمة، وعندما تتم عملية التخمير الأولى يتم تصفية العصير بواسطة قماش من الرواسب وثفل الفاكهة وتحفظ القشور المعصورة لتأكلها الماشية كعلف وكان عصير العنب المخمّر في الجرار يخلط أحيانا بمواد أخرى كالزيت، وصمغ المر (Gall)، وغيرها من المواد لاغراض علاجية (Forbes 1965: 77).

وقد تراجع الاهتمام بمعاصر العنب في الفترة الاسلامية على أثر التحريم القطعي للخمر الذي جاء به الاسلام، وتركزت أمور تصنيع الخمر غالبا على أهل الذمة وغير المسلمين، وأصبح الاهتمام الزراعي والتصنيعي الغذائي يتحول الى مزروعات أخرى كالزيتون والسكر التي عملت لها معاصر خاصة. وكشفت المسوحات الأثرية عن ٣٢ معصرة سكر في منطقة الأغوار أرخت للفترات الأيوبية المملوكية (حمارنة ٧٧-١٩٧٨).

## ثالثا: تصنيف نوعي لتقنيات عمل معاصر العنب المحلية

تكاد تقنيات معاصر العنب في كل من الأردن وفلسطين تتشابه نظرا للقرب الجغرافي بين الاقليمين والعلاقات الاقتصادية والسكانية المتصلة في العصرين الروماني والبيزنطي، ويمكن تصنيف طرق عصر العنب في هذه المنطقة الى أربع طرق رئيسية هي:

١- طريقة عصر العنب بلي الكيس (الطريقة المصرية).
٢- طريقة عصر العنب بالعارضة الخشبية الضاغطة (الطريقة الاغريقية).
٣- طريقة عصر العنب بدوسه بالأرجل في أحواض خاصة تتصل بأحواض ترسيب وتخمير.
٤- العصر في حفر منفصلة.

وفيما يلي عرض لعدد من الأمثلة اعتمادا على هذا التصنيف :

### ١- *طريقة عصر العنب بلي الكيس (الطريقة المصرية)*

بينت الكتابة الهيروغليفية والرسومات المصرية أنه وفي بداية الأسرة الثالثة، استخدمت طريقة عصر العنب بلفة بقماش أو كيس وبتثبيت طرفيه الى عصي اثنتين أو عمودين، ثم يتم إدارة القماش أو الكيس بالاتجاه المقابل بواسطة رجلين الى أن يعصر العنب (Forbes 1965 : 75-76) (أنظر الشكل ٢).

وتعتبر هذه الطريقة نادرة الوجود في المنطقة وما عثر عليه من معاصر عنب تعمل بهذه الطريقة لهي قليلة، ومن أبرزها معاصر عنب اليصيلة الواقعة الى الشرق من مدينة إربد في وحدة الكهف A، حيث عثر فيها على أماكن تثبيت للحبال نحتت في الواجهات الصخرية، وعمل أسفل منها أحواض وحفر لتلقي العصير المنساب من كيس العنب الملتوي، وتؤرخ معاصر اليصيلة على الأغلب للفترة بين القرن الأول والقرن الثالث الميلاديين (ملحم ١٩٩٢: ٩١-٩٩) (أنظر الشكل ٥).

ولازالت تستخدم هذه الطريقة لدى بعض الفلاحين في شمال الأردن في عصر العسل وتصفيته.

### ٢- *طريقة العصر بالعارضة الخشبية الضاغطة (الطريقة الاغريقية)*

تستخدم هذه الطريقة في عصر العنب والزيتون، وقد عثر على تجهيزات عصر بهذه التقنية في معاصر خاصة بالعنب أو الزيتون، اذ استخدمت هذه التقنية في معاصر عنب موقع اليصيلة في وحدة الكهف C، وعملت لهذه الغاية كوة جدارية لتثبيت العارضة الخشبية، يقابلها من أسفل حوض ذو مسقط دائري بعمق ١٦٠سم لوضع العنب المراد ضغطه بالثقل المثبت في الطرف الآخر من العارضة الخشبية حيث يسيل العصير عبر مصرف جانبي الى حوض ترسيب بقطر ٢٥٠سم وبئر تخمير بعمق ٢٢٠ سم متجاورين، ورغم أن هذه الطريقة بطيئة الا انها فعالة في انتاج عصير العنب، وتعمل العارضة بحركة متواصلة وفقاً لمبدأ الرافعة بالرفع والتنزيل المستمرين للضغط على العنب، وعلى الأغلب أن تاريخ هذه الوحدة متزامن مع تاريخ معاصر اليصيلة الواقع ما بين القرن الأول والقرن الثالث الميلاديين (ملحم ١٩٩٢: ١٠٦-١١٠) (أنظر الشكل ٦، ٧ ).

وعثر على تجهيزات عصير مشابهة في معصرة عنب في موقع خربة العقد قرب بلدة عمواس شمال غرب القدس استخدمت في العصرين الهللنستي والروماني، وفي معصرة زيتون من العصر الهللنستي في موقع مستعمرة طيرات يهودا (قرية الطيرة العربية قرب البلدة) (هارئيل ١٩٩٠: ٣١٤، ٣٤١؛ Hirschfeld 1983: 210).

كما عثر على تجهيزات عصر باستخدام العارضة الخشبية والكوة الخلفية في معصرة زيتون في قلعة عمان-منطقة أ وتعود إلى العصر البيزنطي (Zayadine: 1977-78).

كما أمكن للباحث تمييز تجهيزات لهذا النمط من العصر في



٥. إعادة تصوير طريقة عصر العنب بليّ الكيس في وحدة الكهف A في اليصيلة.

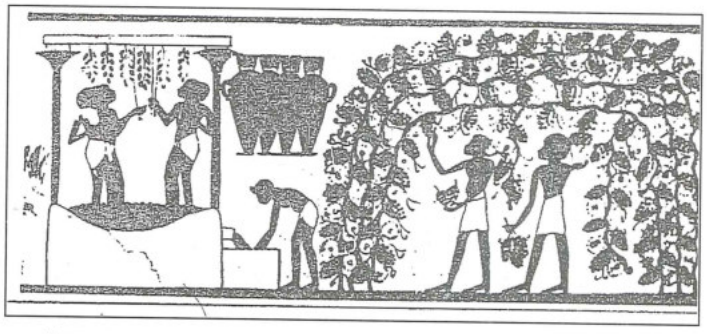
يغرس الا في الارض الطيبة حتى يكون الشراب طيب الطعم، لأن الارض الكريهة أو المالحة يكون الشراب المتخذ من زرعها سريع الفساد، ورديء الطعم مضرا بشاربه (البعلبكي – بدون تاريخ: ٣٥).

والخمر هي الأشربة التي بها الكحول المكونة من ذرات الهيدروجين والكربون، ومنها الكحول الأثيلي، وتتكون الكحول في الخمر بواسطة أنزيمات خمائر تقوم بتحويل المواد السكرية الموجودة في الفواكه مثل العنب والرطب والتين، والنشوية مثل الموجودة في الشعير والذرة والحنطة الى كحول أثيلي، وذلك بعمليات بطيئة متتابعة، وهذه الطريقة تستعمل منذ أقدم العصور الى يومنا هذا للحصول على الخمور (البار ١٩٨٤: ٣٢-٣٣).

وقد عرفت زراعة الكرمة وشرب عصير العنب المخمر في بلاد الرافدين ومصر منذ الألف الرابع قبل الميلاد على الاقل، وورد ذكرها في المصادر الآشورية، ودلت النصوص المصرية القديمة على زراعة الكروم واستهلاك الخمر بكميات كبيرة (Forbes 1965: 72-74; Negev 1986: 403-404) وفي مصر تتم العملية بدوس العنب بالأرجل ثم تصفيته، ثم أخيرا تخزينه ونقله، وهذه العملية تبدو بوضوح في النصوص والرسوم المصرية القديمة التي صورت عملية دوس العنب بالأرجل حيث يسيل العصير الى حوض تجميع (Forbes 1965: 75-76) (الشكل ١) وتشاهد عملية عصر العنب بالأرجل على الرصفات الفسيفسائية في كنيسة لوط وبروكوبيوس وكنيسة القديس جورج في خربة المخيط (Dauphin 1985: 122) (أنظر الشكل ٢).

يتم جني العنب عادة في شهر ايلول ثم يحمل الى معاصر العنب بالسلال لأجل عصره، والأسلوب الشائع في عصره هو نشره في أحواض خاصة أو على الصخر ثم هرسه اما بالأرجل أو بواسطة أسطوانة حجرية، كما يتم الهرس في حفر صغيرة وذلك لدواعي الاستعجال في انتاج الشراب، وهنالك طريقة أخرى تقوم على ضغط العنب في كيس يربط الى عمودين ثم يبدأ تقليبها في الاتجاه المضاد الى أن يتم عصر العنب منها وهذه طريقة مصرية الأصل (الشكل ٣)، وطريقة أخرى بإستخدام عارضة خشبية مثبتة وحجارة أثقال متصلة بها للضغط على ركام العنب لعصره وهي طريقة إغريقية الأصل (الشكل ٤)، وبعد ذلك يسيل العصير في قنوات ضحلة الى حوض تجميع العصير، ويكون عادة منحوت ليتم التخمير، ويترك العصير فترة تناهز ست ساعات ليرسب الشوائب وقشور العنب، علما بأن قشور العنب نفسها تساعد على التخمير (Ahlstrom 1978: 41; Negev 1986: 403; Hirschfeld 1983).

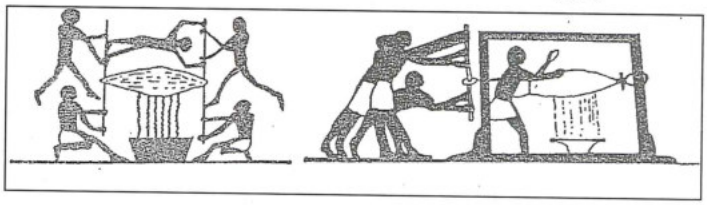
وبعد أن يصفو العصير يجمع في جرار، ويتم اغلاقها بسدادة طينية، ويمكن استعمال كمية من الزيت الطافي في الجرة أعلى سطح العصير لمنع تسرب الهواء الخارجي، وتترك قشور العنب بعد عملية العصر الأولى حيث يعاد عصرها ثانية لاستخلاص العصارة المتبقية منها، أما أماكن التخزين فهي غالبا ما تكون كهوف طبيعية أو حجرات (أقبية). وقد سكن تجار الخمر الرومان أعالي الجبال في فلسطين كما في الخليل والنقب،، وذلك لتوافر صفات الاعتدال الحراري فيها، ويتم دخول الهواء والضوء الى الكهوف من خلال فتحات في السقف أثناء العمل



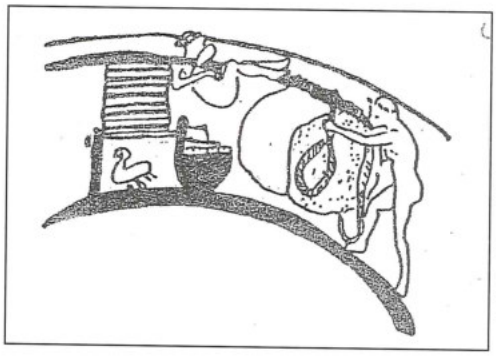
١. مشهد من قبر ناخت في طيبه، يصور قطف العنب وعصره بطريقة الدوس بالأرجل (عن Wood 1987).



٢. مشهد على الفسيفساء يبين طريقة عصر العنب بالأرجل وبالعمود الملولب الضاغط (نيبو).



٣. رسم جداري من أحد القبور يصور معاصر العنب المصرية المبكرة، وطريقة العصر بليّ الكيس (حوالي ٢٠٠٠ ق.م. عن هودجز ١٩٨٨).



٤. رسم إغريقي على إناء من القرن السادس ق.م. يصور استخدام العارضة الخشبية الضاغطة المثبت في طرفها حجر ثقيل (عن Hirschfeld 1983).

اسماعيل أحمد ملحم

# تقنيات معاصر العنب في الأردن وفلسطين في العصرين الروماني والبيزنطي

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## أولا : تاريخ البحث الأثري في معاصر العنب

تكتسب دراسة معاصرالعنب أهمية خاصة في الكشف عن النواحي الزراعية ومرافق التصنيع الغذائي في مجال زراعة العنب وانتاج الأشربة من عصيره، اذ أن الانتشار الكثيف لمعاصر العنب في كل من الأردن وفلسطين في العصرين الروماني والبيزنطي يمثل ظاهرة تستحق البحث، ويعطي وجودها دلالات قوية على الاهتمام الزراعي في المنطقة كما ترتبط المعاصر باحدى المشروبات اليومية الهامة للسكان في تلك العصور وهي الخمور التي خُصت بمرافق وتقنيات عصر وتخزين وأوان خاصة.

وعلى الرغم من وجود العديد من الدراسات التي تتناول الخمر واعداده فإن الدراسات المختصة التي تتناول معاصر العنب في منطقتنا من الناحية الأثرية قليلة، كما أن الاشارات الأولى لمعاصر العنب لم تكن دقيقة، فيذكر (شومخر) على سبيل المثال أنه عثر على معاصر للعنب (أو) الزيتون في قرية كفر أسد (الواقعة الى الشمال الغربي من إربد)، وأورد مخططات لثلاث منها (Schumacher 1890:122). وهذا يشير الى عدم التمييز بين نظام معاصر العنب ومعاصر الزيتون بالرغم من أن المخططات المرفقة للمعاصر هي للعنب. كما وقع برامكي بخطأ في تفسيره لمعصرة عنب بأنها حمام بيزنطي في تقريره الذي نشره عام ١٩٣٣ حول حفرياته في قلنديا (Baramki :1933; Hirschfeld 1983: 214).

