Studies in the History
and Archaeology
of Jordan
XIV

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رقم الإيداع لدى دائرة المكتبة الوطنية
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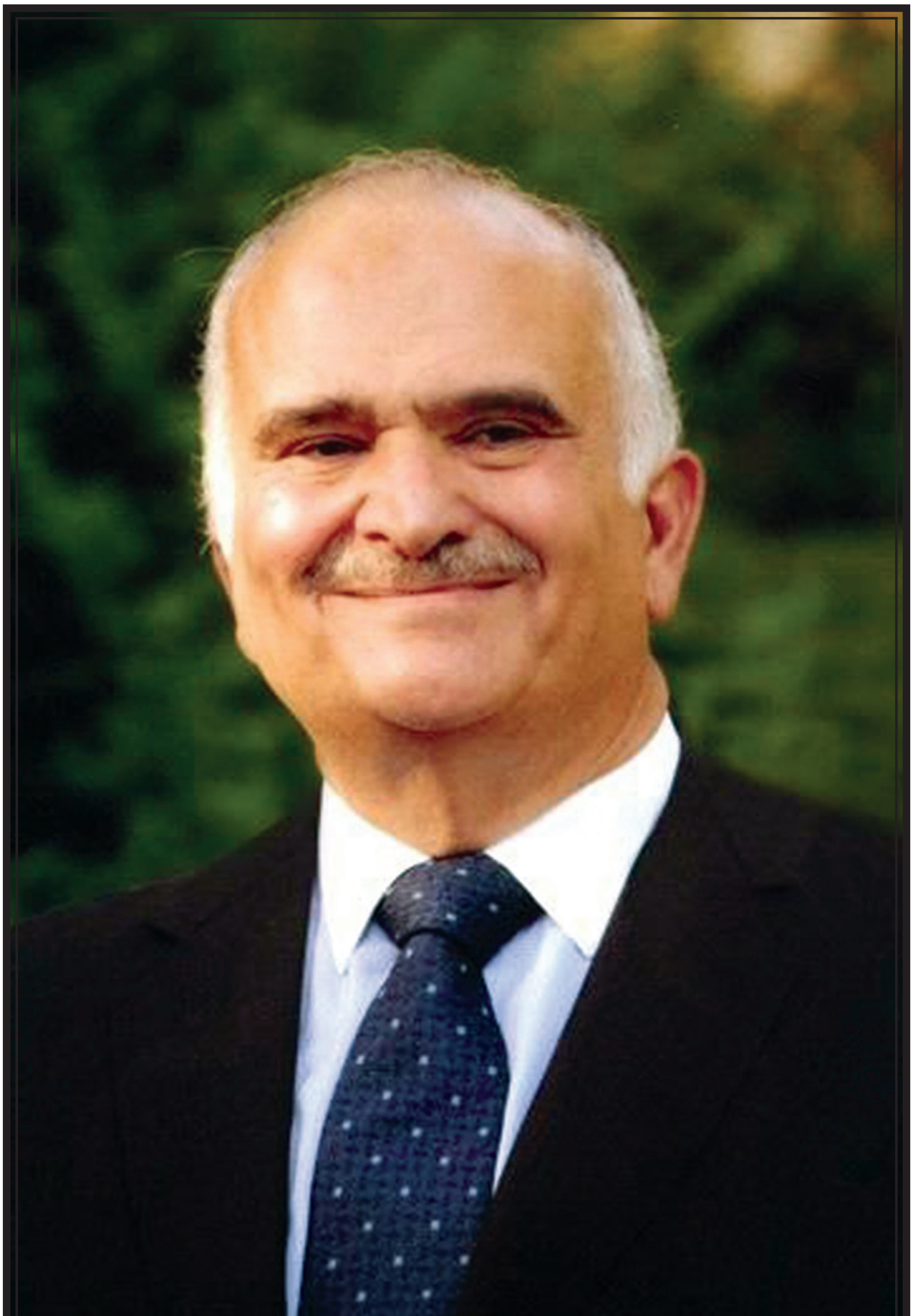
STUDIES IN THE HISTORY AND ARCHAEOLOGY OF JORDAN
XIV

Part 1
Prehistory; Bronze Age; Early Iron Age and Nabatean

Department of Antiquities
Amman, Jordan

HIS MAJESTY KING ABDULLAH THE SECOND IBN AL-HUSSEIN
OF THE HASHEMITE KINGDOM OF JORDAN

HIS ROYAL HIGHNESS PRINCE
AL-HUSSEIN BIN ABDULLAH THE SECOND



HIS ROYAL HIGHNESS PRINCE
EL-HASSAN BIN TALAL

THE HASHEMITE KINGOM OF JORDAN

STUDIES IN THE HISTORY AND ARCHAEOLOGY OF JORDAN XIV

Culture in Crisis: Flows of Peoples, Artifacts, and Ideas

Proceedings of the 14th International Conference on the History and Archaeology of Jordan

Florence, Italy
21–25 January 2019

Part 1
Prehistory; Bronze Age;
Early Iron Age and Nabatean

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Culture in Crisis: Flows of Peoples, Artifacts, and Ideas

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Abbreviations

Journal title abbreviations follow the guidelines of the *American Journal of Archaeology*. Other abbreviations used in this volume are detailed here.

BMCRE	H. Mattingly, *Coins of the Roman Empire in the British Museum* (London, 1923–)
ERAUL	*Etudes et Recherches Archéologiques de l'Université de Liège*
FGrH	F. Jacoby, *Die Fragmente der griechischen Historiker* (Berlin, 1923–1959)
ICHAJ	*International Conference on the History and Archaeology of Jordan*
IGLS	L. Jalabert and R. Mouterde, *Inscriptions grecques et latines de la Syrie* (Paris, 1929–)
ILS	H. Dessau, ed., *Inscriptiones latinae selectae* (Berlin, 1892–1916)
LIMC	J. Boardman, *Lexicon iconographicum mythologiae classicae* (Zurich, 1981–2009)
NEASB	*Near East Archaeology Society Bulletin*
PLRE	*Prosopography of the Later Roman Empire* (Cambridge, 1971–1992)
PNAS	*Proceedings of the National Academy of Sciences of the United States of America*
RE	A. Pauly and G. Wissowa, *Real-Encyclopädie der Classischen Altertumswissenschaft* (Stuttgart, 1893–1978)
RES	*Répertoire d'épigraphie sémitique* (Paris, 1900–1935)
RIC	H. Mattingly *et al.*, *Roman Imperial Coinage* (London, 1923–)
SEG	*Supplementum epigraphicum graecum* (Leiden, 1923–)
SAOC	Studies in Ancient Oriental Civilization (Chicago)
SHAJ	*Studies in the History and Archaeology of Jordan*
SLSA	*Schweizerisch-Liechtensteinische Stiftung für archäologische Forschungen im Ausland*

System of Transliteration from Arabic

Transliterated spellings have been standardized across the volume by the Department of Antiquities of Jordan.

Consonants

ء	’ *(except where initial)*	ض	ḍ
ب	b	ط	ṭ
ت	t	ظ	$\underline{\text{dh}}$
ث	th	ع	‘
ج	j	غ	gh
ح	ḥ	ف	f
خ	kh	ق	q
د	d	ك	k
ذ	dh	ل	l
ر	r	م	m
ز	z	ن	n
س	s	هـ	h
ش	sh	و	w
ص	ṣ	ي	y
ـة ة	a *or* at	ـه ه	a *or* ah

Long Vowels / *Short Vowels*

ا، ى	ā	ـَ	a
و	ū	ـُ	u
ي	ī	ـِ	i

Common Nouns

تَلّ	Tall	دَيْر	Dayr
جَبَل	Jabal	عَيْن	‘Ayn
خِرْبَة	Khirbat	وادي	Wādī
جُرْف	Jurf	غَوْر	Ghawr