وقد أفادت المسوحات والاكتشافات الأثرية في مناطق مختلفة من الاردن وفلسطين في كشف العديد من معاصر العنب وتقنيات عملها. فقد تم العثور على مالا يقل عن (١٢) معصرة في نيبو (خربة المخيط) (Saller and Bagatti 1949: 13-15). وعثر على العديد من معاصر العنب في منطقة بيضا قرب البتراء تعود إلى الفترة النبطية (Al-Muheisen 1983). وتم عمل مسوحات في منطقة جنين–مجدو (تل المتسلم) في فلسطين كشف فيها عن مالا يقل عن (١١٧) معصرة عنب معظمها من العصرين الروماني والبيزنطي (Ahlstrom 1978) كما كشف عن العديد من معاصر العنب على الساحل الفلسطيني تعود إلى العصر البيزنطي، مثل معصرة عنب رحبوت (قرية ديران) (Roll and Ayalon 1981). وأجريت مسوحات في منطقة عمواس شمال غرب القدس كشف فيها عن (١٥) معصرة عنب من العصرين الروماني والبيزنطي (Hirschfeld 1983). وفي مسوحات تمت في منطقة واسعة في فلسطين تم تسجيل معاصر عنب وزيتون في (٣٠٠٠) موقع أثري (Dauphin 1980:122). وكشف عن العديد من معاصر العنب في الجولان شمال فلسطين (Urman 1974) وفي النقب جنوب فلسطين (Mazor 1981). كما كشف عن منطقة تصنيع للخمور ضمت معاصر وأقبية تخزين في الجيب تعود للعصر الحديدي الثاني، جدد استخدام بعض مرافقها في العصر الروماني (Pritchard 1964: 1-27). وأشار (هانبري – تينسون) في مسوحات وادي العرب الى وجود عدد من المعاصر (Hanbury-Tenison 1984). وكشف مؤخرا عن معصرة عنب في موقع رجم الكرسي في عمان تعود إلى الفترة البيزنطية والفترة الأموية (وفقا لمعلومات الدكتور عبدالجليل عمرو مدير الحفرية).

وكشف أيضا عن معاصر للعنب في الصويفية – عمان، من الفترة البيزنطية (Rashdan 1988). ومعصرة عنب من الفترة البيزنطية في موقع أبو نصير– الى الشمال الغربي من صويلح (أبو غنيمة ١٩٨٢). كما عثر مؤخرا على معاصر عنب في موقع اليصيلة الاثري الى الشرق من مدينة اربد، تعتبر من أهم وأكبر المعاصر المكتشفة في مناطق بلاد الشام (المحيسن ١٩٩٠). وعثر أيضا على العديد من معاصر العنب في عدة مناطق من شمال الاردن كبيت راس وجرش ودير أبي سعيد والحصن والعديد من المواقع الاخرى في محافظة إربد (ملحم ١٩٩٢: ١٧١–١٩١).

## ثانيا: تاريخ تقنية صنع الخمور من عصير العنب

ينمو العنب في المناطق المعتدلة المناخ، ويتميز بقدرته على النمو والأثمار، وتبلغ المساحة المزروعة من نبات العنب في العالم عشرة ملايين هكتار، ويمكن زراعته في الاراضي الصخرية والرملية وشديدة الانحدار، ويستخدم أكثر من ٨٠٪ من انتاج العالم من العنب في انتاج الخمور، كما يصل امتداد حياة العنب من ٧٠–٨٠ عاما (الاشرم وعبدول ١٩٨٥ : ١٦–٢٢، ٦٠–٨٧، ١٠١–١٥٠).

ويذكر ابن لوقا البعلبكي في كتابه (الفلاحة الرومية) أن أفضل أوقات غرس شجر العنب في شهر تشرين الثاني، وينبغي أن لا

وهناك بعض الأنماط الأخـــرى التي لا تندرج تحت أي من الأنماط السابقة وتصعب قراءة نقوشها.



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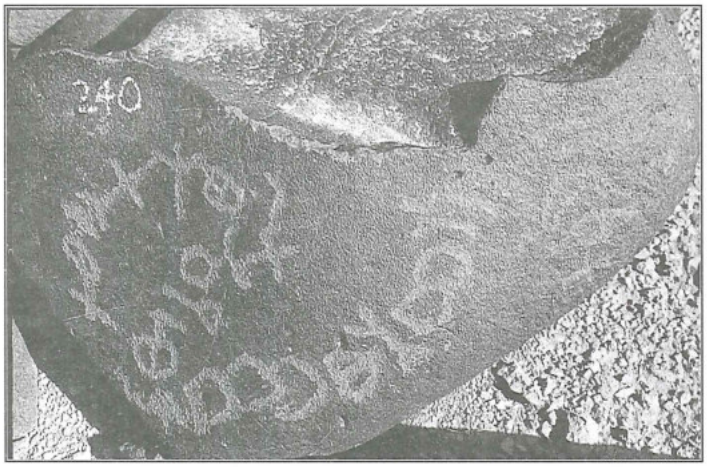

١٦.

ويكتب بلا تكلف أو تحديد، فنجده يكتب من اليمين إلى اليسار ثم من اليسار إلى اليمين أو من أعلى إلى أسفل أو العكس، وأحياناً يكتب بشكل دائري أو حلزوني والمسافات بين الحروف غير متوازنة أو متساوية، وأطوال الحروف غير متناسقة (شكل ١١، ١٢) WH 2945 WH 2830-2833 ومعظم هذه النقوش يصاحبها السبعة خطوط أو السبعة نجوم، وغالباً ما يعني ذلك الالتزام الديني عند أصحاب هذه النقوش.

ومن خصائص هذا النمط عدم التفريق ما بين الحروف المتشابهة مثل حرفي الباء والراء، والشين والفاء، ولا يتم التعرف على هوية الحروف إلا بالممارسة والقراءة المتكررة للنقش نفسه، أو أن يكون اسم العلم معروفاً وشائعاً، أو أن يكون فعلاً ورد في أنماط الخطوط الأخرى التي لا لبس في قراءتها.

خامساً: الخط الهش السميك : وهو من الأنماط القريبة من خط العامة، غير أن كاتبه يحاول تضخيم الحروف وذلك بجعل الحرف الواحد أسمك من الحروف العادية بخمس مرات إما بقصد ابرازه عن غيره من الخطوط حتى تسهل قراءته عن بعد، أو تعبيراً عن مكانة الشخص نفسه بين أقرانه. ومن ميزات هذا النمط أن حرف العين به دائرة صماء حتى تبدو كبيرة الحجم، وفي هذه الحالة فإن الكاتب يضع خطاً عمودياً سميكاً لحرف النون منعاً للتشابه. ولا تتم كتابة هذا النمط إلاّ بطريقة الدق بأداة كبيرة (شكل ١٣، ١٤) (WH 351).

سادساً: الخط المشبوك، وأقصد هنا أن الكاتب يحاول ربط بعض الحروف ببعضها خاصة أداة البنوة، وهو فن معروف بالعربية الجنوبية وهو «المنوقرام» أي ربط حروف الإسم الواحد سواء كان علماً أو اسم إله كنوع من القدسية والجلال أو اسم أحد الملوك، أما في هذه النقوش فكانت هذه المحاولات في الأنماط الخشنة السميكة، فبدأ النقش وكأنه خط واحد (شكل ١٥، ١٦) ( WH 1747, 1748) وقد كان للأستاذ مايكل ماكدونالد محاولات طيبة في قراءة هذا الخط نشرت في حولية دائرة الآثار الأردنية ودراسات عربية في ذكرى محمود الغول(١٧).



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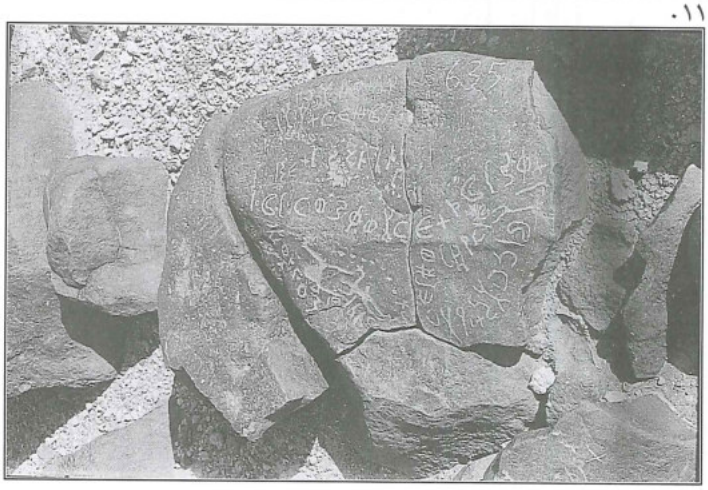

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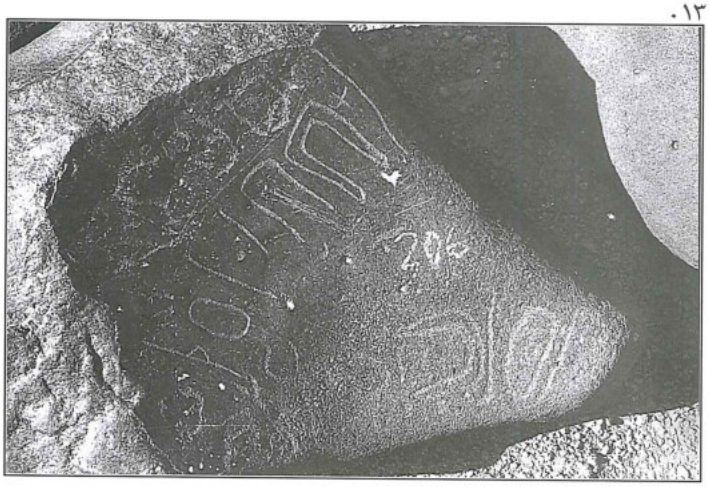

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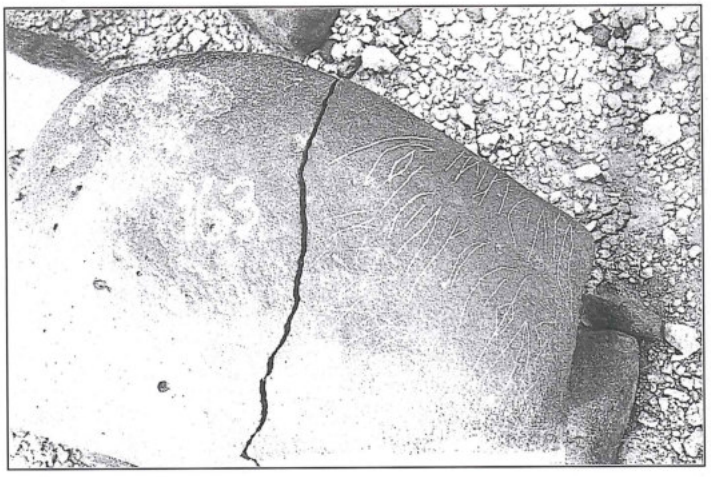
(١٧) أنظر أيضاً : M. C. H. Macdonald, 'ABC's and Letter Order in Ancient North Arabian,' *PSAS6* (1986), pp. 101-116; 'Epigraphic Gleanings from the Archive of the Palestine Exploration Fund,' *PEQ* (1991), p. 114.

المصاحبة للنقوش بالأسلوب نفسه والأدوات نفسها، وهي عبارة عن رأس رمح معدني أو من حجر الصوان الحاد، وقد عثر على مثل هذه الأدوات بأعداد كبيرة مجاورة للصخور المكتوبة ومعظمها تالف مكسور الرأس.

وقد كتب أفراد قبيلة ضيف العدد الكبير من هذه النقوش في الصحراء الأردنية وجنوب سوريا، حتى أننا حاولنا تسميته بخط قبيلة ضيف(١٦) ولدينا أكثر من خمسين نقشاً لهذه القبيلة كتبت بهذا النمط نفسه (شكل ٧، ٨).

ثالثاً: الخط الخاص: وهو الخط الذي يكتب بطريقة تختلف نوعاً ما عن باقي الخطوط الأخرى، ويمتاز بتناسق فريد بمجمل حروف النقش من حيث النهايات العليا والسفلى، ومن حيث المسافات بين الحروف؛ فتجد أن لكل حرف مكتوب شخصية قوية معبرة لا لبس في قراءته ولا احتمال لتأويله. وأشكال حروفه لا هي المربعة ولا الرفيعة بل ما بين ذلك (شكل ٩، ١٠) (WH 593 - 594, WH 2112).



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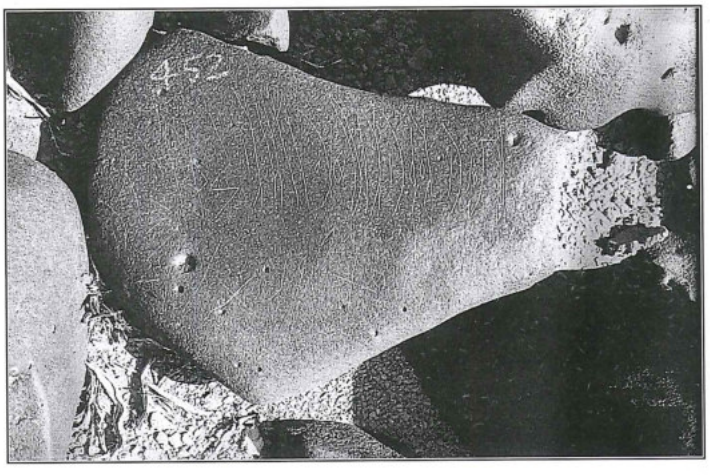

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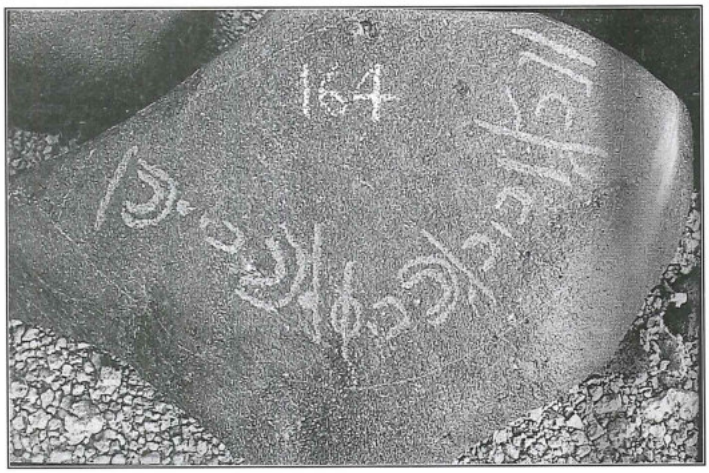
رابعاً: خط العامة: وهو الخط الغالب في النقوش الصفوية، وكتب به أكثر من نصف هذه النقوش في المناطق المختلفة. ويمكن أن يطلق عليه اسم الخط «الدارج»،



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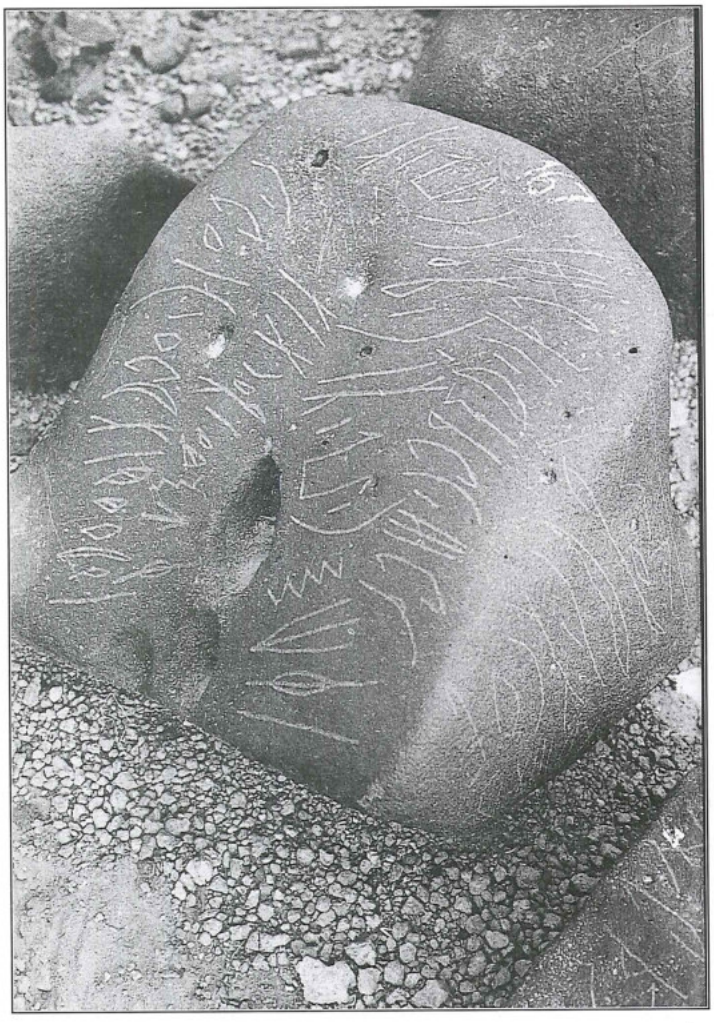

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١٦) انظر: E. Littmann, *Safaitic Inscriptions*, Publications of the Princeton University Expedition to Syria, Division IV, Leyden, 1943; Winnett and Harding, *Inscriptions from Fifty Safaitic Cairns.*

وأطراف العراق الغربية. ويبدو أن الأطراف الشمالية لشبه الجزيرة العربية كانت المنطلق لهذه النقوش، إذ إنه لم يعثر إلى يومنا هذا على أية نقوش صفوية أبعد من جنوب عرعر في المملكة العربية السعودية بينما اتجهت شمالاً حتى مدينة حمص، بشمال سوريا.

وسأستعرض فيما يلي أنماط وأشكال الخط الصفوي دون ترتيب تاريخي متسلسل بسبب عدم وضوح الرؤية الحقيقية والتصور المقبول لمثل هذا التسلسل الذي كان يرتبط في مواقع أخرى بالدلائل الأثرية العديدة من مراحل معمارية وطبقات من المخلفات الحضارية، وبوسائل تكنولوجية حديثة تساعد زملاءنا الآثاريين في تأريخ معثوراتهم الثابتة والمنقولة ولكنها لم تساعدنا في حقل النقوش الصفوية والثمودية خاصة والتيمانية واللحيانية عامة.

ومن هذه الأنماط والأشكال:

أولاً : الخط الصفوي المربع الذي دأب العلماء على جعله الأقدم في النقوش الصفوية، فقد جعله الاستاذ جام(١٣) عند مقارنته بالخط المعيني بالعلا في القرن الرابع وبداية القرن الثالث قبل الميلاد، ودلل على ذلك بمجموعة من الحروف المعينية في العلا ومقابلها في النقوش الصفوية خاصة حروف: الطاء، والظاء، والغين، والصاد، والراء والسين واعتمد في تطور الحرف من المعينية إلى الصفوية الشكل البدائي وحتى الصفوي المتطور معتبراً الشكل المربع وهو الأقرب إلى المعيني هو الأقدم وهكذا.

ومن ميزات الخط المربع استخدام أدوات مصاحبة لأدوات الحفر ربما كانت نوعاً من الأدوات الهندسية، لأن حروف هذا الخط كانت ذوات زوايا قائمة تماماً، ولا يمكن أن يتم ذلك الا بالاستعانة بأداة هندسية تثبت له الشكل والزاوية المطلوبة خاصة الحروف ذات الخطوط الطولية والأفقية مثل الهمزة، والباء، والثاء، والميم وهكذا، أما الحروف الدائرية مثل الواو، والعين، ونهايتي حرف التاء ومنتصف حرف القاف فكانت دائرية تماما وبتوازن حريص، مما يدل على استخدام أداة هندسية ترسم بها الدائرة. غير أن الكاتب كان يضيف إلى الحروف المتشابهة نهايات تبدو أنها خرجت عن الخطة الأساسية خاصة في حرفي الباء والراء، والسين والهاء وهكذا.

ولهذا الخط أيضاً ميزة أخرى وهي تباعد حروفه عن بعضها مما يؤكد ما ذكرناه سابقاً من استخدام الأدوات الهندسية أو شبه الهندسية. وكذلك لوحظ أن هذا الخط نادراً ما تصاحبه الرسوم الآدمية أو الحيوانية، وكتب بطريقة السطور المتوازية مع ترك الفراغ الكافي فيما بين الأسطر، وهما صفتان اختصت بهما الخطوط الجنوبية.

وقد كتب العديد من كتابات قبيلة عمره أو عمرات بهذا الخط حتى كدنا أن نطلق عليه خط عمره أو عمرات أو العمارات(١٤) وهي قبيلة صفوية كبيرة انتشرت في مناطق شاسعة من الصحراء الأردنية شرقاً وجنوباً(١٥) (شكل ٥، ٦).

ثانياً: الخط الرأس رمحي: وهو خط مستدق جداً رفيع غير غائر في سطح الصخور، حروفه طويلة، تميل إلى الأشكال الوترية. وتتقارب حروفه حتى تكاد أن تتشابك، وتصعب قراءته من أول محاولة لاحتمال الخلط في التعرف على الحروف، وغالبا ما يكون شكل النقش حلزونيا متداخلاً.

ويمكن التعرف على أكثر من شكل لهذا النوع:

أ – الخط الرفيع بحروف طويلة جداً،

ب – الخط الرفيع بحروف وسط،

ج – الخط الرفيع بحروف صغيرة.

ومن خصائص هذا الخط أن ترسم جميع الرسوم



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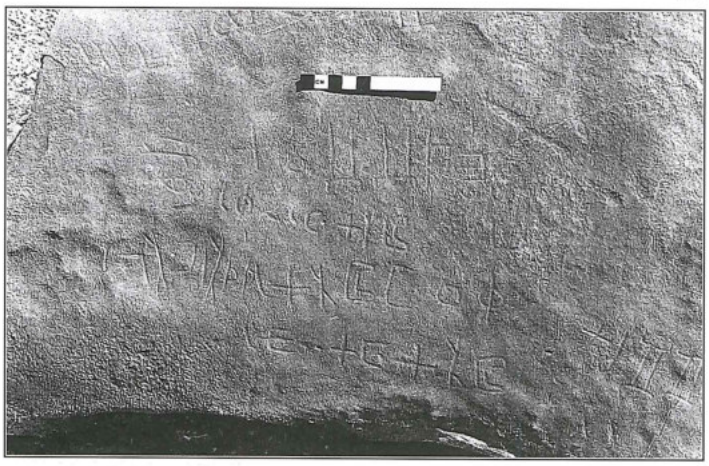

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(١٣) A. Jaṃme, 'Safaitic Inscriptions from the Country of 'Ar'ar and Ra's al-'Anāniy,' in E. Altheim and R. Stiehl, *Christentum am Roten Meer*, Berlin, 1971, pp. 53-54.

(١٤) F. V. Winnett and W. L. Reed, *Ancient Records from North Arabia*, Toronto, 1970, pp. 14-13, no's 1,2.

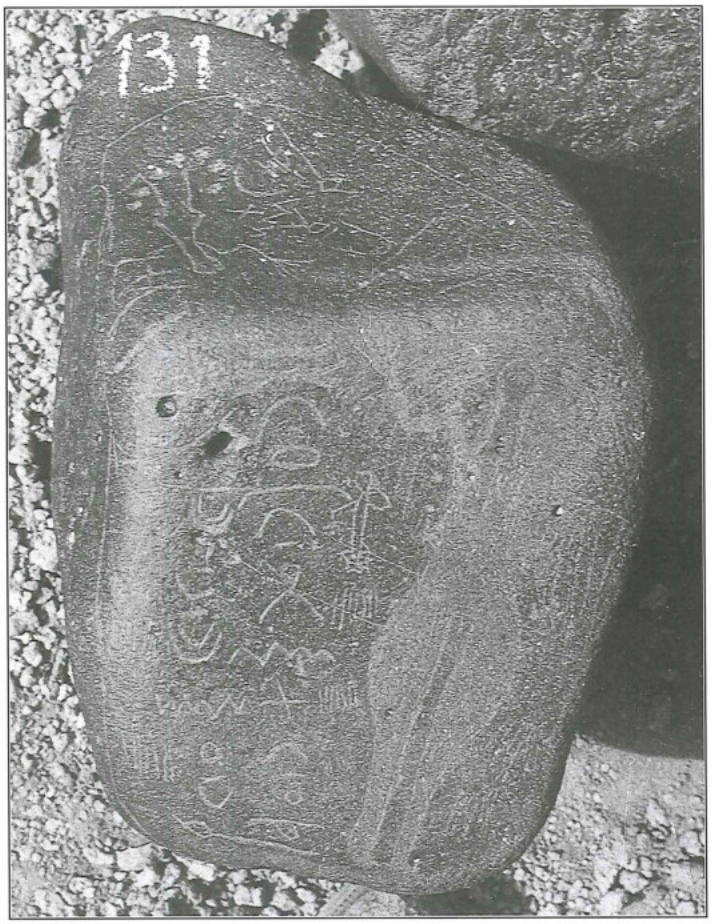
(١٥) الروسان ، **قبائل**، ص ٣٣٦.

ولأي سبب ينهي نقشه بطريقة أخرى، ومن هذه الأسباب فقد أداته لرأسها المدبب، وعدم توافر أداة مماثلة، مما يدفعه إلى إكمال كتابته بطريقة أخرى وأداة مختلفة.

وبعد أن يصبح النقش ذات شخصية مستقلة سواء كان على صخرة منفرداً أم مجتمعاً مع نقش آخر أو نقوش أخرى أو كان داخل اطار أو بدون فإنه لا بد من التعرف على اتجاهات هذه النقوش، والمعروف في معظم النقوش العربية الجنوبية والشمالية نظام قديم وآخر أحدث؛ ففي العربية الجنوبية كان اتجاه الكتابة من اليمين إلى اليسار ثم من اليسار إلى اليمين وهو ما عرف بخط المحراث، أي كما يقوم الفلاح بزراعة أرضه. ثم أصبح طريقة واحدة وهي من اليسار إلى اليمين فقط، وهو ما عرف باللحيانية والديدانية إيضاً. أما الخطوط الأخرى مثل الصفوية والثمودية والتيمانية (نسبة إلى تيماء) فقد اختلفت صورتها إذ كتبت هذه النقوش بطرق عدة منها من اليمين إلى اليسار أو من اليسار إلى اليمين أو من أعلى إلى أسفل أو بطريقة دائرية أو حلزونية وخاصة الصفوية (شكل ٣، ٤)، ولذا يصعب جداً على المختصين معرفة بدايات النقوش، وقد وضعتُ ترتيباً خاصاً لمثل هذه البدايات في كتابي «القبائل الثمودية والقبائل الصفوية»، ص ٦٦ و ص ٢٥١، أما في النقوش الصفوية فيسهل التعرف على البداية من وجود اللام التي تعني الملكية لصاحب النقش أو تعني أنه كتب لفلان بن فلان صاحب النقش.

أما أدوات الكتابة التي حفرت بها النقوش الصفوية فليست معروفة تماماً حتى الآن، إذ أننا ما زلنا نعالج نقوشاً كتبت أو نقشت على صفحات الصخور، أي على مادة الحجارة فقط، ولم نجدها مكتوبة على مواد أخرى سوى بعض الأمثلة النادرة كالفخار والحجر الصابوني. وقد حرمنا من مواد أخرى كالجلود والعظام والمعادن والأخشاب والزجاج قد يكون الصفويين قد كتبوا عليها بأدوات مختلفة وبأنماط مختلفة لأنها أطوع، علماً بأن بعض العلماء قد أكدوا على استمرار استخدام هذا الخط حتى عام ٦١٤م.(١٠) ويرى ليتمان أنها بقيت مستخدمة حتى نهاية القرن الثالث الميلادي،(١١) ويؤيد ذلك ونت.(١٢) أي أنها توقفت عند استخدام خط آخر أصله آرامي وهو نقش النمارة (٣٢٨م).