The International Conference on the History and Archaeology of Jordan

I	The History and Archaeology of Jordan from the Earliest Prehistoric Times to the End of the Ottoman Period	University of Oxford Oxford, United Kingdom	25–31 March 1980
II	Jordanian Environment: Geographical and Historical	Department of Antiquities ʻAmra Hotel Amman, Jordan	4–16 April 1983
III	Trade, Communications and International Relations throughout the Ages	University of Tübingen Tübingen, Germany	6–12 April 1986
IV	Sites and Settlement in Jordan	University of Lyons Lyons, France	30 May– 4 June 1989
V	Art and Technology throughout the Ages	University of Science and Technology Irbid, Jordan	12–17 April 1992
VI	Landscape Resources and Human Occupation in Jordan throughout the Ages	University of Turin Turin, Italy	5–10 June 1995
VII	Jordan by the Millennia	University of Copenhagen Copenhagen, Denmark	12–19 June 1998
VIII	Archaeological and Historical Perspectives on Society, Culture and Identity	The University of Sydney Sydney, Australia	9–13 July 2001
IX	Cultural Interaction through the Ages	Al-Hussein Bin Talal University Petra, Jordan	23–27 May 2004
X	Crossing Jordan	The George Washington University Washington, D.C., United States of America	23–28 May 2007
XI	Changes and Challenges	Paris, France	7–12 June 2010
XII	Transparent Borders	Humboldt University Berlin, Germany	5–11 May 2013
XIII	Culture in Crisis: Flows of Peoples, Artifacts, and Ideas	Florence, Italy	21–25 January 2019

Prof. Guido Vannini, Ordinario di Archeologia Medievale
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Opening of Proceedings (21 January 2019) 14th International Conference on the History and Archaeology of Jordan

Culture in Crisis: Flows of People, Artifacts, and Ideas 21–25 January 2019 — University of Florence — Florence, Italy

1. After more than 30 years of what has been for us a fascinating commitment in the beloved Land of Jordan, it is with great satisfaction[1] that my university welcomes to the banks of the Arno River all of our Jordanian friends and those from across the world who are dedicating part of their lives—and often not only at a professional level—to Jordan: a welcoming land that knows how to engender admiration and even amazement in these difficult times.

It is under the patronage of HRH Prince El-Hassan Bin Talal that the Department of Antiquities of Jordan and the University of Florence organized the 14th International Conference on the History and Archaeology of Jordan (ICHAJ). HRH Prince El-Hassan Bin Talal is the founder of this conference, which has been organized every three years since its first iteration in 1980 at Oxford University. Since its inception, it has also been held in Jordan, the United Kingdom, Germany, France, Italy, Denmark, Australia, and the United States of America.[2] ICHAJ has therefore become a prestigious and important event for the international scientific community of archaeologists, historians, and researchers who are interested and work in Jordan.

During the closing ceremony of ICHAJ 13, held in Amman at

[1] I would also like to also express the satisfaction of the President of my university, Prof. Luigi Dei, and of the Dean of the SAGAS Department, Prof. Andrea Zorzi, who together with many colleagues, have helped in every way to ensure hospitality to this Congress, whose complexity was equal to its interest (not only at a scientific level). I would also like to thank Dr. Olivia Montepaone for the linguistic revision.

[2] In the following order: Amman (1983), Tubingen (1986), Lyon (1989), Irbid (1992), Torino (1995), Copenhagen (1998), Sydney (2001), Petra (2004), Washington DC (2007), Paris (2010), Berlin (2013), and Amman (2016).

Princess Sumaya University for Technology, it was announced that the 14th ICHAJ would be held in Florence, and HRH Prince El-Hassan Bin Talal[3] issued a statement asserting that the ICHAJ 14 should focus on the theme "Culture in Crisis: Flows of People, Artifacts, and Ideas," and that within the framework of this theme, UNESCO would raise the issue of protecting cultural heritage and its people in areas facing serious military conflicts.[4]

2. The program and the series of papers that follow paint a dynamic and unique picture in terms of breadth and a truly systematic approach. The papers range from rich and articulated archaeological research across a broad span of time (in this respect it presents some parallels to Italy and certainly not many other regions) to a 'laboratory' where innovative, or even experimental, forms of international archaeological research are applied to equally extraordinary contexts. It is this dual scenario that marks the 14th Florentine ICHAJ edition at the apex of a trend that, through this cultural event and with an increased participation both in terms of contributions and authors, essentially places Jordan among the top countries at this level within the field.

The ICHAJ, therefore, returns to Italy 24 years after the Turin conference (ICHAJ 6; Department of Antiquities 1997), which represented an important contribution towards including Jordanian archaeological findings in the Euro-Mediterranean network, a primary focus of organizer Giorgio Gullini's work with his Centro ricerche archeologiche e scavi per il Medio Oriente.

I believe that the unanimous decision of the Scientific Committee to select Florence as the venue for the ICHAJ's return can be ascribed to the recognition given to the growing role played by Italian culture (and not only in archaeology), the interest it took in preserving (between

[3] I would like to take this opportunity to express gratitude to His Royal Highness Prince El-Hassan Bin Talal, the founder of this event, whom I had the fortune and honor to meet personally in Florence. For many years, His Royal Highness Prince El-Hassan Bin Talal has been able to inspire and curate this event, making it a unique international success. His personality is one that combines an intellectual and cultural profile with a civil courage, witnessed and admired by many of us on several public occasions, and not only in Europe. This year HRH Prince El-Hassan Bin Talal will host us for an event that has already become a tradition in a place worthy of him, the Istituto degli Innocenti—one of the most remarkable monuments of its time, a 'signature' of the Florentine Renaissance with elements designed by both Brunelleschi and Della Robbia, and made available to the less fortunate by the Republic of Florence six centuries ago: a lesson for our time, which I believe the Prince will have appreciated.

[4] "It is certainly true that cultural heritage is in danger of destruction, looting, or illicit trafficking in many places around the world. It is also true that new types of threats to the cultural heritage have developed in the last few decades. These include: the easy transfer of goods across national borders via online marketplaces like eBay, the spread of global banking, the outbreak of war and other forms of political instability, poverty, and the widespread availability of heavy machinery and explosives. The world is changing at a rapid pace, and research, as well as academic training, must keep up with these challenges. Cultural heritage is about identity, knowledge, and the future, as well as the past."

science and conservation) Jordan's cultural heritage (not just stones, not just men), and the specific, now seemingly irreplaceable, part played by that courageous and generous country that is Jordan.[5] Finally, I believe it is also due to the contribution that the culture and history of a place like Florence can give (also because of a recent tradition[6]) to a nearby region in this difficult phase (as its history can testify). It is now possible to see this in the small but accurate guide *Florence and Islamic Culture* (Curatola and Vannini 2019, with editions in Italian, English, and Arabic), produced with the collaboration of the Talal Abu Ghazaleh Organization. This guide highlights the existence of extraordinary "Oriental Florentine Paths," which will also remain as mementos of this meeting.[7]

I would also like to believe that another, more fortuitous element has contributed to the choice of Florence, namely the (methodological, substantial, but especially 'public') role held by the archaeological mission of the Florence University, Medieval Petra.[8] Medieval Petra has had 35 years of uninterrupted activity, thanks to the 'sympathy' (in the Greek sense of the word) with which the Department of Antiquities has stood by us and supported us, in an always friendly and competent cooperation with the DoA officials (with the GD, whom I remember very well, one by one: Adnan al-Hadidi, Ghazi Bisheh, Safwan Al Tell, Fawwaz Al Khraysheh , Ziad Al Saad, Faris Al Hmoud, Monther

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[5] The 'Special Event' of the program was dedicated to this: "Culture in Countries that are Going through Crises: The Experience of Italy, Jordan and UNESCO in Preserving Cultural Heritage," hosted with the collaboration of another Florentine cultural institution, the Teatro della Compagnia (I particularly extend my gratitude to the excellent simultaneous translator, Giulia Pruneti, who is also a valuable member of the staff of *Archeologia Viva*, one of the largest popular magazines in Europe). Present at this event were Mr. Fayiz Khouri, Ambassador of the Hashemite Kingdom of Jordan in Rome, and SE Fabio Cassese, Ambassador of Italy in Amman, to whom I would like to pay tribute for his competence, courtesy, and availability, well beyond the best of practice. On numerous occasions, we were well assisted for the preparatory phases in Jordan by the cultural *attaché* Federico Vidic. His initiative allowed us to solve problems at every level, which made it possible for the Congress week to meet expectations.

[6] I am referring, for example, to the now traditional, always lively and widely attended event held since the 1950s (with the "Colloqui mediterranei") by the never-forgotten Mayor Giorgio La Pira, where mayors and towns from all over the world meet in Palazzo della Signoria to discuss problems of cooperation in the context of a peace that must be constantly rebuilt ("Gli Stati passano, le città restano"). Currently, the series of meetings continues as "Unity in Diversity" at the initiative of Mayor Dario Nardella (Giovannoni 2006)..

[7] It is our intention to dedicate it to all residents of not only Jordanian but more generally Arab origin, as well as to those who have, or could have, an interest in this culture. In addition to this, see the parallel exhibition, also curated by Giovanni Curatola (2018): *Islam e Firenze. Arte e Collezionismo dai Medici al Novecento* (Museo Nazionale del Bargello-Galleria degli Uffizi).

[8] The mission of the University of Florence ('Medieval' Petra. Archaeology of the Crusader-Ayyubid Settlement in Transjordan—founded by the author of this paper in 1986 in pioneering conditions, at least with regard to later developments), is the largest Italian medieval archaeological mission abroad and the oldest international one in Petra. As for its value, it is not for us to express an opinion.

Jamhawi, and Yazid Elayyan).[9]

3. For these reasons, we have tried to give a national scope to the Florentine event, directly involving all Italian archaeological missions supported by the MAECI,[10] as its presence is visible in the small yet detailed exhibition exemplifying a work that for several years has affected the entire chronological period of the long archaeological history of the country that hosts us, the Hashemite Kingdom of Jordan.[11]

The theme in this ICHAJ is neither impromptu nor the simple consequence of the anguished reports of war affecting the entire region surrounding Jordan. On the contrary, it is part of a certainly not accidental continuity, a cultural, rather than thematic, thread, and before that, ethic continuity, at least among the last ICHAJ: from "Transparent Borders" (ICHAJ 11)[12] to "Ethics in Archaeology" (ICHAJ 13), these events form the background of the theme that we have been called to debate in Florence.

In fact, ICHAJ 14 has devoted much of its program to the discussion and development of new proposals and methodologies to preserve and enhance cultural heritage in Jordan and in other international contexts. Such an approach emerged clearly during the 'Special Event' (January 24th), promoted by HRH Prince El-Hassan Bin Talal, organized by

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[9] He was also present in Florence, supported by the talented official Aktham Oweidi. As Project Leader, I would like to express a special thanks (because organizing an event like the ICHAJ, involves this), to the international staff (the Steering Committee, the Scientific Committee), the national Italian-Jordanian staff (the Organizing Committee), the Scientific Secretariat (with Guido Guarducci and Stefano Valentini), but also to that of our University (especially the group of young archaeology interns of the Italian Organizing Committee, Conference staff, and our academic spin off 'LASG;' as well as my wife Anna Marx, who is the author of an excellent photographic documentation of the event).

[10] While among the patrons who joined the organizers (Department of Antiquities of Jordan and the University of Florence, with the collaboration of CAMNES) are the main local institutions (Municipality of Florence, Tuscany Region), the Ministry of Foreign Affairs (represented by Vice-Minister Emanuela Del Re, with the Italian Embassy in Amman and the Agency of Development and Cooperation, with its director and friend 'in the field' Michele Morana, to whom I owe so much gratitude that I had to transmit it to Michele Nucciotti, who will direct the Cooperation Project dedicated to Shawbak, born during the organizational phase of the Congress), UNESCO (with special thanks for the attentiveness and assistance of the director of the Amman office Costanza Farina and the young, talented Giorgia Cesaro), and ACOR (in this case with gratitude and appreciation for the director Barbara Porter, also for the tactful discretion with which she provided truly irreplaceable assistance).

[11] Curated by Andrea Polcaro and Michele Nucciotti, and organized by the *Italian Archeology Consortium in Jordan*, constituted thanks to the competent and generous commitment of another institutional protagonist of this Congress, the Ambassador Giovanni Brauzzi, whose assistance in the realization of the Florentine ICHAJ was simply essential, and whom I would like to thank, together with Professor Monther Jahmawi, for their precious work.

[12] A theme that has already been at the very core of our considerations: cf. the conference *The Transjordan in 12th–13th Centuries and the Frontiers of the Medieval Mediterranean*, Florence, Palazzo Vecchio-Palazzo Strozzi, 5–8 November 2008, and the exhibition *From Petra to Shawbak. Archaeology of a Frontier*, Florence, Palazzo Pitti, 2009.

the Presidency of the Regional Council of Tuscany (sponsored and supported by MAECI and UNESCO), open to the public and, for the first time in the 40-year history of the ICHAJ, also addressing issues outside the national borders of Jordan.[13] The main focus was the situation of prolonged crisis in the region, and the role played in several respects by Jordan as the only country at peace in the region. Jordan has contributed to, and ensured the continuity of, international attention to the cultural heritage of the area, with important support from Italy as well; in fact, there were speeches by the directors of archaeological research in Syria, Iraq, and Libya.

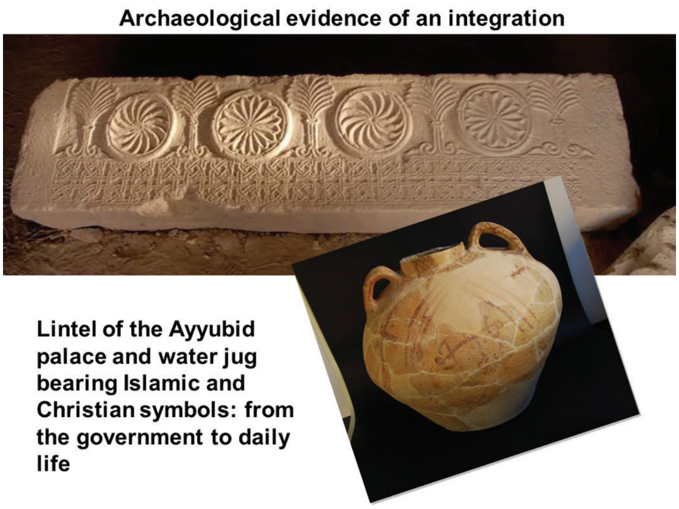
Finally, a point of great importance engaging us in the near future is also that of the relationship between research and widespread teaching of history, in particular towards resident communities: a delicate yet unavoidable ground. If the perception of our own past—and, more importantly, the way we accept it—changes, the same happens to our vision and our existential as well as economic approach towards our own environment and our own present (and here we come back, once again, to the relationship between time and space, the tools, and also the dimension of archaeology).

Some fundamental guidelines—given the difficult time the region to which Jordan belongs is certainly experiencing, together with many other regions (the entire Euro-Mediterranean area and, once again, not only this area)—are already present in the insights offered by our illustrious friends Øystein LaBianca and Giovanni Curatola (who together represent well, if I may say so, the crossroads between the fields of archaeology, history, and art) in their opening talks at the Congress (already in the Salone dei '500 in Palazzo Vecchio, after Mayor Dario Nardella's welcoming remarks). An entire cultural, rather than archaeological, sector must grasp these pivotal aspects in order to reflect deeply (starting from a thorough reinterpretation of the concept of the mission itself). There is certainly a crisis, but, if possible, it also carries along with it all of the future prospects hidden in the Greek etymon of the term 'crisis.'

4. As director of the Medieval Petra project of my university, for years I have witnessed different seasons, alternating moments of expansion of the archaeological activities—also in the civil implications of cultural heritage—with very serious crises in various parts of this difficult and unlucky region, that had a strong impact on Jordan (*e.g.*, Fig. 1). I can therefore confirm that the current period is tenuous and given the duration as well as the intensity of the crisis, the effects on the region are potentially irreversible. In order to avoid this, the small and courageous country of Jordan (also thanks to a high-quality cooperation with some missions, including the Italian ones and UNESCO) is objectively playing a unique and important role in maintaining operating relations with the

[13] Main character in the organization of the event, and as always, the best representative of the civil authorities, was the President of the Tuscany Region, Eugenio Giani, who was a perfect and appreciated host for the Jordanian authorities.

1. Promotional poster for the European Day of the Righteous, 2016. Rimini, 'Park of the Righteous': a tree for Khaled (with commentary by Maria T. Grassi, Director of the Palmyra mission, University of Milano and Guido Vannini, Director of the Petra Mission, University of Florence).



2. Saladin's Shawbak. Archaeological evidence of a civic integration. Lintel of the Ayyubid palace and water jug bearing Islamic and Christian symbols ranging from the political government to daily life (photo A. Marx).

international community in this sector on behalf of the whole region.

The attack on the cultural heritage aims to erase elements of identity in order to homogenize society, making it less aware of itself and therefore easier to manipulate. Archaeology can play an essential role in the re-appropriation of the 'stratigraphic' historical process that represents the true cultural roots of a society. We must, however, start from an observation, namely that archaeology as a science has always conceived of itself as a discipline that is contemporary with its time, perhaps even more than history.