لم تؤكد الدراسات الخاصة بتأريخ النقوش الصفوية حتى الآن لعدة أسباب، منها عدم وجود نقوش كافية ومؤرخة بسني حكم ملوك أو سلاطين أو حتى مجلس شيوخ قبائل، ولا ذكر لحوادث ذات صلة تاريخية مهمة تؤيد حقائق ثابتة عند شعوب مجاورة ومعاصرة للنقوش نفسها الا اليسير، ولم يعط هذا الموضوع العناية الكافية، وهنا لا بد من توجيه طلاب الدراسات العليا خاصة إلى البحث والتدقيق في هذا الموضوع ومعالجته بطرق حديثة تختلف من حيث الأسلوب المتبع ولست بصدد المحاولات السابقة التي كانت نتائجها اختلافاً في الرأي القائل بأن هذه النقوش بدأت منذ القرن الأول



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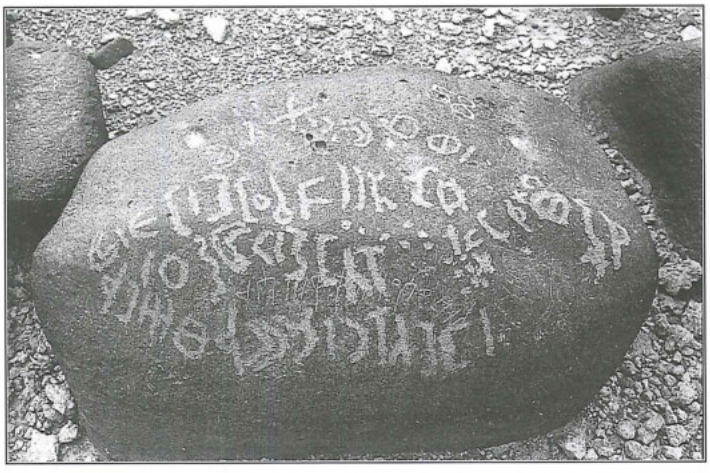

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قبل الميلاد وحتى القرن السابع الميلادي، هذه الفكرة التي تعارضها مجموعة من العلماء (ليتمان، وينت) ويحددون نهاية القرن الرابع الميلادي كحد فاصل لاستخدام هذه الكتابة. ولم يتفق أيضاً على المكان الذي نبتت به غراس الكتابة الصفوية ومن ثم انتشارها في المناطق الشمالية من الجزيرة العربية وجنوب سوريا الكبرى

(١٠) W. G. Oxtoby, *Some Inscriptions of the Safaitic Bedouin*, New Haven, 1968, pp. 6-7.

(١١) E. Littmann, *Thamud und Safa, Studien zur altnordarabischen Inschriftenkunde*, Leipzig, 1940, p. Bnf 104.

(١٢) F. V. Winnett, *Safaitic Inscriptions from Jordan*, Toronto, 1957, pp. 11-12.

منها النقوش المختلفة، ثم الخطوات المتبعة عند كتابة النقش وحتى يصبح نقشاً واضحاً، ثم مهارة الكاتب نفسه في التعامل مع السطح العلوي للصخور المنوي الكتابة عليها، وهي في غالبها صخور بركانية صماء ذات لون أسود ضارب للحمرة.

ويعتقد البعض بأن هذه الكتابات ما هي إلا رسوم(٥) وقد رأى بعض المختصين أن أصل الحروف للكتابات الشمالية رسوم آدمية وحيوانية حورت إلى أشكال ثابتة ثم أصبحت فيما بعد أبجديات.(٦) أما كاتبو النقوش الصفوية فقد نهجوا عدة طرق خاصة عندما كتبوا على الصخور البركانية، فاستخدموا أدوات حادة كالأزاميل الحديدية التي تخدش الجزء العلوي من سطح الصخرة أو الحجر، وتحدث به شقاً يختلف عمقه بين نقش وآخر (١-٣ملم)، وكذلك يختلف حجم الحروف في النقش الواحد عن غيره حسب سماكة هذا المنقاش ومهارة الناقش، وأعتقد أنه كان يسبق هذه الخطوة ما يعرف بتقدير المساحة المعّدة للنقش، ويجب أن تكون ظاهرة كاملة للعيان، ولا يختفي جزء من النقش عن النظر، وإذا حدث مثل ذلك فإنه يكرر النقش في مكان قريب من النقش الأول، كذلك فإنه يترك مساحة كافية أيضاً إذا كان يصاحب النقش رسم من الرسوم لجمل أو أسد أو حمار أو فرس أو أية رسوم آدمية أخرى. وكثير من النقوش كانت تحاط بإطار بيضاوي الشكل أو مستطيل، ولا ينسى الكاتب أن يضع في اعتباره ترك مساحة للسبعة نجوم(٧) التي تتكرر في حالة وجود رسم يصاحب النقش، وكأنها العين الساهرة على النقش وعلى الرسم.(٨)

ثم يحدد حجم الحرف بأداة غير حادة، ثم يتم دقّه بالأداة الحادة (شكل ١) (نقش WH 362) ، وعند إضافة رسم إلى النقش يتم نقشه بطريقة الرسم نفسها (شكل ٢) (نقش WH 627) أما في حالة ارتكاب الكاتب لأي خطأ فإنه يحاول طمس معالم الحرف تماماً بوضع خطوط طويلة وأفقية.(٩)

وهناك طريقة الخدش السريع لسطح الصخرة العلوي بسن مدبب كالسكين أو السيف أو رأس الرمح، وهي أدوات متيسرة خاصة لمن يعيش متنقلاً وسط الحرار، وتستخدم للصيد والذبح وسلخ الجلود أيضاً، أو دفاعاً عن النفس عند مجابهة حيوان كبير كالأسد أو الذئب.

وأستخدمت كذلك طريقة الدق المتتابع، فنجد أن الحرف الواحد يتكون من عدد كبير من النقاط المتجاورة التي حدثت بفعل الدق، وتكبر هذه النقاط وتصغر حسب حدة رأس الأداة، وهي طريقة متبعة بكثرة. والحروف التي تحدثها هذه الطريقة تعتبر كبيرة نوعاً وسميكة، وتترك أثراً ذا لون أحمر على السطح العلوي. ولكن هذه الطرق بمجملها لا تكوّن مراحل لكتابة ولا يسهل تحديد أيها الأقدم، فإن بعض النقوش قد يبدأ كاتبه بطريقة من الطرق السابقة



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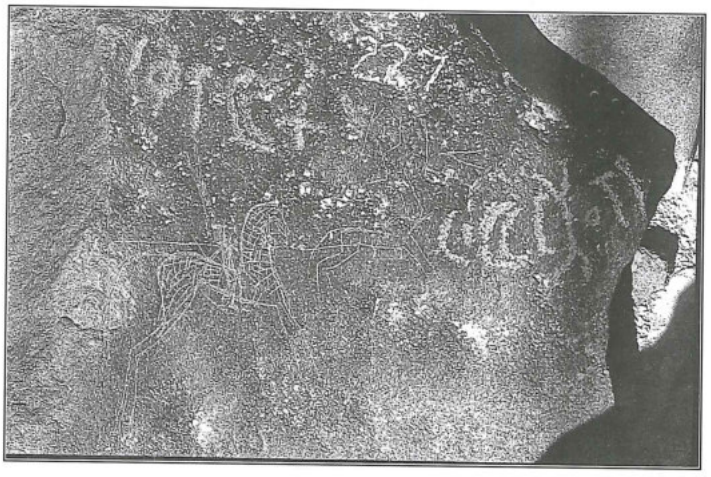

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(٥) رينيه ديسو، **العرب في سوريا قبل الاسلام**، ترجمة عبدالحميد الدواخلي، القاهرة، ١٩٥٩، ص٥٦.

(٦) K. Majeed, *The Prehistoric Rock Art of Northern Saudi Arabia*, Ph.D. Thesis under publication, University of Southampton, 1988, Charts A and B.

(٧) السبعة نجوم تأتي بأشكال متعددة منها النقاط، أو الدوائر، أو الخطوط العمودية. وفي الغالب تكون داخل إطار أو على الإطار نفسه، وفي بعض النقوش يصاحب هذه السبعة نجوم رسم آدمي «طفل أو إله».

(٨) عادل ناجي، «كتابة صفوية من صحراء الرطبة»، **سومر** ١٨ (١٩٦٢)، ص ١٦٩.

(٩) F. V. Winnett and G. L. Harding, *Inscriptions from Fifty Safaitic Cairns*, Toronto, 1978. (WH).

محمود محمد الروسان

# دراسات في أنماط الخط الصفوي

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إن دراسة أنماط هذا الخط ليست باليسيرة، وخاصة أن دراسته ومعرفة أبجديته مرت بمراحل عديدة وشاقة بدأت سنة ١٨٥٧م من قبل المستشرقين والرحالة الغربيين الذين قدموا إلى بلاد الشام والأطراف الشمالية لشبه الجزيرة العربية لأهداف متعددة، كانت النقوش العربية أحدها بالرغم من عدم معرفة الكثيرين منهم لأوليات وأبجديات هذه النقوش، وكانت الخطوة الأولى هي نقل كل ما تقع عليه أعينهم من كتابات ورسوم على صفحات الصخور التي كان يقودهم اليها متطوعون من أبناء البادية، حيث كانت هذه النقوش بالنسبة لهم ضرباً من أعمال خارقة. وهكذا كانت الخطوة الأولى في عام ١٨٥٧م من قبل العالم سيرل جراهام Cyril Graham ثم جوزيف هالفي J. Halvy الذي استطاع ان يتعرف على هوية سبعة أحرف من الأبجدية المسماة «الصفوية» وذلك في عام ١٨٨٢م بعد أن أخذ باعتباره اكتشافات سيرل جراهام عن طريق الجمعية الجغرافية الملكية بلندن، ولم تكن تلك المحاولات للتعرف على الأبجدية -رغم تعثرها - كثيرة، ومنها محاولة بلاو وديفيد مولر اللذين نشرا محاولاتهما في مجلة المستشرقين الألمانية (المجلد ١٤ ص ٤٥٠). أما جوزيف هالفي فقد تعرف على مصطلح البنوة «بن»، ونشر محاولته للتعرف على الأبجدية الصفوية في المجلة الآسيوية تحت عنوان «محاولة في دراسة النقوش الصفوية» عام ١٨٨١م.

وقد أدخل بريتوريوس بعض التعديلات على الأبجدية الصفوية، ولم يتخل عن محاولات. ج. هالفي.

أما اينو لتمان فقد أتم العمل في هذه الأبجدية ووضعها في الشكل الذي نعرفه الآن وذلك في عام ١٩٠١م، وبهذا أصبح لدينا ثمانية وعشرون حرفاً لهذه الأبجدية، وهي بهذا تشبه أبجدية لغتنا العربية.(١)

وقد جمع من النقوش الصفوية أكثر من عشرين ألف نقش منذ المحاولات الأولى وحتى يومنا هذا خاصة بعد اكتشاف الأبجدية مما يسَّر متابعة وكشف سر هذه النقوش من قبل المستشرقين والهيئات العربية سواء في دائرة الآثار الأردنية أم الجامعة الأردنية عن طريق قسم الآثار، وجامعة اليرموك عن طريق معهد الآثار والانثروبولوجيا. والأمل كبير في أن ترى هذه النقوش النور في مجلدات أو مقالات.(٢)

أما مواقع النقوش الصفوية المعروفة إلى الآن فتمتد من جبل العرب في سوريا إلى أواسط الجزء الشمالي من الجزيرة العربية - الصحراء الأردنية والعلا وتبوك وعرعر - ومعظمها كتب على رجوم في الحرار الصحراوية، وعلى حواف الوديان التي تخترق الصحراء، والتي كانت منذ ما قبل الميلاد موطناً يلتجىء إليها الإنسان طلباً للكلأ والماء، وللأسف الشديد فإن دراسة جادة لمعرفة إن كانت هذه الحرار أو ما جاورها من الأرضين تضم بعض المستوطنات، لم تتم حتى الآن باستثناء محاولات طفيفة لم تتابع من قبل العلماء.(٣)

ومن الراجح - حتى هذا التاريخ - أن الخط الصفوي إن لم يكن قد أخذ من العربية الجنوبية (المسند) للتوافق التام من حيث التعبير والاستخدام وبعض أشكال الحروف إلى جانب بعض المميزات اللغوية،(٤) إلا أن الجزيرة العربية هي المصدر الأول له.

أما أنماط هذا الخط ، وهي موضوعنا الحالي الذي تصعب دراسته بمعزل عن الخطوط العربية الشمالية المعاصرة له أو السابقة عليه، فلا بد من تناولها في بحث الأمور التالية:

- طريقة الكتابة،
- أدوات الكتابة،
- المواد التي كتب عليها هذا الخط.

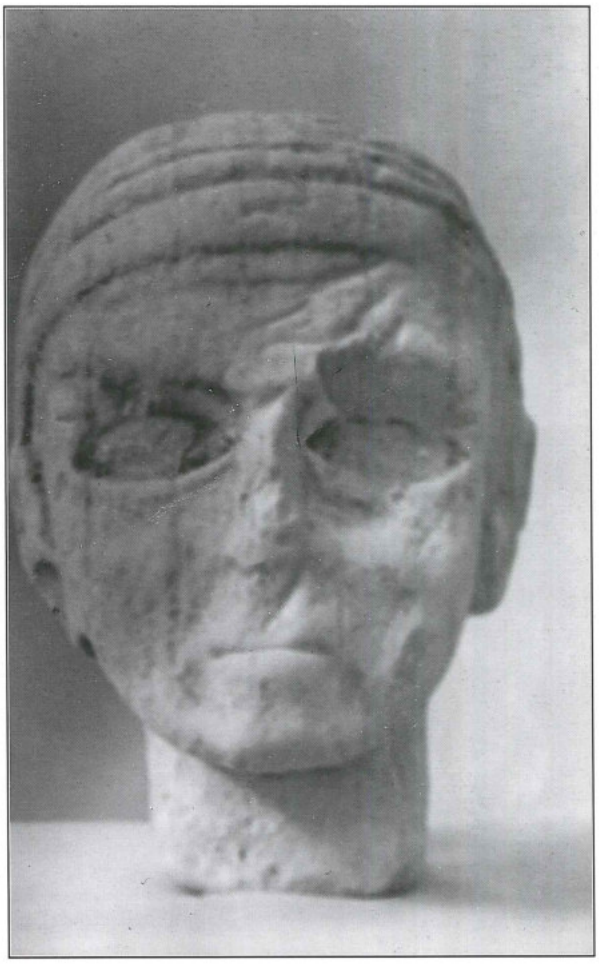
والمقصود بطريقة الكتابة هنا: الاتجاهات والبدايات التي تتشكل

(١) للمزيد انظر محمود محمد الروسان، **القبائل الثمودية والصفوية** .الرياض / عمادة شؤون المكتبات / جامعة الملك سعود، ١٩٨٧.
E. Littmann, *Zur Entzifferung der Safa-Inschriften*. 1901.