With our mission, we have started a reflection about the social role of international archaeological activities and the close relationship that should be maintained between an urgent, deep, structural review of the missions as scientific projects and as civil programs for a renewed cultural setting (it could also be considered a specific declination of public archaeology). And it is precisely the current crisis, even in its most violent outcomes (as in Syria, but not only there), that has highlighted the key role played by the political dimension that cultural heritage has, namely showing all of the 'contemporary' potential of archaeological science in fundamental aspects of specific communities.[14]

Yet, an archaeology that restores important fragments of history to the identities of local communities and to a broadly shared cultural heritage already has a future: you will forgive me if I close with an example from the discovery, made in November 2018 by the Florentine mission Medieval Petra, of the extraordinary urban residential Palace in Jaya, at the bottom of the hill of Shawbak. This discovery is of particular relevance with regard to the medieval and Islamic heritage of Jordan (Fig. 2; no architecture of similar quality has ever been found in the country for the Ayyubid-Mamluk period), as well as to the archaeological confirmation of the existence, location, and level of the new capital city of southern Jordan, founded by Saladin, lost to history and now rediscovered by archaeology.[15] Thus, a call to action consisting of a program of conservative restoration, social valorization, and diffuse communication addressed both to the local communities

[14] "A crisis from which we must get out together, suggesting better cultural models (more ethical, more efficient: between the two aspects, we believe, there is a consistent relationship) than those with which we entered such crisis, and which in any case demonstrate, even in different contexts, that they no longer work. In the case of archaeological missions in the Middle East (and not only there), whose scientific productivity requires continuity, but which are located in now critically unstable environmental conditions, there is the practical problem of how to redesign our activities in order to act virtuously in a new, difficult situation, that might however reveal interesting points of view for both parties. The issue about archaeological missions is: for a new cultural approach, beyond the crisis; in other terms, the perspective of overcoming for good the classical structure of international archaeological missions, with its cumbersome legacy of colonial origin" (Vannini 2019).

[15] Cf. *infra* and Vannini 2020: 8–12, 83–108. I would like to take this opportunity to mention the extraordinary efficiency in taking care of the complex logistics of the Congress (as well as those of the Medieval Petra mission for several years) of the Yanez Agency directed by Cinzia Chiaramonti.

and to the international public must take place in order to protect both the recently discovered building and, step by step, the structures of the Castle. This will be in alignment with the implementation of the master plan (2010–2014), which includes territorial tourist routes connecting Shawbak with the Petra area, already defined by the Medieval Petra mission in recent years.[16]

5. I, therefore, welcome everyone to Florence: a city whose hospitality could become apparent, so to speak, through the locations of the activities that will take place in some sites, not because they are monumental, but rather because they represent at the highest level the values that the history of this city has been able to offer to the civilization of Europe, the Mediterranean, and humanity itself.

Welcome in particular to those coming from the land of Jordan and the Arab regions: this city has, in fact, shared part of its history with the nearby Arab and Islamic East, which leaves its traces in the monuments, arts, and archives of Florence, with a parallel only in Venice among European cities.

Welcome to Florence, for an experience that is both scientific and personal, possibly with no separation between these two dimensions: both should be interpreted—according to the *genius loci*—in fully humanistic terms. For a historical archaeology that knows how to be contemporary, and at the service of a conscious and peaceful life. For a normal life.[17]

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[16] A national frame of reference for the elaboration of the choices applied in the public archaeology programs in Jordan is now available in Nucciotti *et al.* 2019.

[17] I cannot close these notes without remembering with admiration and affection dear H.R.H. Princess Wijdan Al Hashemi who, with tact, discretion, competence, but also a lot of passion, has been following our work for Jordan—from the time of the international exhibition at Palazzo Pitti in 2009 (note 12 *supra*), when she energetically represented her country as Ambassador to Italy, to this event, which has certainly well-represented the culture and civilization of her noble, beloved nation.

European Archaeological Mission 'Medieval Petra' of the University of Florence." In *Ethics in Archaeology*. *SHAJ* 13, 295–309. Amman: Department of Antiquities.

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Keynote Address :
A 'Global Turn' for the History and Archaeology of Jordan: Scholars Engaging a Planet and a Culture in Crisis

How well do you know Earth—our home planet? "On this little pale dot," said the astronomer Carl Sagan, "are all histories written, all battles fought, all lovers kiss, and all families love. It is our home, our cradle, and protector. How well do you know the planet that gave rise to our species and way of life?"

Most of us live out our lives in a relatively limited geographical space on our vast planet. Though we belong to the only species that has managed to make the entire planet its home, our outlook as individuals on who we are and where we belong is predominantly provincial and local. For the vast majority of us, we experience a sense of belonging and loyalty to one or perhaps two geographical regions, nations, ethnic or religious groups, or denominations. The largest entity to which any of us typically have some sort of solidarity and sense of attachment is to a particular Great Tradition or civilization. Though some of us may aspire to, and express sentiments of, global citizenship and planetary consciousness, such sentiments all too often are dismissed as impractical and naïve, and may even be perceived by some fellow citizens to be disloyal, unpatriotic, and dangerous.

The theme of this conference is "A Culture in Crisis: Flows of Peoples, Artifacts, and Ideas." The disconnect between our provincial outlook on the world as individuals and members of local towns, provinces or states, and the dire condition of our planet on the verge of climate catastrophe is a crisis of a scale that our human species has never had to face before. Today I want to talk about this crisis. I will touch on the ways in which our work as scholars has helped create and sustain it, and make a few suggestions on how we can contribute to resolving it. As a remedy for our culture in crisis I wish to present the case for a 'global turn.' By this I mean a shift in one's outlook toward greater awareness of how our attitudes and actions as individuals and scholars impact the condition of our planet and the prospects for an inhabitable Earth home for future generations of humans and other living creatures. I believe such a turn is urgent for the survival of our species and key to keeping our various disciplines relevant in a globalized world with global-scale challenges.

As scholars rooted in our own ethnocentric cultural worlds, we have played a significant role in producing and reinforcing the provincial outlook of the wider society of which we are a part. The disciplines and areas of specialization that we have invented to organize research, teaching, and public outreach dealing with the Near East have all too often involved a Eurocentric bias. For those of us coming from the West, we have emphasized storylines about our own desired past, especially that of the biblical and Greco-Roman worlds. And as Edward Said has alerted us, as academics we have been complicit in creating and reinforcing a narrative about the present-day peoples and cultures of the Middle East and the rest of the Orient as the opposite of ourselves, as the Other. In this way we have helped to harden and sustain the parochial sentiments that have produced the current crisis of outlook

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and understanding of those other than us, of other living things, and of our planet as a whole, that we now find ourselves entrapped in.

As scholars of the Eastern Mediterranean lands, and of the history of Jordan in particular, we have an ethical and scientific mandate to find a new narrative about this region that overcomes the Eurocentric and Orientalist leanings of much past scholarship. This is what the call for 'a global turn' is all about: challenging us to imagine and share a new kind of history that widens rather than narrows our own and our fellow human beings' outlook on others, on other living creatures, and on our planet. Such a turn is urgent because the crisis of survival we face requires a broader outlook. Continuing onward with the status quo is simply bad scholarship, bad science, and bad for the planet. But how can we change the status quo and make our research resonant with the challenges of our global age? I would like to propose six steps that can start us on this journey:

A first step is to give critical thought to the interpretive lenses we use to research and narrate the past. Interpretive lenses help give us a general sense of reference and guidance as we approach our research. As we have already noted the lenses we use as scholars can contribute to either the narrowing or widening of our outlook and understanding of other people and our planet.

Our esteemed colleagues researching Jordan's prehistoric past deserve a shout out! From the very start their research has been exemplary in using lenses and propagating narratives that have emphasized our common heritage as *Homo sapiens*. They have also paid detailed attention to the interaction of humans with other species and with the local environment. We have them to thank for bringing the archaeology of prehistoric Jordan to the attention of scholars and the public all over the world.

Those of us whose focus has been the historical past of our region have favored questions and interpretive lenses that have largely ignored our relationship to other species and the environment. Our research has been animated by subtle and not so subtle longings for a particular desired and admired historical past. And this is not only a criticism of our colleagues concerned with the biblical past. It also applies to much research within the fields of Classical and Islamic history and archaeology. Much of this research has been laden with an urban, elitist bias. Our approach has tended to be from the perspective of ancient texts, from the point of view of empire, from the heights of ancient citadels and towns. To a large extent we have not concerned ourselves with the lives of the masses living in the shadows of such heights and in their hinterlands—the lives of families of shepherds, farmers, craftsmen, and miners. And as for the impact on the local environment and on other living things of the activities of our subjects, our ponderous tomes are largely silent.

A second step is to stay informed about new interpretive lenses and approaches being developed by global historians that can help us rethink the way we frame our research questions. Global history seeks to understand the past through the lens of connectivity from an interspecies perspective and on a planet-wide canvas. Neither traditional periodization schemes nor traditional units of spatial analysis can be taken for granted. Global history instead seeks to create a new narrative of humanity's past that is neither confessional, nationalist, imperialist, nor Western, but truly global in geographical scope and narrative. It is a project inspired by images of our planet streamed from satellites orbiting the Earth. It is made urgent by the accelerated pace at which human activity impacts and overwhelms our environment and our planet's regulatory processes.[1]

As many of you know, my research over the past five decades has focused on the Madaba Plains region in Jordan—particularly at the archaeological site of Tall Ḥisbān and its surrounding region. In my efforts to use the global history lens, I have tried to imagine myself positioned in a fixed location in space observing the Madaba Plains project area over multiple millennia. From this vantage point I have imagined examining the various forces that have impacted local cultural production and change over time. In line with the approach of global history, my aim has been to discover long-term processes on a planet-wide canvas that transcend conventional historical periods and civilizational boundaries.

A dozen entwined storylines spanning multiple millennia have come into view in our project area from this overlook high in the sky. These include stories of changing patterns of livelihood and food production; the impact of innovations in technology and warfare; the rise and fall of local elites and imperial powers; the birth and spread of great religious movements; the migration of diverse groups of people in and out of the region; deepening entanglements of the local with the global; the devastations wrought by epidemics, famines, and other extreme events; the resilient coping strategies of the local population; the unprecedented growth in human population and technological know-how over the past century and a half; the impact of all of the foregoing on the survival of other species and on the local landscape; stories of desired pasts, contested pasts, forbidden pasts, and propaganda pasts; and last but not least, hypotheses about the underlying long-term drivers of accumulative cultural production and change in our region

A third step we as scholars can take is to situate whatever problem we are studying within a long-term frame of reference. This too is a signature feature of global history, and we have Braudel and the Annales School to thank for breaking up the cartel which has sustained the fiction of the past as consisting of clearly delimited historical periods.

The original expedition to Tall Ḥisbān under Professor Siegfried Horn of Andrews University Theological Seminary had one primary objective: finding biblical Heshbon. The team, now under the leadership of Horn's successor, Professor Lawrence Geraty, also of Andrews, would not have lasted long had they not soon accommodated themselves to the inconvenient truth that the hill they had come to dig was by no means exclusively a biblical period ruin. What they ended

[1] Remarkably this state of affairs was predicted almost 150 years ago, in 1873, by the Italian geologist Antonio Stoppani who spoke about a "new telluric force which in power and universality may be compared to the greater forces of earth" (See Crutzen, Paul J. 2002. "Geology of Mankind." *Nature* 415:23).

up uncovering was an abundant array of well-preserved architectural features and a rich assemblage of pottery and other artifacts, most of which came from more recent Classical and Islamic contexts. Even as Braudel's tomes challenging long-standing historiographical conventions were still being translated into English, the Heshbon Expedition leaders were channeling his revolutionary vision by embracing a *longue durée* orientation as the way forward for their research at the site. This has continued to this day to be a core feature of the work not only at Tall Ḥisbān, but at all of the other spin-off excavations and surveys mounted by the Madaba Plains Consortium.

A scan of the abstracts posted on-line for these meetings reveal that deep-time perspectives are no longer only the purview of prehistorians. It has also become an explicit approach of a number of projects concerned with later periods—and that not only regional surveys, but also excavation projects. The sorts of interpretive lenses used by these projects include studies of place-making, water management technologies, territorial management, desertification, and environmental degradation.[2]

A fourth step is to embrace the notion of connectivity as an influencer of local cultural production and change that functions apart from imperial agendas or civilizational confines. A line of research that has accelerated with the global turn in academe are projects tracing the origins and routes of the worldwide spread of particular commercial products such as aromatic resins, sugar, salt, wine, and much more. In these meetings there are at least half a dozen presentations on wine making in Jordan.[3] Surprisingly, I did not notice any studies of trade in aromatic resins—surely a most important window on connections impacting the history of Jordan.

The study of social networks is another burgeoning approach among global history researchers, and I see we have several papers that do so here. Examples from these meetings include inquiries into the role of networks in the Early and Middle Epipalaeolithic times, Late Neolithic ceramic and obsidian networks, home-maker networks during EBA III, and Mamluk trade networks for the movement of sugar.[4]

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[2] See for example Lisa Maher and Danielle Macdonald's study of hunter-gatherer place-making and lifeways at the Epipalaeolithic site of Kharaneh IV in eastern Jordan; Roser Marsal's study of ancient water technologies at Sela in southern Jordan; Michele Nucciotti and Chiara Marcotulli's light archaeology studies of the Castle of Al-Habis in Petra; Saba Fares and Vincent Olive's research on societal interrelationship between human groups and territorial management in the Wadi Ramm; Bill Finlayson's study of desertification and environmental degradation in the Wadi Faynan; Paula Kouki, Berhard Lucke and Nizar Abu-Jaber's geoarchaeological investigations of cultivation and environment change in the Petra region; Muhammad Najjar and Steven Collins study of patterns of occupation in the Jordan Valley; and Andrea Zerbini and Michael Fradley's research on landscape change in Northern Jordan.

[3] Namely, Ueli Bellwald in the Badia; Claudine Dauphin and Mohamed Jeddou at Umm Ar-Rasas; Jolanta Młynarczyk and Mariusz Burdajewicz at Beit Ras; and John Peter Oleson at Humayma.

[4] Including Danielle Macdonald and Lisa Maher's on the role of networks in Early and Middle Epipalaeolithic; Elizabeth Gibben's on Late Neolithic ceramic and obsidian networks; Meredith Chasson's on the social networks of homemakers in EBA III Numayra; and Stephen McPhillips at Pella on trade networks and movements of sugar products during Mamluk times.

A fifth step is to prioritize, whenever and wherever possible, investigations of interactions between humans and animals and humans and the environment. Stories of eco-system engineering projects at all levels of society are important to a global turn because of what they can tell us about the accumulative impact on other living species and on the natural environment of such activities. Such studies are also pivotal to understanding the root causes that have brought us to the dawn of a new geological epoch, the Anthropocene—the era when the activities of humankind are overwhelming and rapidly altering the Earth's natural processes: climate, sea levels, soil regeneration, fish and wildlife survival and extinctions, and much more.[5] Not surprisingly, the prehistorians in our conference are addressing many of these concerns. The rest of us, for the most part, are not!

The attention to water-related topics and desertification nevertheless holds promise. Of the dozen or so papers dealing with water issues in our program, nearly half are focused on the Southern Jordan and the Petra region. Approaches to this topic include studies of flood control methods, terracing practices, water pipelines, garden pools, underground cisterns, open air reservoirs, rain water harvesting, urban water management, and Roman baths.[6] But none of these papers, as far as I can tell, make an explicit effort to relate their research to the Great Acceleration and the Anthropocene crisis.

A sixth step is to engage host communities where we carry out our projects with our fieldwork and research agendas. The global history storyline with its concern for our planet's well-being is pivotal and well worth sharing with local residents where we work. They, as much as we ourselves, have a stake in preserving our planet as an inhabitable place for future generations. Engaging our host communities with the global history storyline opens to a broader outlook on the past and on what we do as archaeologists. It makes possible seeing the past in a way that is different from the ethnocentric gaze that is the received point of view of most of us where the past is concerned. It can even inspire grass-roots activism on behalf of the environment and is clearly a sustainable way forward for protecting Jordan's archaeological heritage.

Jordan is in the vanguard in the Islamic world and beyond when it comes to community engagement and public outreach. Proof of this are the many sessions and papers devoted to this theme in these meetings: the USAID sponsored Sustainable Cultural Heritage through Engagement of Local Communities Project, the Virtual

[5] See Crutzen, Paul J. 2002. "Geology of Mankind." *Nature* 415:23.

[6] I note Catreena Hamarneh, Abdallah Rawabdeh, Qasem Abdelal, Khaldoon al Qudah, and Khaled Al-Amrien examining Nabatean flood control in the Wadi Madras, Petra; Amer Salah Abdo Alsouliman studying water management in North Western Arabia; Leigh-Ann Bedal investigating ceramic water pipelines in the Petra Garden and Pool Complex; David Boyer reconstructing the Classical period water management system at Geresa; Yazid Elayan and Regine Hunziker-Rodewald recovering the water supply system at the Amman Citadel; Cynthia Finlayson examining the underground cistern complex at Ad-Deir Palteau, Petra; Randall Younker, Paul Gregor and Constance Gane uncovering the open air water reservoir at Tall Jalul; Craig Harvey examining the Roman bath at ʿAyn Gharandal; Mechthild Ladurner and Fawzi Abudanah researching water harvesting techniques of farmers in Petra; Roser Marsal studying rainwater storage systems at Sela in Petra; and Ezio Burri and Angelo Ferrari studying the ancient water supply system in the Ma'an area.