(٢) شكل ما يعرف الآن بمدونة النقوش الأردنية في قسم النقوش بمعهد الآثار، ويحاول المختصون نشر مجلد النقوش الصفوية التي جمعت اثناء العمل الميداني في العامين ١٩٩٠ - ١٩٩١ من موقع غدير الملاح إلى الجنوب الشرقي من الصفاوي، وكذلك نشر ما جمع من نقوش في كل المواقع التالية: بيار الغصين، الشبيكة، والنقوش الثمودية من منطقة باير.

(٣) محاولات هاردنج وأوكسبتي في معرفة بعض ما تحتويه الرجوم. كذلك المحاولة في جاوه من قبل البعثة الأثرية في الموقع، أنظر:
G. L. Harding, 'The Cairn of Hani', *ADAJ* 2 (1953): 8-56; S. W. Helms, *Jawa. Lost City of the Black Desert*, 1981, pp. 217-229.

(٤) محمود الروسان، **القبائل**، ص ٢١٤ وما بعدها.



١١ . ٤٧٥٤ J رأس رجل من عمان (متحف الآثار الأردني).

وخلاصة القول أننا نميز أربع مجموعات من المنحوتات العمونية تتميز عن بعضها بأسلوب نحتها:

أ- مجموعة من نتاج مدرسة عمونية جمعت بين التقاليد القديمة الموروثة في بلاد الشام والابداع المحلي (أرقام ١، ٢، ٣، ١٨، ١٩، ٢٠).

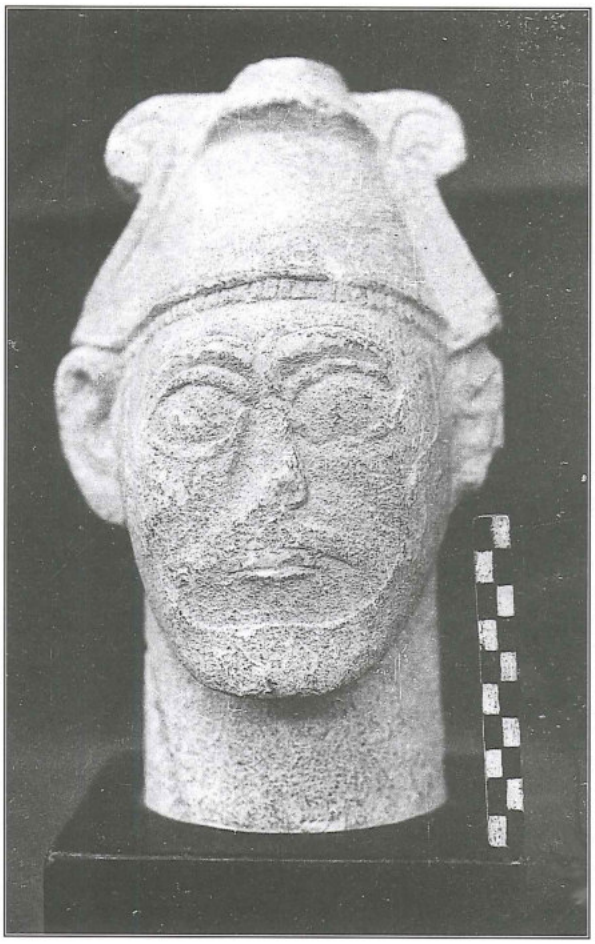
ب- مجموعة تأثرت بالأساليب الفنية المعاصرة في بلاد الشام وحافظت على خصائصها المحلية (أرقام ٩، ١٠، ١١، ١٧، ٢٥).

جـ- مجموعة يظهر فيها التأثير المصري واضحاً في وقفة التمثال وزيّة فقط. أما تسريحة الشعر وملامح الوجه وغيرها فهي عمونية (أرقام ٨، ١٢، ١٧).

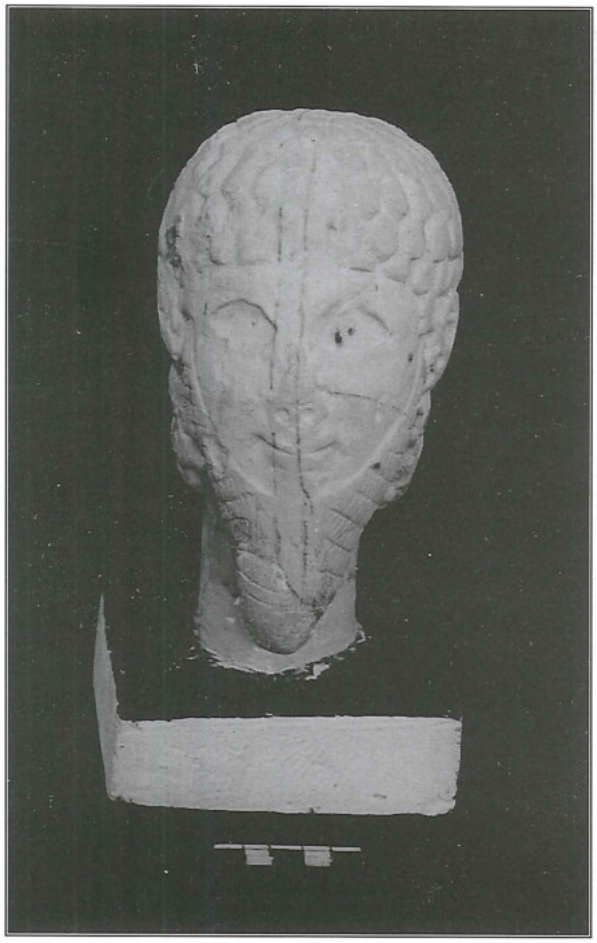
د- إن الرؤوس ذات الوجهين كانت عناصر معمارية تذكرنا بالقطع العاجية المكتشفة في أرسلان طاش ونمرود وغيرها، وهي على شكل نافذة تطل منها فتاة (أرقام ٢١-٢٤).

لقد أرّخنا المنحوتات العمونية بالاعتماد على الدراسة المقارنة مع الفنون المعاصرة في البلاد المجاورة، وتبعاً لذلك قسّمناها إلى خمس مجموعات:

- المجموعتين الأولى والثانية وتضمان المنحوتات ذوات الأرقام ١ حتى ٧ وقد نسبناها إلى فجر نشوء الحضارة العمونية (حوالي٨٠٠-٧٣٠ق.م).
- المجموعتين الثالثة والرابعة وتضمان المنحوتات ذوات الأرقام ٨ حتى ١٧ وجذع التمثال رقم ٢٥، وقد نسبناها إلى العصر العموني الأوسط (حوالي٧٣٠-٦٩٠ق.م).
- المجموعة الخامسة وتضم الرؤوس ذوات الوجهين، وهي من نتاج العصر العموني الأخير (حوالي٦٩٠-٥٨٠ق.م).



٩ . ٢٨٠١ J رأس رب (متحف الآثار الأردني).



١٠ . ١٦٥٤ J رأس رجل من القلعة (متحف الآثار الأردني).

هنالك تماثيل صنعت من مادة واحدة وأخرى مركبة من عدة مواد، ونجدها في العيون التي قد تشكل من المادة نفسها، أو من مادة أخرى ذات لون مغاير للون حجر التمثال تنزل في مكانها بالوجه.

وثمة أمر آخر يجب أن أذكره قبل الانتقال إلى تقنية صنع التمثال وهوية التمثال ووظيفته، وهو أن المنحوتات العمونية التي بين أيدينا تنقسم إلى المجموعات التالية: أرباب، وحكّام، ونساء، وعناصر زخرفية معمارية.

أ- تماثيل الأرباب وقد ميزّت عن غيرها بوساطة التاج.

ب- تماثيل الحكام وقد ميزت عن غيرها بوساطة الزنبقة التي يحملها الحاكم بيده.

جـ- تمثال امرأة وجد في خربة الحجار، وقد ميزت بلباسها الذي يتألف من ثوب ودرّاعة.

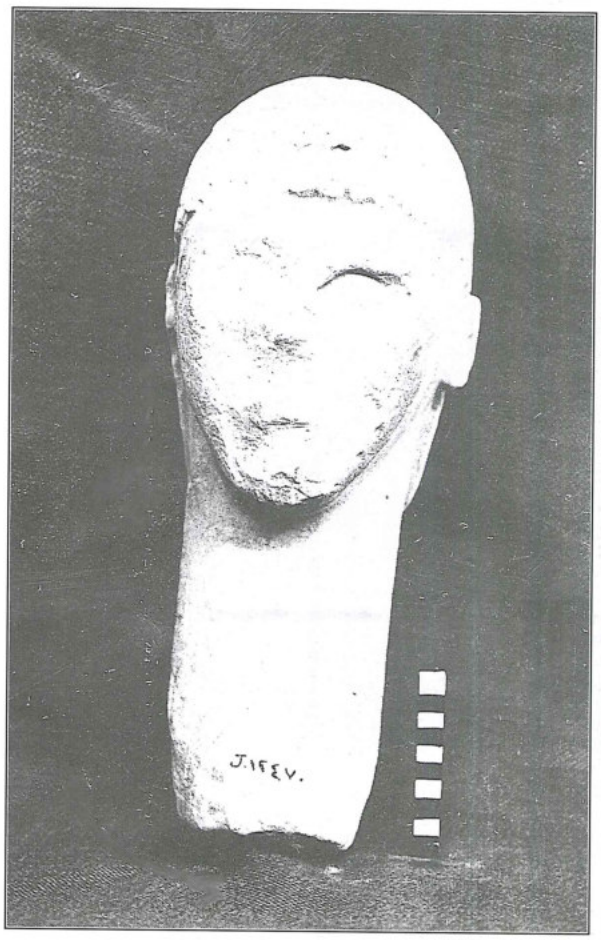
د- تماثيل النساء ذوات الوجهين.

إن الانطباع الذي يولده تمثالا خربة الحجار (رقم ١-٢) هو أنهما تقليد لأشكال صنعت من الخشب، ففصل ساعد الرب عن جسمه، وقطع الثوب فوق القدمين يذكراننا بالنجر في الخشب أو العاج.

ويبدو الفصل بين طرفي حزام وأصابع قدمي تمثال الرب المكتشف في قلعة عمان (رقم ٣) كفرضة في الخشب والعاج. وإذا أمعنا النظر في الرأس (رقم ٥) نلاحظ أن حافة التاج والعينين والذقن قد فصلّت عن محيطها بحزوز دقيقة لا تختلف عن مثيلاتها في العاج والخشب. ومثل هذه الحزوز الدقيقة نلاحظها على تمثال يرح عزر وخاصة على شعره. أما ساقي تمثال عرجان فهي غير عضوية، أي خالية من التفاصيل، وغير طبيعية، تبدو وكأنها كونت من خشب أو عاج أيضاً.

إن الأثلام والحزوز والفرضات التي تتكون بوساطتها خصل الشعر أو تتميز بها العيون عن محيطها، أو تتحدد بوساطتها أهداب الثياب وطياتها هي انعكاس للفرض والحزّ والثلم في الخشب والعاج. وليس قصدي من كل هذا أن تماثيل العمونيين كانت نسخاً عن تماثيل خشبية وعاجية بل هي متأثرة بأسلوب صنع التماثيل من هاتين المادتين. وهي أيضاً ليست صوراً لأشخاص معينين، بل هي تكوين لبشر بوضعيات مختلفة بعيدة في مجملها عن الواقعية والجمالية والقوة والحركة التي تتمتع بها الأجسام البشرية عامة.

فغاية الفنان إبداع منحوتات بشرية تجريدية رمزية لا تحاكي الأشكال البشرية الحقيقية المنسوبة لأشخاص بعينهم.




٨ أ.



٨ ب.

٨ . ١٢٤٧٠ J رأس من أبي علنده (متحف الآثار الأردني).

إنّ الرؤوس التي اكتشفت في بلاد عمون كثيرة، ومتنوعة، ومختلفة، ولا تنتسب لعصر واحد، أو مدرسة واحدة. ويمكن توزيعها على ثلاث مجموعات حسب أسلوب نحتها وعصرها.

فالرؤوس ذوات الأرقام ٤-٧ هي رؤوس أرباب تحمل على رأسها التاج الذي يزين جانبيه عنصر نباتي، وتكون ذقونها ولحاها قصيرة جداً، تكاد تكون غير واضحة لولا فصلها عن الوجنتين بوساطة حزّ جلي (شكل٩)، وتذكرنا برأس ملك اللالخ ياريم ليم (القرن السابع عشر ق.م)، وبالأسلوب نفسه كوّنت العينان، منهما ملساويتان يفصلهما عن محيطهما حزّاً أو جفن دقيق، وحدّدت معالم كأس الزهرة الملتصق بالتاج كالمقبض. وإلى جانب رؤوس الأرباب هذه، لدينا مجموعة رؤوس حاسرة من أبي علندة (أرقام ٥، ١٣، ١٤، ١٥، ١٦)، ورأس من قلعة عمان (رقم ١٧) وآخر شراء (رقم ٨). ومع ذلك يمكن التعرف على تسريحة الشعر المتشابهة في هذه الرؤوس، حيث تنبعث من اليافوخ عدة صفوف من خصل الشعر المفتولة والمعقوفة والدائرية (شكل ١٠). أما في رأس عمان فخصل الشعر عادية غيرمفتولة، وفي الرأس رقم (٨) تكون خصل الشعر طويلة ومتوازية (شكل ١١). وما دمنا في وصف هذا النوع من الشعر، لا بدّ أن نضم إلى هذه المجموعة تمثال عرجان الذي يقف على قاعدة ويسند ظهره على مسند عال كالفراعنة، وفي وقفته هذه تمكن الفنان من فصل التمثال عن الكتلة الحجرية، فالتمثال هو البارز وليس المسند.

وممّا تقدم يتضح أنّ هذه المجموعة، كانت متميزة عن سابقتها، نجد فيها تأثيرات خارجية تتجلي في الزي وتسريحة الشعر ووقفة التمثال. ويجب ألاّ يدهشنا هذا الأمر لأن الاتصالات بين ممالك بلاد الشام، في هذا العصر، قويت واشتدت رغم الغزوات الآشورية المتكررة على البلاد.

وهذا الانفتاح على فنون البلاد المجاورة، لم ينسي العمونيون تقاليدهم الموروثة، بل مضوا في صنع منحوتات وفق أساليبهم المعهودة. مثل رؤوس الأرباب (١٨-٢٠) والرؤوس ذوات الوجهين (٢١-٢٤).

يضع الأرباب التاج العموني المعروف ونرى سطحه أملساً ناعماً، ومقبضه ذا حروف حادة. أمّا كأس الزهرة فقد حدد بوساطة أثلام دقيقة. وجوه الأرباب ملساء ناعمة مفعمة بالحيوية وتوحي بأنها لفتيان، وقد مثّلت ذقن الرأس (رقم ١٩) قصيرة وفق التقاليد القديمة، في حين جعلت ذقن الرأس (رقم ١٨) طويلة مستطيلة الشكل تقريباً تذكرنا بتماثيل العبّاد من تل خويرة التي تعود إلى عصر نشوء الممالك (٢٦٠٠ق.م.).

والازدواجية التي نراها في صنع التماثيل، والتي تعني أن



٧ أ.



٧ ب.

٧ . ١١٦٨٨ J رأس فتاة بوجهين من القلعة (متحف الآثار الأردني).

إبراز تفاصيل الجسم، بل اكتفى بمعالجة السطح بالقدر الذي سمح له بتوصيف الملابس. لقد كان همه تطوير الانسان الذي تلفه الملابس من غير أن تكون ملاءمة بين الجسم والملابس، فالملابس لا تأثر بحركة الجسم. ليس هذا وحسب، بل كوّن النحات رؤوس تماثيل خربة الحجار والقلعة (رقم٣)، (شكل ١، ٢، ٣) كبيرة نسبياً بلا رقاب تقريباً، ويرجع السبب في ذلك إلى أن النحات إما أنه أحبّ تمثيل أشخاص برقاب قصيرة ليحافظ على قوة التمثال، أو أنه مبتدىء في أعمال النحت، وبما أن التماثيل قصيرة فإنها تبدو منضغوطة وجامدة، غير حيوية.

وبعد استعراضنا لهذه التماثيل الثلاثة، نعرض إلى تمثال يرح عزر الشهير (رقم ٩) (شكل ٥). فالنحات الذي نفذ التمثال حافظ على الصيغ التقليدية الموروثة مثل وضعية الوقوف ونوع الملابس الخ.، وأضفى على تمثاله الحيوية والحركة بواسطة التفاعل بين الثوب وحركة الجسم. فيرح عزر يقف ماشياً فتبرز القدمان من تحت أطراف الثوب الذي تظهر عليه الثنيات كردة فعل على حركة القدمين.

ويدرج مع تمثال يرح عزر في قائمة واحدة التمثال المشوّه (رقم ١) وجذع التمثال (رقم ١٠) والجذع (رقم ٢٥) وجميعها تتشابه في الوقفة والحركة والملابس (شكل ٤) ونجد على قاعدة تمثال يرح عزز نقشاً كتابياً. ولو كانت تماثيل هذه المجموعة كاملة، لربما كانت فيها نقوش كتابية أيضاً.

ومهما يكن الأمر، فإن الملابس ترتفع فوق بعضها ساف فوق ساف حروفها واضحة. أما الزنبقة وباقة الورد فقد أبرزهما النحات وفصلهما عن الجسم. وقد راعى أن تكون ذؤابات الملابس وكذلك الأصابع والأظافر واقعية. وعلى النقيض من هذا كله نرى عيباً بسيطاً في تنفيذ بعض التفاصيل، ويتمثل في أن أهداف حافة المئزر العليا منتصبة وليست متدلية كما يجب أن تكون. وهنا نضع في الحسبان أن جزفة الثوب سميكة قوية خيطت عليها الأهداب، وإذا كان الأمر كذلك فإننا لا نرى في انتصاب الأهداب أي عيب.

ومن هذه القطع الفنية التي عرضنا لها نرى أن تمثال يرح عزر تاماً، والتمثال (رقم٢٥) رأسه مفقود، بقيت خصل شعره فوق ظهره (شكل ٤). إنّ هذا التصوير الواقعي يبرز بدائية تماثيل خربة الحجار، التي تطل أقدامها من نافذة في أسفل الثوب، وبين هذا وذاك يقف تمثال قلعة عمان (رقم٣) صنو تمثال يرح عزر، إذ لم يقطع طرف الثوب على شكل نافذة بل يسقط الثوب فوق القدمين حتى الكاحل ويبقى مرتبطاً بالقاعدة من الخلف (شكل ١). وارتباطه بالقاعدة على هذا النحو يظهر مدى رغبة الفنان في المحافظة على الكتلة الحجرية متماسكة بحيث يبقى التمثال جزءاً من الكتلة الحجرية.

وعلى النقيض من التماثيل الواقفة التامة تبدو أعناق الرؤوس المكتشفة في أبو علندة (رقم ٥، ١٣، ١٤، ١٥، ١٦، ١٧) (شكل ٨) والأخرى التي اشترتها دائرة الآثار العامة (رقم ٤-٧) طويلة جداً أو عادية. وقد تحسب أنّ ذات الرقاب الطويلة كانت مغموسة في جسم من المادة نفسها أو من مادة أخرى لشدة طولها. وبمعنى آخر نجد أن مردّ التعارض بين رقاب رؤوس التماثيل هو بلا شك وظيفتها وماهيتها.



٥ . ١٦٥٦ J الملك يرح عزر (متحف الآثار الأردني).

واضحاً من لغتهم التي هي على الأرجح لهجة آرامية.(٩) ومن جهة أخرى، كان سكان بعض مدن ساحل بلاد الشام كصيدا وصور روّاداً في الحركتين الفنية والمعمارية ببلاد الشام. ولا نشك بأن شهرتهم وصلت إلى مسامع بني عمون، أو تعرفوا اليهم عن طريق بعض أعمالهم الشهيرة مثل التحف العاجية وغيرها.

والحالة هذه، كان من المفترض أن نجد تأثيرات آرامية وساحلية قوية وواضحة في الفن العموني، وأن تكون فنون الممالك الآرامية والمدن الساحلية –على الأقل– روافد الفن العموني تستمد منها بعض الأسس والقواعد، نظراً لأن البلاد كانت تفتقر إلى الفنون التي كان من الممكن أن تشكل القاعدة التي يرتكز عليها الفن العموني في إنطلاقته وتكوينه.

صحيح أنه عثر في موآب على النصب المعروف بنصب البالوعة وعلى قطع فنية معينة صغيرة طينية أو حجرية في أماكن متفرقة من المملكة الأردنية الهاشمية،(١٠) إلا أن هذه القطع التي تنتسب إلى عصور سبقت العصر العموني كانت قاصرة عن أن تكوّن القاعدة لانطلاق الفن العموني. زد على ذلك أننا لا نعرف مدرسة فنية قامت في هذه الديار تصلح لأن تكون أصولاً ينهل منها

(٩) A. Abou Assaf, *ibid*. pp. 13-14, 17. 17.



٦ . ٤٧٦٧ J رأس الرب الفتي (متحف الآثار الأردني).

النحات العموني مثل مدارس ماري وايبلا وصيدا وصور وحماه وغيرها.

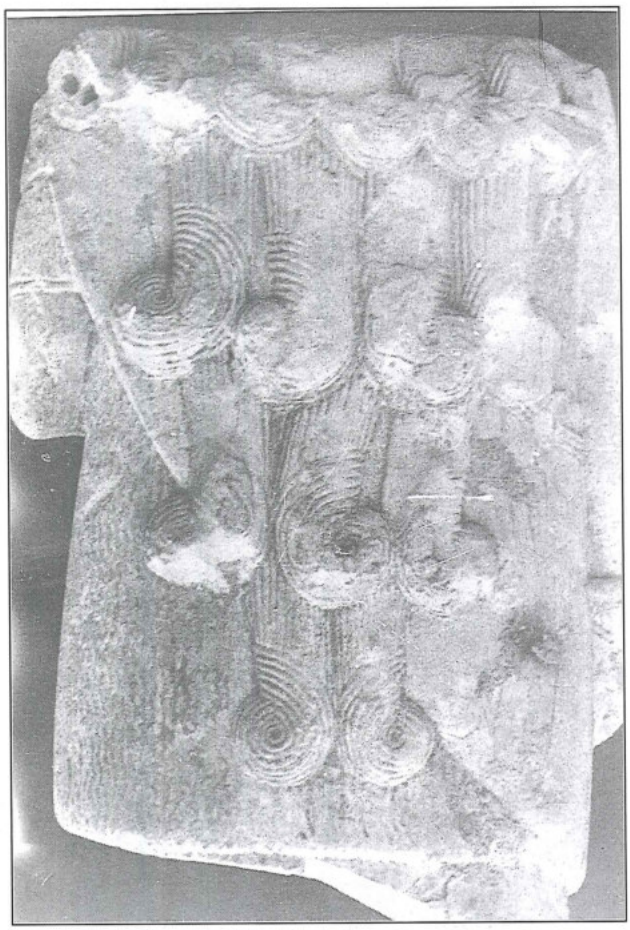
وتأسيساً على ما تقدم لم يعمل العمونيون على إحياء الفنون النحتية القديمة لأنها لم تكن من الفنون المتطورة والمتقدمة، كما أنهم لم يقلدوا الآراميين في فنونهم. فالفن العموني في بداياته لم يتأثر بالفن الآرامي ولا بفنون الممالك الأخرى المجاورة. وهنا يجب أن نشير إلى شيء مهم جداً، وهو أن فن مملكة دمشق الآرامية لا يزال مجهولاً، ولا يمثله سوى قطع قليلة جداً تنبيء برقيه. ومن المعروف أن أولى الأعمال الفنية العمونية ترقى إلى القرن الثامن ق.م. في حين أن بدايات الفنون الآرامية تعود إلى القرن العاشر ق.م. وخاصة في الممالك الشمالية. ومع ذلك لم يتأثر العمونيون بالآراميين في بداية نهضتهم الفنية.

لقد سار العمونيون وفق قواعد خاصة بهم، فعمدوا إلى اختيار الحجر الكلسي الأبيض الطري، وعملوا به نحتاً ضمن فراغ هندسي مستطيل الشكل. والناظر إلى تمثالي خربة الحجار (رقم١ ورقم٢) (شكل٣) يستنتج أن النحات المعلم لم تكن له خبرة واسعة أو قوية في نحت الحجر، فهو لم يجرؤ على التعمق في الحجر

(١٠) - R. H. Dorenmann, *The Archaeology of the Transjordan in the Bronze and Iron Ages*,1983.



٤ أ.



٤ ب.

٤ . ١٦٧٠٢ J جذع تمثال عموني – **حولية دائرة الآثار العامة** ٣٣ (١٩٨٩) لوحة رقم ٥١، القسم الأجنبي.

جانبيها عنصر من صنف النبات يشبه كأس الزهرة. ولم يتغير هذا لشكل على مدى قرون، إنما الذي تغير هي طريقة التمثيل، فقد كون القرص سميكاً أو رقيقاً أو منحنياً، والعنصران النباتيان حّوران أو واقعيان (شكل ١، ٦). ومهما يكن الأمر فإن هذا التاج ن نوع التاج المصري، تاج عاطف. ويتميز عنه في أن له عنصرين باتيين يقابلهما على التاج المصري أرياش ويعصب الملك أو الرجل امة شعره بعصاب رفيع غير مزوق، وتعصب الفتيات شعورهن عصبة أعرض قليلاً (شكل ٥، ٧)، وفي هذا يجاري المعلم العموني قرانه في الممالك الآرامية والمملكة الآشورية. ولئن ميز النحات بين لأرباب والبشر في لباس الرأس، فقد ساوى بينهم في تصويرهم فاة.

وكعادة أهل عصرهم كان العمونيون يتزينون بالحلي، ونعرف نها: الأقراص والأطواق والأساور. والقرط حلية نسائية يتزين به رجال في بعض الأحيان، حيث كان شكله وكانت صنعته ملائمتين ذوق العصر. فالقرط الذي أثبتته المرأة المكتشف تمثالها في خربة حجار في أذنيها (رقم ٢) وتمثال عرجان (رقم ١٢) هو حلقة سغيرة علّق عليها ثلاث حبّات مدورة، وهو يشبه العديد من الأقراط لآرامية والآشورية (شكل ٢، ٣)، والصنف الثاني من الأقراط: هو قرط الذي نراه على الرؤوس الحجرية النسائية التي اكتشفت في القلعة بعمان (أرقام ٢١–٢٤)، ويتألف من قضيب صغير علّقت عليه ثلاث حبّات، ويمكن مقارنته مع أقراط من الملك الآشوري سنحاريب (٧٠٥–٦٨١ق.م) (شكل ٧).

وتزينت النساء بالأطواق، ففي أعناق الرؤوس ذات الوجهين أطواق متشابهة، يتألف كل منها من قضيب ذي حافتين سميكتين يعلق عليهما حبّات أو خرزات سوداء اللون (شكل ٥، ٧) وعلى صدر تمثال عرجان نشاهد قلادة مشوهة تتألف من خيط طويل شكت فيه خرزات. وإلى جانب هذه الحلي يضع الرب الذي اكتشف تمثاله في خربة الحجار، والملك الذي اكتشف تمثاله في القلعة، سواراً عادياً في المعصم.