Petra Initiative, the al-Hallabat Complex Interpretation Center, the Jordanian Museums' National Awareness Outreach Program, the UNESCO sponsored 'Siq' of Petra Project, the Madaba Regional Archaeological Museum Project, the Department of Antiquities Amman Citadel Community Engagement Initiative, the Archaeology Clubs in Jordan Schools Initiative of the Friends of Archaeology, the Employment through Community Heritage Project, and the King's Highway Community Engagement Initiative.[7] A question for the leaders of each of these initiatives is to what extent do the storylines they propagate narrow or widen outlook with regard to the environment and the global scale crisis of culture we now face as humans.

Leonardo da Vinci, the Florentine genius whose 500th anniversary is being marked these days around the world, is reported to have said: "Learn how to see. Realize that everything connects to everything else." In his biography of Leonardo, Walter Isaacson stresses "how much Leonardo always pulled from different fields and disciplines to guide his art. He studied optics, geometry, math, and anatomy. . . to both satiate his curiosity and better inform his art. The more he understood reality as it was, the better he could reflect it and combine it with his imagination in his creations."[8]

The global turn is a call for a Renaissance of outlook and vision for dealing with the crisis of culture that has brought us to the verge of climate catastrophe. It is a demand to those of us with narrowly specialized fields of expertise to give thought to, and to articulate how, what we do fits within a larger whole. It is an appeal for all of us to rethink and perhaps even reinvent our programs of research to more clearly reveal to our students and the public the relevance of what we do to address the greatest crises of our global age.

I would like to thank the organizers of this conference for challenging us with the theme: "Culture in Crisis: Flows of Peoples, Artifacts, and Ideas." It is evident from the sessions and papers that will be delivered this week that they have succeeded in fostering many new and promising approaches to the history and archaeology of Jordan. And as I have shown, among these are a number that are anticipating to varying extents the global turn of which I have spoken.

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[7] Project presenters are: the USAID sponsored Sustainable Cultural Heritage through Engagement of Local Communities Project or SCHEP (Nizar Al Adarbeh and Jehad Haroun); the Virtual Petra initiative (Bjorn Anderson); the Interpretation Centre of al-Hallabat Complex (Ignacio Arce and Darat Othman Bdeir); the national awareness outreach initiatives of Jordanian museums (Lina Bakkar); the UNESCO sponsored 'Siq' of Petra Project (Giorgia Cesaro, Ciusseppe Delmonaco, Falah Al Amoush, Monther Jamhawi, and Khaled Amryyin); the Madaba Regional Archaeological Museum Project or MRAMP (Douglas Clark, Suzanne Richard, Andrea Polcaro, Marta D'Andrea, and Basem Mahamid); the Department of Antiquities Amman Citadel Community Engagement Initiative (Husam Hjazeen); the Archaeology Clubs in Jordan Schools initiative of the Jordan Friends of Archaeology and Heritage Society (Nofa Nasser); the Employment through Community Heritage Project or EHP (Maria Elena Ronza and Eman Abdassalam); and the University of Helsinki King's Highway Community Engagement Initiative (Suzi Thomas and Rick Bonnie).

[8] Isaacson, Walter. 2017. *Leonardo da Vinci*. New York: Simon & Schuster.

During this week I challenge all of us to undertake a critical vetting of this call for a global turn for our field. To what extent are we as scholars complicit in creating and sustaining the cultural and environmental crisis we now face? What, if any, are the pitfalls of a global turn for our field? What collective actions might we take that would capitalize on the momentum already underway?

In the words of the Apostle Paul, "the whole Creation groans!" The question now is: What can we as individuals, scholars, and teachers do about it?

I close with another saying of Leonardo: "I have been impressed with the urgency of doing. Knowing is not enough; we must apply. Being willing is not enough; we must do."

Thank you for letting me share in this way my hopes and personal passion for a global turn for the history and archaeology of Jordan.

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The First Human Settlements on the Left Bank of the Jordan Valley: The 2015, 2016, and 2018 Surveys

Abstract

This project, focusing on the Palaeolithic period of the Upper Jordan Valley between the Yarmouk River and Dayr ʻAllā, is a joint Jordanian-Swiss research venture of the University of Basel, the University of Jordan, and Yarmouk University. Two hundred and nineteen Palaeolithic sites and 96 undiagnostic sites of unknown age were located during three field seasons in 2015, 2016, and 2018. All of these discoveries are open-air factory sites exposed on the modern surface, and only five of these are well stratified with more pending confirmation. This paper is an interim report of an ongoing project. There is possible evidence of an Early Palaeolithic occupation that needs further investigation. Acheulean-style hand axes are widespread as surface finds, with only a single major site confirmed. The most important discoveries include: the Yabrudian sites embedded in the travertine of the Ṭabaqat Fiḥl and strong evidence of an Early/Middle Palaeolithic blade industry rarely observed in the Middle East. About half of the diagnostic discoveries observed during the surveys confirm a widespread and constant presence of humans during the Middle Palaeolithic. One of the survey sites north of Ṭabaqat Fiḥl showed evidence of the Upper Palaeolithic in the Jordan Valley. Late Palaeolithic occupation centres on a small area north of the Ṭabaqat Fiḥl, but few isolated finds demonstrate a farther reach.

Introduction[1]

New discoveries in the El Kowm region (Central Syria) of the Middle East triggered new discussions about human dispersal from Africa into Eurasia and caused re-evaluation of our understanding of the earliest occupations in the Levant (Le Tensorer *et al.* 2015). The initial human colonisation of the Arabian Desert and the

[1] Spelling of place names in this work may differ from the orthography used in other publications by the authors due to standardization procedures during editing, per the series guidelines.

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Levant occurred about 1.8 million years ago and can be associated with the oldest lithic technologies of the Oldowan stage, typically seen in East Africa from about 2.5 million years ago. Expansions out of Africa occurred many times, although the routes taken by these early humans into Eurasia are still poorly understood. However, it appears that the Near East stands as a favoured pathway to Asia and Europe. The sites studding the length of the corridor formed by the Dead Sea and the Jordan and Beqa'a Valleys evidence the route taken towards the North, a natural passageway resulting from the tectonic movements of the Syro-African rift (Le Tensorer 2009; Le Tensorer *et al.* 2015).

In the catchment area of the Jordan Valley between the Sea of Galilee and the Dead Sea, the Lower Palaeolithic site of 'Ubeidiya on the left bank of the River Jordan and observations from Abū Hābīl or the Dawqara Formation prove the antiquity of the dispersals and the first human settlements in the region (Muheisen 1988a; Bar-Yosef and Goren-Inbar 1993; Parenti 1997; Copeland 1998; Malago 2015). Despite its central position in the geography of the Levant, the Jordan Valley hitherto has never been subject to systematic surveys concerning the earliest human cultures in the Middle East. A preliminary synthesis by Mujahed Muheisen (1988a), and the geological work of P. Macumber (1992) in the Mashara Region, identified a prospective sector on the east bank along the Jordan Valley between the Yarmouk River and Dayr 'Allā.

The Jordan Valley

The Jordan Valley owes its existence not to riverine activity, but to tectonic plate movement. The valley was formed by a strike-slip fault at the eastern margin of the Arabian plate drifting northeastwards against the Sinai-Africa plate, along the Dead Sea Transform Fault running from the Gulf of 'Aqaba to the foothills of the Taurus Mountains. The Arabian plate has been moving northwards for about 18 million years at a rate of about 4–5 mm per year during the Late Pleistocene (Ferry *et al.* 2007). Secondary lateral movements opened successive strike-slip basins, like pearls on a string, resulting in today's graben structure. In compensation for the subsidence movement of these basins, the lateral margins were lifted upwards. The relative displacement of these movements created the spectacular margins of the valley. Locally, such movements could equal several millimetres per year, permitting substantial vertical displacements of several metres per millennium in a relatively short geological time frame and creating important topographical changes. The present-day topography of the Jordan Valley is the result of a multitude of local episodes, and it continues to be in a permanent state of evolution.

The topographic delimitation of the endorheic valley and the low altitude create specific climatic conditions. The height of the valley wall protects the floor from most of the prevailing winds, which, with the additional density of the atmosphere, results in a mean temperature about 7–8°C higher than in the adjacent landscapes. These conditions were probably attractive for Palaeolithic hunters and gatherers during winter, especially in colder climatic periods during the Pleistocene. Considersing the geography of the Middle East, the valley served as a refuge, providing shelter against the cold.

The climate in the Levant over the past million years was considerably different, with substantially lower temperatures for most of this period. Under glacial conditions, mean annual temperatures were at least 6–7°C lower than in the present (Affek *et al.* 2008), leading to much less evaporation. However, even with reduced precipitation, moisture was more readily available to plants for a longer period than is the case today, allowing a build-up of a much larger biomass (Wirth 1971). These lower temperatures and decreased evaporation led to runoff from the surrounding areas filling the endorheic Jordan Valley basin, which under favourable conditions could create a freshwater lake that stretched some 245 km from the Sea of Galilee in the north to the Dead Sea in the south. Estimates based on the youngest of these episodes, known as Lake Lisān (*e.g.*, Abu Ghazleh and Kempe 2009; Lisker *et al.* 2009; Abu Ghazleh 2011; Torfstein *et al.* 2013), together with observations from older episodes such as Lake Samra and Lake Amora (Waldmann *et al.* 2009, Torfstein 2017), and the aid of palaeoclimate proxies (*e.g.*, Lisiecki and Raymo 2005; Affek *et al.* 2008) permit the reconstruction of a massive barrier to movement for at least two-thirds of the Middle Pleistocene.

This change in palaeogeography had a deep impact on migration routes, a fact that is easily overlooked in our perception of the Levant. This massive barrier separated the coastal areas from the interior, forcing both humans and animals to make considerable detours either to the north or the south. Crossing the Naqab (Negev; Negeb) desert was a possibility for humans, but only certain animals could attempt the same. Today a trip from ʻAmman to Jerusalem would take two or three days on foot, however with the presence of the lake, the journey becomes four or five times as long. For most of the Palaeolithic, the Jordan Valley has to be considered as a massive barrier that limited movement.

According to global and local climate archives (*e.g.*, Bar-Mathews *et al.* 2003; Lisiecki and Raymo 2005), the current climate with wet winters, hot dry summers and relatively high annual mean temperatures has prevailed for about 11,000 years, but only corresponds to relatively short periods since the Middle Pleistocene (*i.e.*, in the past 800,000 years). Precipitation was brought by west winds from the Mediterranean Sea, and its restricted size meant that massive cyclones were rare (Rogerson *et al.* 2019 and literature therein). In cooler conditions, potentially less moisture was transported, but lower temperatures meant less evaporation, hence better conditions for the development of the plant cover (Pabot 1956; Haude 1969; Wirth 1971; Schiebel 2013).

Survey Strategy and Procedures

Screening for lithic artefacts was carried out over the natural and ploughed surfaces within defined sectors (Fig. 1). Depending on the topographical situation, either regular transects or systematic inspections of promising locations were walked by individuals or in small groups of two to three.

All observations, regardless of the presence or absence of archaeological evidence, were documented with their GPS coordinates. In order to establish a comprehensive archaeological map of the surveyed area, both positive and ʻnegative' observations (*i.e.*, the absence of archaeological finds) were strictly and congruently documented.

In order to gather the greatest amount of data possible in the time allotted, the discovery of potential sites was recorded with only their basic chronological context. Comprehensive studies of these sites (except for exceptional discoveries) were not planned at this stage of the project, in favour of a wider ranging dataset.

The general database contains GPS coordinates for each point surveyed, the presence or absence of archaeological finds, chronological evaluations, discovery situation, artefact abundance, number of sample finds taken, and artefact characteristics according to basic technomorphogical classification. Furthermore, topographical and geological survey sectors and special observations were noted together with the local place names. Altitude was measured with a high-resolution digital elevation

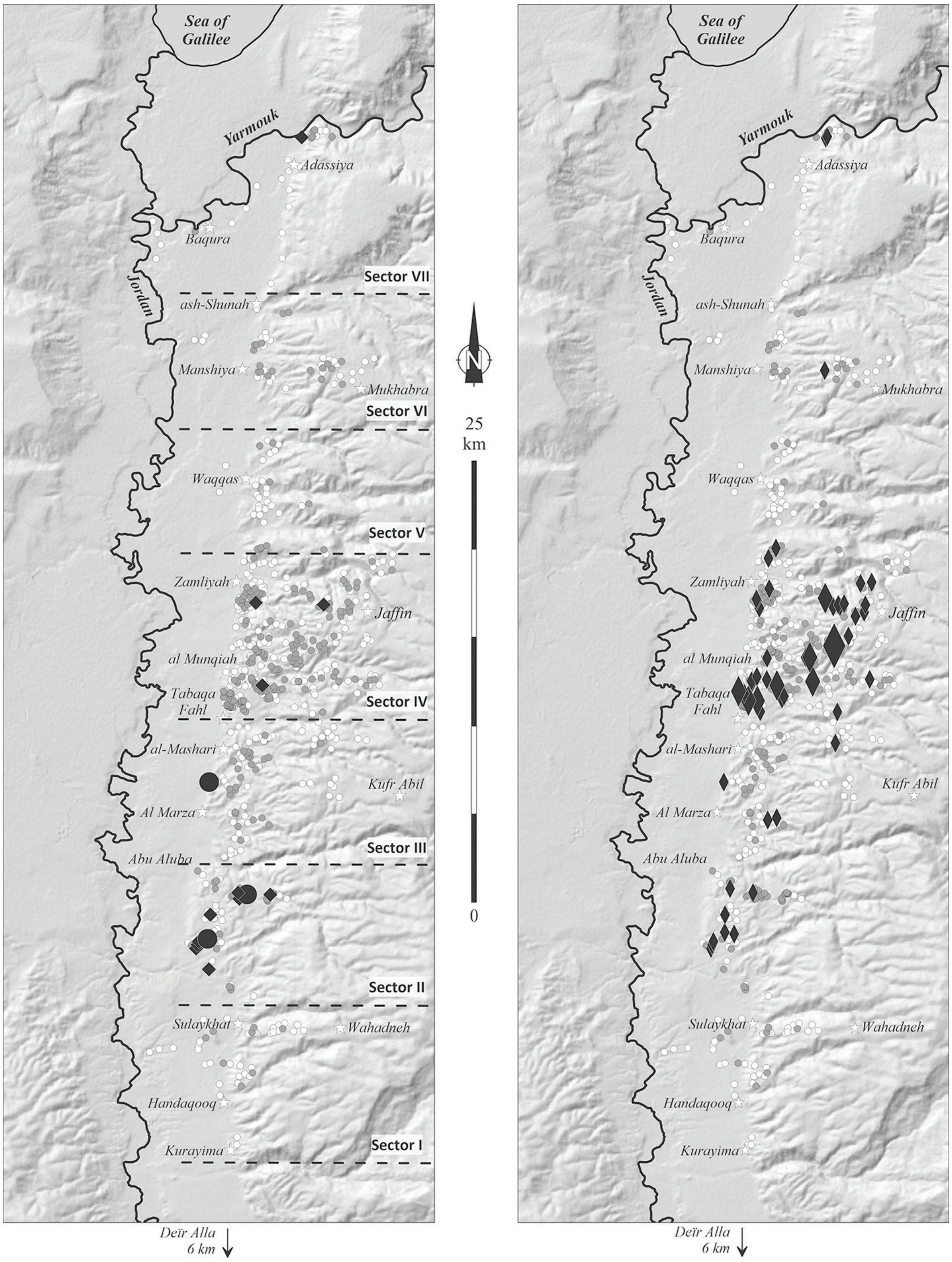
1. Screening for artefacts at the Munqiah 10 site on the western margins of the Jaffin formation.

model, based on the USGS (United Stated Geological Survey) SRTM1 (Shuttle Radar Topography Mission) data set with a resolution of 1 arc-second (*i.e.*, 31 x 26 m on the ground), as vertical GPS measurements showed considerable variance. As a whole, the dataset consists of 11,500 documented entries relating to 663 locations.

Survey Area

The scope of the survey in the original project design was to cover the area of the northern half of the Jordan Valley between Dayr ʻAllā and the Yarmouk River. Potential survey areas were defined based on their geographic and geological settings. Few topographical maps with the necessary resolution were available, so the initial fieldwork preparation essentially relied upon satellite imagery and digital terrain models. However, the remote sensing data from Google Earth appeared misleading as the potentially identified bedrock exposures were covered with Upper Pleistocene lake sediments. Moreover, the intensive agriculture of the valley floor impeded any useful observations. Other than a few explorative attempts, this sector was quickly abandoned.