هذه باختصار صفات التماثيل العمونية التي تميزها عن غيرها، فماذا عن أسلوب النحت وتأثره بفنون الممالك المجاورة وتأريخ المنحوتات العمونية؟

نحن نعلم من أخبار العمونيين المدوّنة في كتاب العهد القديم، ومن أخبارهم المدونة في الوثائق الآشورية، أنهم كانوا على صلة وثيقة بجيرانهم الآراميين الذين هبّوا للدفاع عن عمون ضد غارات أسباط بني اسرائيل، بينما جرد العمونيون قوّاتهم لمشاركة الآراميين في مقاتلة الآشوريين. ونحن على ثقة من أن العلاقة بينهم قد تجاوزت هذه الأمور إلى أمور ثقافية حضارية، ويظهر ذلك جلياً

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# نحت التماثيل العمونية

تتعرَّض إلى فن النحت العموني لا بد أن نشير إلى أن بلاد
ن تفتقر إلى اللوحات المنقوشة، فنحن لانعرف حتى الآن أية
عمونية من النوع الذي نعرفه في بلاد الشام وخاصة في
ر الآرامي،(١) وقد تتغير هذه الحقيقة إذا توالت الاكتشافات
لمواقع العمونية وعثر فيها على لوحات منقوشة، ولذلك
صر دراستنا على نحت التماثيل.

تميز التماثيل العمونية عن أقرانها الآرامية المعروفة حتى الآن
ر قامتها، فارتفاعها يتراوح بين ٣٦–٧٤سم.(٢) وتذكرنا هذه
رة بتماثيل العُبّاد التي تعود إلى الألف الثالث ق.م. والتي
ت في تل خويرة وماري وتل أسمر وأور وغيرها، والتي كانت
ا قصيرة.(٣) فهل أحبّ الفنان العموني إحياء الصيغ التقليدية
ة؟

على العكس من ذلك، فإن التماثيل التي عثر عليها في جوزن
صمة بيت بحياني – يزيد ارتفاعها على ٢,٧٥م لأنها تحمل
ف مدخل القصر، بينما يبلغ طول الملك هدد يسعى ١,٦٠م،
ل ملك صرّين ١,٦٥م، ولم تشذ عن ذلك تماثيل عين التل
از التي كانت هي الأخرى بالطول الطبيعي للانسان.(٤) ومثلها
ل التماثيل التي اكتشفت في بلاد عمون، وهي بالحجم
عي تقريباً.

د اختار النحات العموني الحجر الكلسي القاسي أو الطري
ض أو الوردي)، ومرة واحدة فقط الحجر الصابوني
ياتيت) لصنع تماثيله، ولم يستخدم الحجر البازلتي الأسود
ي إلا مرة واحدة في الرأس (رقم J١٦٧٣٩) جرياً على عادة
ين، وقد يكون مردّ ذلك إلى سهولة النحت في الحجر
ي أو الصابوني، فهذان الحجران طرّيان، ويتوافران في
ط العموني، هذا من جهة، ومن جهة أخرى نرى أنّ النحات
تمثيل الرب أو الانسان واقفاً راكباً، اليد اليمنى مسبلة،
رى مرفوعة إلى البطن، والقدمان متجاورتان (شكل ١) وهو

بهذه المبادرة يكون قد خرج على صيغة تقليدية موروثة سادت قروناً عديدة في بلاد الشام والعراق، وتتمثل في تشابك اليدين أمام البطن. ليس هذا فحسب بل انفرد النحات العموني بهذا الشكل بينما ابتعد عنه الفنانون الآراميون والآشوريون الذين لجأوا إلى وضعية اليدين هذه إذا كانت تخدم غرضاً معيناً، فالملك بر راكب أسبل اليد اليمنى، بينما أمسك باليد اليسرى على طرف الإزار.(٥)



١. J ١٦٥٧ تمثل رب من قلعة عمان (متحف الآثار الأردني).

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ي أبو عساف، **الآراميون تاريخاً ولغة وفناً**، ١٩٨٨، ص٢٠٤ وما بعد.

A. Abou Assaf 'Untersuchungen zur Ammonitischen Rundbild Kunst' *Ugarit-Forschungen* 12.

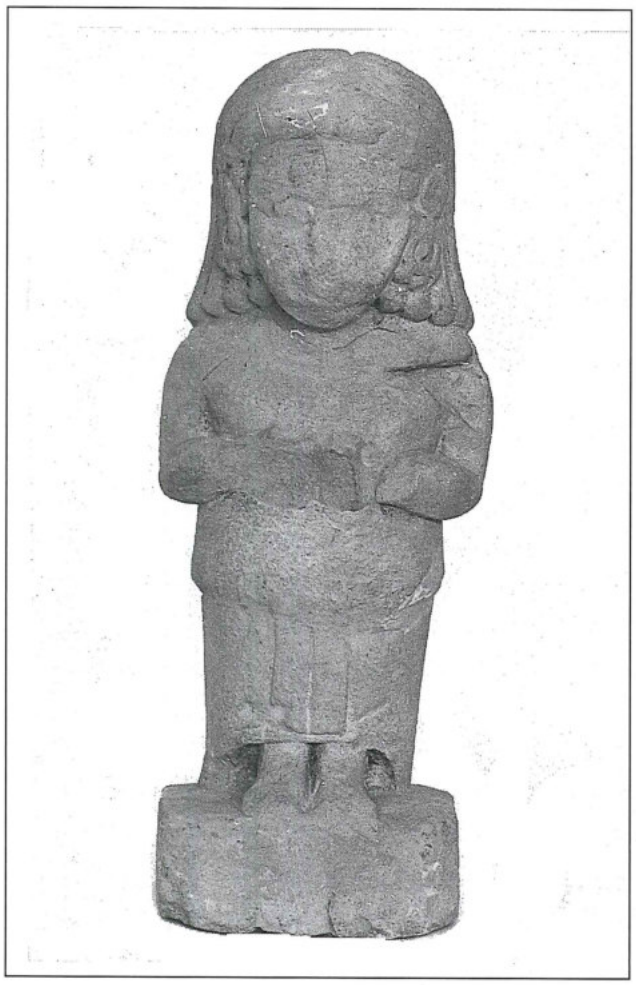
(٣) A. Moortgat, *Die Kunst Mesopotamien*, 1967, Taf-57 FF.

(٤) علي أبو عساف : المرجع السابق، صورة ١٣ وصورة ٢٢ إلى ٢٥.

(٥) على أبو عساف : المرجع السابق، صورة ٣٩.



٢. ١١٢٦٠ J تمثال عرجان (متحف الآثار الأردني).



٣. ١٢٩٤٥ J سيدة من خربة الحجار (متحف الآثار الأردني).

أما الملك الأشوري أشور ناصر بال الثاني فقد أسبل اليمنى ورفع اليسرى، وفي كل واحدة سلاح.

ولئن ابتدع الفنان العموني وضعية خاصة لليدين تناسب الوقفة التمثيلية، فإنه قلّد الفنان المصري حينما صنع تمثال عرجان (رقم ١٢).(٦) والشخص الممثل هنا يقف ماشياً وطرفاه العلويان مسبلان. وتقبض يداه على نتوئين أفقيين يخرجان من المسند الخلفي (شكل ٢). ولا يوجد حتى تاريخه سوى تمثال أنثوي واحد مؤكد في عمون، عثر عليه في خربة الحجار مع تمثال (رب)، وواضح أن المرأة قد مثلت واقفة راكبة (رقم ٢) تضع قبضتيها على صدرها على عكس وضعية يدي الرب الذي وجد تمثاله مع تمثالها (شكل ٣)، وقد جاءت وضعية يديها على شاكلة وضعية تماثيل نساء كثيرات من الألفين الثالث والثاني ق.م.(٧) اكتشفت في مواقع متفرقة في بلاد الشام والعراق. هذا من جهة، ومن جهة أخرى فإن التمثال المكتشف في قلعة عمان ورغم انه مسترسل

الظفائر (شكل ٤ب)، إلا انه يشبه تماثيل الزعماء الآشوري
المكتشفة في غرود. وهو غير تام، ولم يبق منه سوى الجذع (ر
٢٥)(٨) (شكل ٤).

وعلى أية حال، فالتماثيل جميعها تستوي فوق قواعد حجر
شكلت من حجر التمثال نفسه، وهي وقورة متأدبة، وكأنها
مراسم دينية أو في احتفالات رسمية، ترتدي الملابس البسي
المتشابهة التي تتألف من قميص طويل أملس أو ذو ثنيات، وفوقه
في بعض الأحيان – درّاعة نسائية أو إزار عادي أو ذي ثنيـ
(شكل ١، ٣، ٥) ويشذ عن ذلك تمثال عرجان الذي يتألف ملبس
من مئزر يشده إلى الخصر حزام عريض مثل التماثيل الأخر
(شكل ٢) والواقع أن الإزار كان معروفاً عند الآراميين وخاصة
مدينة شمأل عاصمة مملكة يأدى أو شمأل.

ولم يميز النحات بين الرب والانسان إلاّ في غطاء الرأس، فالر
يضع تاجاً يتألف من قلنسوة عالية في أعلاها قرص، وع

(٦) إتّبعنا الترقيم الذي اعتمدناه في المصدر المذكور في الهامش رقم ٢.

(٧) A. Moortgat, *ibid*, Taf. 63.184.

(٨) أعطي له رقم متسلسل وفق ترقيم المنحوتات العمونية المدروسة من قبلنا فجاء ترتيبه الأخير، أنظر المصدر المذكور في الهامش ٢؛ Zayadine, J-B. Humbert M. Najjar, *ADAJ* 33 (1989), p. 359; F. Zayadine, *RB* 97 (1990), p. 73, S II-III.

امكانيات التعاون في المستقبل.

ومن أجل كل هذه الأسباب فإننا نرجو من السلطات الأردنية أن تتقبل جزيل شكرنا وأتمنى الآن كل النجاح للمؤتمر الخامس.

**اوليفيه اورانش**
**مدير دار الشرق**
**جامعة ليون لوميير الثانية**
**فرنسا**

**معالي الوزير**
**السيد الرئيس**
**السيد المدير العام**
**أيها الزملاء الأعزاء،**

إن عام ١٩٩٢ وكما تعلمون هو العام الأولمبي، وبهذه المناسبة فإن الشعلة التي تنطلق من بلاد الاغريق تصل إلى البلاد المنظمة للألعاب. وبنفس الطريقة فإني أُعيد اليوم إلى الأردن الشعلة التي سُلمت إلى فرنسا بمناسبة انعقاد المؤتمر الرابع.

لقد كان لفرنسا وجامعة ليون لوميير الثانية ودار الشرق الشرف العظيم بتنظيم تلك التظاهرة العلمية والذي زادها رونقاً معرض الفسيفساء الأردنية الذي افتتحته جلالة الملكة نور المعظمة.

إن الروابط المحكمة في مجال الآثار بين الأردن وفرنسا لهي عديدة وإن لم تكن هي الأقدم. والرواد في هذا المجال هما المرحوم الأب جان ستاركي والأستاذ ارنست فيل الحاضر هنا. ولقد أخذت هذه الروابط طابعاً رسمياً بولادة معهد الآثار الفرنسي للشرق الأدنى عام ١٩٧٨ والذي أضاف جهوده للمعاهد الأجنبية الأخرى.

إن المعهد الفرنسي للآثار والفرق الأثرية الأجنبية الأخرى قد أنجزت العديد من المشاريع والتي لا يزال بعضها قيد التنفيذ وذلك في مجال علم ما قبل التاريخ، أو في مجال التراث المعاصر، أو في مجال علم النقوش اليونانية والعربية أو في مجال علم الانثروبولوجيا، وأن سرد أسماء المواقع سوف يُعطي فكرة على تنوعها وهي: الأزرق، البتراء، عراق الأمير، عمان، جرش، قويلبه، خربة الذريح، الحلابات، قصير عمرة، المفرق، خربة السمرا، السماكية، العيمة. وبعض هذه المشاريع تتم بالتعاون مع دائرة الآثار العامة التي يعمل فيها ومنذ وقت طويل صديقنا الدكتور فوزي زيادين. كما وهنالك مشاريع أخرى يتم تنفيذها مع جامعة اليرموك مثل حفريات تل أبوحامد وكذلك يتم تبادل المدرسين والطلاب. ولا يزال هناك مشاريع قيد الدراسة مع الجامعة الأردنية.

لا يوجد إلا القليل من البلدان حيث النشاط الاثاري موزع بمثل هذه الحكمة بين الفرق الوطنية والأجنبية وحيث التعاون يصل إلى مثل هذا المستوى المثمر. كما وأنه لا يوجد إلا القليل من البلدان حيث يصرف المسؤولين الوقت والامكانيات المتوفرة لتنظيم مثل هذه المؤتمرات في موعدها وفيها تنقل المعلومات بسهولة وتدرس نتائج البحث الأثري كما وتتبلور

يوقدون عليه في النار ابتغاء حلية أو متاع زبد مثله / كذلك يضرب الله الحق والباطل / فأما الزبد فيذهب جفاءً / وأما ما ينفع الناس فيمكث في الأرض / كذلك يضرب الله الأمثال».

صدق الله العظيم

سيدي صاحب السمو،
سيداتي، سادتي،

اسمحو لي أن أرحب بكم مرة أخرى في هذه الجامعة وأن أتمنى لكم طيب الاقامة وأدعو الله أن يكون هذا التجمع لخير الأردن والبشرية.

«يا أيها الناس إنّا خلقناكم من ذكرٍ وأنثى وجعلناكم شعوباً وقبائل لتعارفوا».

صدق الله العظيم

وقبل أن أنهي كلمتي أرجو من سموكم رفع أسمى آيات المحبة والاخلاص والتقدير لصاحب الجلالة الملك الحسين المعظم قائد مسيرتنا وراعي نهضتنا أدامه الله.

«وقل اعملوا فسيرى الله عملكم ورسوله والمؤمنون».

صدق الله العظيم

والسلام عليكم ورحمة الله وبركاته،،،

**الدكتـــور كامـــل العجلونـــي**
**رئيس جامعة العلوم والتكنولوجيا**

**صاحب السمو الملكي الأمير الحسن المعظم**
**معالي وزير السياحة والآثار**
**ضيوفنا الأجلاء**
**سيداتي، سادتي،**

يوم أغر نفرح به بلقائكم ونسر لوجودكم في رحاب هذه الجامعة جامعة العلوم والتكنولوجيا الأردنية، التي أرادها الحسين منارة جديدة ومصنعاً للرجال وذخراً للمستقبل.

أما أنت يا صاحب السمو الملكي فلك في القلب أغلى موضع وفي هذه الجامعة بالذات أعز موقع فكلما ودعتنا بعد لقاء ازددنا شوقاً للقائك وحاجة لإرشادك وأملاً في قريب عودتك، كيف لا وقد كنت معنا وبيننا عندما كانت هذه الجامعة شبه خالية تجابهها المصاعب وتضنيها التحديات. جئتنا عندما كانت هذه القاعة خالية من كل شيء فكنت لأبنائها أباً ولأساتذتها أخاً ولرئيسها مرشداً وها أنت اليوم تكرمها بتشريفكم والسماح لها بأن تحتضن في رحابها المؤتمر الدولي الخامس لتاريخ وآثار الأردن، الذي تحضره نخبة من صفوة علماء الآثار الذين بذلوا الكثير وضحوا بالكثير من راحتهم ووقتهم لإزالة ستارة الزمن عن كنوز الأردن وآثاره التي تشيد بالحضارات على مدى الأزمان التي مرت في هذا البلد الطيب الثابت المرابط.

وإن كانت الآثار والتماثيل المتناثرة في الأردن تشهد للسابقين موضحة لنا خط تطور التاريخ الانساني فسلامتها هنا وفي كل البلاد العربية ما هي إلا شهادة للحضارة الاسلامية وللعرب المسلمين خاصة وأثرهم في الحفاظ عليها.

فعندما فتح العرب المسلمون بلاد الشام ومصر كانت مهداً لحضارات قديمة مليئة بالتماثيل فهل هدموا المنشآت والتماثيل في البلاد المفتوحة مثل أبي الهول وأبي سنبل والكرنك وبلاد بابل والشام علماً بأن الفتوحات تمت في السنين العشر الأولى بعد وفاة الرسول عليه الصلاة والسلام؟! والعرب الفاتحون كانوا من الجيل النبوي أي أنهم عاصروا النبي من أصغر جندي إلى الخليفة.

كل هذه التماثيل لم تهدم لأنها لم تكن تعبد ولو كان الأمر غير ذلك لدخل العرب المسلمون التاريخ كهمجيين، ولكنهم حافظوا عليها ورعوها وزادوها لتشهد للعالمين على دورهم الحضاري الرائد مصداقاً لقوله تعالى:

«أنزل من السماء ماء فسالت أودية بقدرها فاحتمل السيل زبداً رابياً / ومما

لحماية مدينتهم من السيول الجارفة. وأنه لمن المؤسف حقاً بعد أن مرت بنا تجربة عام ١٩٦٣ التي جرفت فيها السيول عدداً من السواح في البتراء أن تتحدانا الطبيعة مرة أخرى في شهر آذار ١٩٩١ ونظهرعاجزين عن مواجهتها بينما كان الأنباط ومنذ أكثر من ألفي عام قد بنوا السدود وجمعوا مياه الأمطار وزرعوا الأودية القاحلة بالخضار والفواكه بحيث تحولت مدينتهم إلى جنة كما يشهد على ذلك الجغرافي الروماني سترابو.

ومن بعد الأنباط جاء الخلفاء الأمويون وعملوا على استصلاح الأراضي بالري والزراعة وبنوا القصور في البادية الأردنية مزودين إياها بالحمامات ووسائل الترفيه.

اننا نأمل أن يتطرق مؤتمركم لهذه التقنيات القديمة والتوصية لوضعها موضع التنفيذ وذلك لربط الماضي بالحاضر.

اني أعلم وأنتم تعلمون أن بلادنا بعيدة عن تحقيق الاكتفاء التقني والغذائي وأنّا مرتبطين بالغرب ارتباطاً كلياً في هذا المجال، علماً بأننا نحن الذين صدّروا أساليب الري وبناء النواعير وجر المياه إلى الصحراء. كما وبرع العرب في فن النحت والتصوير والعمارة وفي فن الملاحة أيضا. فكم نحن بحاجة اليوم إلى دراسة لأساليب البناء القديمة في عراق الأمير وجرش وأم الجمال لتطبيقها في حياتنا الحديثة بحيث تقترن الفائدة العلمية بالطابع الجمالي المميز كما هو الحال في استعمال الجص في أبنية البتراء والرخام والأصباغ التي برع بها الفنان النبطي والأموي حيث نشاهد ذلك في البيضا وقصير عمره.

إنه لا يخفى عليكم أن التكنولوجيا هي سلاح ذو حدين تستطيع أن تبعث السعادة في حياة الانسان كما يمكنها أن تكون السبب في شقائه وتدمير حضارته.

وإننا في هذا البلد الصغير نتطلع بلهفة إلى السلام العادل والشامل الذي بدأت تباشيره تلوح ولكن بصعوبة في أفق الشرق. وهذا السلام سوف يحقق العمل الجاد على تقدم الانسان في تأمين غذائة بواسطة التقنيات الزراعية الحديثة وحاجاته الأساسية بواسطة الصناعة.

نأمل أن يكون مؤتمركم هذا مبشراً بعهد جديد في الشرق الأوسط نجني ثماره جميعاً بالعمل الصادق على تطوير حياتنا اليومية وتكون أبحاثكم بمثابة المحرك للعمل على التوصل إلى حياة أفضل.

سيداتي سادتي،

أتمنى لمؤتمركم النجاح ولكم طيب الاقامة في بلدنا المضياف ويشرفني أن أنقل اليكم تحيات حضرة صاحب الجلالة الملك الحسين المعظم الذي كلفني أن أبلغكم امنياته بنجاح مؤتمركم، كما وأشكر جميع الذين عملوا على إنجاح هذه التظاهرة العلمية من موظفي دائرة الآثار العامة ورؤساء الجامعات وأخص بالذكر رئيس جامعة العلوم والتكنولوجيا الدكتور كامل العجلوني الذي وضع جميع امكاناته في رحاب هذا الصرح العلمي في سبيل أن تشعروا بالراحة وأن تعملوا في جو من الطمأنينة والموضوعية العلمية.

والسلام عليكم ورحمة الله وبركاته.

**الدكتـــور صفـــوان التـــل**
**مدير عام دائرة الآثار العامة**

**أصحاب السعادة والمعالي،**
**أيها العلماء الأفاضل - أيها السيدات والسادة**
**السلام عليكم ورحمة الله وبركاته..**

أتشرف أن أقف هنا اليوم لأعبر عن خالص شكري وعظيم امتناني إلى حضرة صاحب السمو الملكي الأمير الحسن ولي العهد المعظم على ا هتمامه الشخصي والدائم لعقد هذه السلسلة من المؤتمرات التي تتناول تاريخ الأردن وآثاره وعلى دعمه المتواصل بتنظيمها وانجاحها.

كما وأنه لمن دواعي سروري أن أكون اليوم بينكم في رحاب هذه الجامعة الزاهرة جامعة العلوم والتكنولوجيا في محافظة اربد حاضرة الشمال لكي نفتتح معاً مؤتمركم الخامس لتاريخ الأردن وآثاره ولكي أشكركم على وفائكم لهذه التظاهرة العلمية التي دأبت دائرة الآثار العامة على تنظيمها منذ اثني عشر عاماً وأصدرت عنها مجموعة قيمة من البحوث الجادة التي تناولت آثارنا وتراثنا عبر العصور. ولقد غطت هذه المؤتمرات نواحي متعددة من تاريخ الأردن ومنجزاته الحضارية فشملت أبحاثكم بيئة الأردن وجغرافيته وصلاته التجارية والعلاقات الخارجية ثم «المواقع الأثرية ومراكز الاستطيان» وقد دلت أبحاثكم بما لا يدعو إلى الشك على المركز الطليعي الذي يحتله الأردن بين حضارات الشرق الأوسط وقد عملتم من خلال هذه المؤتمرات على ربط واقع بلادنا بماضيها والاستفادة من خبرات الأجيال الغابرة لتطوير الواقع الاجتماعي والاقتصادي.

إن موضوعكم في هذا المؤتمر يقع في صميم احتياجات الأردن العلمية. فهذه البلاد - كما حال العالم العربي إجمالاً - هي أحوج ما تكون إلى دراسة علمية صادقة وموضوعية للتقنيات القديمة لايجاد سبل تطبيقها على حياتنا اليومية.

لقد أضاء الانسان في بلادنا منذ الألف الرابع قبل الميلاد مشاعل الحضارة الانسانية المبكرة فعلى هذه الأرض عرف الانسان ذاته فأقام المدن وازدهرت الصناعة والعلوم كما ومارس أساليب زراعة الحبوب وتدجين الحيوانات وتسخيرها لأعماله والاستفاده منها لتأمين غذائة. وانتشرت على أرض هذا الوطن معالم حضارية نعتز بها جيلاً بعد جيل. ومن خلال أربعة مؤتمرات دولية سبقت هذا المؤتمر منذ عام ١٩٨٠ في اكسفورد وتوبنجن وعمان وليون يسرني أن يكون مؤتمركم اليوم مخصصاً لبحث ومناقشة أساليب جمع المياه في الأردن وخاصة في الجنوب من الحميمة حتى البتراء - فقد برع العرب الأنباط ببناء السدود والبرك والآبار لجمع مياه الأمطار حتى لا تضيع قطرة واحدة سدى. كما واستنبطوا أساليب التقنية

الأمير الحسن ولي العهد المعظم الذي كان المبادر الى عقد سلسلة مؤتمرات تاريخ وآثار الأردن والتي نمت وازدهرت بفضل اهتمامه وتوجيهاته ورعايته لها. كذلك أتوجه بالشكر الجزيل لمعالي الدكتور كامل العجلوني، رئيس جامعة العلوم والتكنولوجيا الذي لم يتوان عن تقديم كافة التسهيلات المتوفرة لدى الجامعة لانجاح المؤتمر. أما جهود الدكتور صفوان التل، المدير السابق لدائرة الآثار العامة، في الاعداد للمؤتمر ومتابعة تنظيمه فتستحق كل تقدير وثناء. كما يسرني ان أشيد بجهود جميع الذين اشرفوا على اعداد هذا المجلد وعملوا بصبر وأناة تحت ظروف صعبة في بعض الاحيان، فلهم جميعاً خالص الشكر وبالغ التقدير. أخيراً يجب أن أسجل الشكر لجميع الزميلات والزملاء في دائرة الآثار العامة والى الجامعات الاردنية والمراكز الاثرية المختلفة في عمان لجهودهم المتصلة وعطائهم السخي من أجل انجاح المؤتمر وأعماله.

**د. غازي بيشه**
**مدير عام دائرة الآثار**
**وزارة السياحة والآثار - عمان**

الدكتور غازي بيشه

# مقـــدمـــــة

يحتوي هذا المجلد على الابحاث التي قدمت الى المؤتمر الدولي الخامس لدراسة تاريخ وآثار الأردن، الذي عقد تحت رعاية صاحب السمو الملكي الأمير الحسن ولي العهد المعظم في رحاب جامعة العلوم والتكنولوجيا باربد خلال الفترة ما بين ١٢- ١٧ نيسان من عام ١٩٩٢. كان موضوع المؤتمر «الفن والتقنية في الأردن عبر العصور»، وهو موضوع شاسع يشتمل على نشاطات متعددة مارستها الشعوب المتعاقبة عبر عشرات القرون، ويغطي مجالات متنوعة تتراوح من العمارة وصناعة الفخار والزراعة والري والمطاحن المائية الى استخراج المعادن والتنجيم بالاضافة الى بناء السدود والجسور والطرق والحصون وغيرها من النشاطات الانسانية.

ان المعالم التي تشهد على انجازات الانسان في مجال الفن والعمارة والتقنية تغطي ربوع الاردن كالازهار البرية التي تزيّن هضاب هذا البلد في ايام الربيع الزاهية. وهذه المعالم وان كانت جزءاً من الماضي البعيد الا أنها شواهد حية تحكي تاريخ الأردن الذي ارتبط بحضارات الشرق الأدنى القديمة.

في خطاب الافتتاح الذي القاه سمو الامير الحسن ولي العهد المعظم عند انعقاد المؤتمر الدولي الأول لدراسة تاريخ وآثار الأردن في جامعة اكسفورد قال سموه: «إننا في هذه الايام نتحدث كثيراً عن الحاجة الى التقدم التكنولوجي.... ولكن بالنسبة الى الحاجة لنظام إنساني جديد، فاننا نأمل عند محاولة التعرف على المتطلبات الانسانية للماضي والمستقبل بأن يساهم التاريخ والآثار في التعرف على المساحات المشتركة: الأرضية المشتركة بين الحضارات» إن مشاركة باحثين من جنسيات متعددة واقطار مختلفة في المؤتمر الدولي الخامس لدراسة تاريخ وآثار الاردن لا تدل فقط على الاهمية التي تحظى بها آثار الأردن، بل وتساعد أيضا في التعرف على «الأرضية المشتركة بين الحضارات» التي اشار اليها سمو الامير الحسن المعظم.

إن الابحاث المنشورة في هذا المجلد تبين بشكل واضح الدور الذي صارت تلعبه العلوم المساعدة في البحث الأثري، إذ أن علم الآثار صار بحثاً جماعياً لا يقتصر على باحث واحد متخصص، فغالباً ما نجد ضمن الفريق من يقوم بأعمال الدراسات الجيولوجية والجغرافية والمتخصص في أنواع النباتات القديمة بالاضافة الى باحثي علم الانسان وغيرهم.

إن عقد مثل هذا المؤتمر في رحاب جامعة العلوم والتكنولوجيا لم يكن ممكناً بدون دعم وتعاون عدة جهات ومراكز أكاديمية. هنا يقتضي واجب العرفان التنويه بجهودهم والتوجه بالشكر اليهم.

بداية يسرني ان أتوجه بخالص الشكر وعظيم الامتنان الى حضرة صاحب السمو الملكي

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مطابع المؤسسة الصحفية الأردنية "الرأي"



المملكة الأردنية الهاشمية

# دراسات في تاريخ وآثار الأردن

المجلد الخامس

دائرة الآثار العامة – عمّان