Survey activity focused on the foothills of the Jordanian escarpment (Fig. 2.1), between the village of Kurayima (*ca.* 12 km north of Dayr ʻAllā) and the Yarmouk River approximately 45 km distant (Le Tensorer *et al.* 2016; Jagher *et al.* 2017, 2019). Agriculture was hindered here by the lack of irrigation. The northern sector was only briefly explored; field work essentially concentrated along a narrow strip, about 36 km by 2–6 km wide, between Kurayima and Ash Shūnah situated about 550 m above the valley floor. A systematic and continuous



2.1. (Left) Distribution of pebble tools: diamonds n=1, dots n=4; surveyed places (white dots); locations with lithic artefacts (grey dots). Dashed lines show limits of survey sectors.

2.2. (Right) Distribution of hand axes: small rhombs, isolated discoveries; medium rhombs, small group of hand axes; big rhomb, major Acheulean site of Jaffin 4; surveyed places (white dots); locations with lithic artefacts (grey dots).

3. Collecting artefacts at the Al Marza 7 Middle Palaeolithic site on the first foot-hills just above the Jordan Valley plain.

survey was impeded by the nature of the terrain, ravines, and erosional gullies cutting deep into the slopes of the Jordanian Valley.

In the first stage of the project, special emphasis was given to the identification of Lower Pleistocene deposits and associated archaeological sites, thus concentrating on the valley floor and the directly adjacent hills. No clear evidence of Lower Palaeolithic sites was uncovered. Early Pleistocene deposits in the Jordan graben were exposed in only a few restricted zones. Old graben sediments have so far only been observed in the sector between ʻAdassiyyah and Ṭabaqat Fiḥl. Farther south, excluding the enigmatic Abū Hābīl Formation, probably an alluvial fan rather than a true graben filling, no Lower Pleistocene deposits were positively identified during the survey.

During the second stage of the survey, more attention was given to the lower part of the foothills of the Jordan Valley (Fig. 3), as the valley floor is completely covered with Late Pleistocene deposits, again intensive agricultural works impeded the study of the natural features.

For the third survey season, the attention was moved to the Jaffin area (Fig. 4), rich in flint raw material identified late in the second season. Furthermore, local observations made in the vicinity of the valley in the previous seasons were investigated. A transect of approx. 8 km by 5–6 km along the valley foothills was surveyed to a height of 550 m above the valley floor.

Raw Material Availability in the Jordan Valley

Along the entire foothills of the northern part of the Jordan Valley suitable raw material is scarce. Only seven locations out of 663 showed primary outcrops of flint. In

4. View from the Jaffin 1 site to the Jordan Valley. Artefacts are eroding in the foreground from the caliche (calcium-carbonate precipitations which are consolidating the former surface).

every case there was restricted accessibility to the flint due to the nature of the exposure or the extension of the beds. Moreover, the low degree of silicification, the presence of fissures (from tectonic stress), the size of the blocks, and the low quantity yielded only poor quality flint for flaking.

However, some alluvial deposits in secondary position are rich in flint nodules. During transportation from the original outcrop, poor and fissured material was naturally discarded and the remaining nodules deposited in the current location. The original source of the flint here is the conglomerates of the Abū Hābīl Formation, but suitable raw material is available only in small quantities.

So far, only a single area has shown to be rich in excellent raw material during the survey. In the hills, east of the Ṭabaqat Fiḥl and north of az-Zumaylah, about 250–450 m above the valley floor, extensive outcrops of old fluviatile deposits are rich in large flint cobbles of excellent quality. The age of this so-called Jaffin Formation is unknown and covers a well-defined area of about 10 km^2 (*ca.*7 km from north to south and 1–2.3 km from east to west), delimited on all sides by tectonic faults.

Downhill from these outcrops there are a few accumulations of flint cobbles in residual alluvial deposits in tertiary position. The Munqiah workshop sites are located adjacent to them. The flint accumulations at az-Zumaylah about 2.5 km to the north of Munqiah also seem to be derived from the Jaffin Formation, but from an older displacement.

Despite the scarcity of raw material in the surveyed area, not every outcrop of flint in the Jaffin area was exploited during the Palaeolithic. Indeed, 43% of the flint occurrences surveyed here, for no obvious reason, were barely or never exploited during the Palaeolithic. Just one-third of the flint outcrops were heavily used for tool production. The reason for selecting certain sites for tool production remains puzzling. Alongside this, one fifth of the artefact-rich sites in the area are not directly connected with flint outcrops. Obviously, Palaeolithic people had a clear understanding of the criteria needed to set up workshops for flint knapping, but their choices depended on wider criteria than just the local availability of suitable raw material.

The Ṭabaqat Fiḥl Travertine Formation

The plateau of the Ṭabaqat Fiḥl (next to Al Mashari) is one of the most prominent topographical structures on the eastern flank of the Jordan Valley between Dayr ʻAllā and the Yarmouk River. The actual appearance of this plateau is due to an extremely active spring system that deposited a massive travertine complex in the Middle Pleistocene. The travertines extend more than 1.5 km north-south along the valley rim and cover a surface area of at least 1 km^2 with an estimated thickness of about 100 m. The depth into the interior of the plateau is less evident, as the formation is deeply covered by younger terra rossa deposits. Visible outcrops indicate that the travertine formation is at least 600 m wide in the north, and 750 m at its southern end.

The Ṭabaqat Fiḥl travertine formation originated as shallow pools and terraces of tens of metres across, where mineral detritus and flowstones accumulated with the upward movement of the outer rim. At the margins of these pools, dense stands of Poaceae reeds and other plants were rapidly covered by thick precipitations of calcium carbonates. Accumulation rates must have been high, attested to by the still visible stalks in the deposits, probably due to intense evaporation. Exposures along the western façade of the Ṭabaqat Fiḥl travertines show a general stratification within these deposits which dips slightly to the south, *i.e.*, a progressive growth of the formation from north to south.

Considering the volume of deposited carbonates, these springs must have been active over many tens of thousands of years. The age of this formation can be estimated as they are ‘bookended’ by embedded archaeological sites. Two Acheulean sites are confirmed at the base, and at the top a series of Yabrudian sites are covered by a thin layer of travertine, thus indicating an age between the end of the Acheulean and the beginning of the Yabrudian, approximatively 350–300 ka.

The face of the structure, which was white when the springs were active, must have been a conspicuous feature in the Jordan Valley. The striking appearance of the travertine and the abundant availability of water in this semi-arid region must have been attractive for game and humans, who found ideal shelter on the terraces.

The Palaeolithic in the Jordan Valley between Kurayima and the Yarmouk

The Lower Palaeolithic

The presence of Lower Palaeolithic sites on the eastern side of the Jordan River has been claimed for a few decades (Huckriede 1966; Muheisen 1988b; Villiers 1980, 1983). However, the evidence is scarce, and controversy still surrounds the archaeological data and the geological situation of the discoveries.

The Abū Hābīl Formation, an extensive area covered by a thick layer of poorly sorted alluvial and loosely structured conglomerates, has an archaeological (supposedly Oldowan) context (Huckriede 1966) that has caused it to be attributed to the Lower Pleistocene. Subsequent finds of archaic pebble tools and primitive hand axes corroborated an early age for these discoveries, techno-typologically attributed to the ʻUbeidiya finds (Muheisen 1988b).

Observations by Macumber and Edwards (1997) found no Oldowan artefacts and suggested a much younger age for the formation. In 2015, the joint team of the Jordan Valley Palaeolithic Survey spent three days investigating the conglomerates of the Abū Hābīl Formation. Artefact density was surprisingly low. Artificial profiles in construction pits and natural outcrops along erosional gullies, often up to 10 m deep, were scrutinised for *in situ* artefacts with no result. Pebble tools, such as choppers and chopping tools, were observed in two spots, one of which yielded four pebble tools (see Fig. 2.1). The three hand axes found in the context of the Abū Hābīl Formation show some archaic features but cannot clearly be attributed to the early Acheulean as they were heavily eroded, like all surface material from the area. Today the available evidence no longer supports the presence of a very old period at Abū Hābīl.

The presence of archaic-looking pebble tools was not only noted at Abū Hābīl but also in the neighbouring areas of Kurkuma, Ṭabaqat-az-Zumaylah-Jaffin, and ʻAdassiyyah. In each of these areas just one lone pebble tool was recorded, giving no evidence of very early occupation. The only exceptions are the observations at Abu Aluba, where the walls of an artificial outcrop yielded four pebble tools, an archaic-looking hand axe, and a few associated flakes. The appearance of the assemblage and its geological context, a coarse, poorly structured conglomerate, confirm the integrity of the collection, with the possibility of a very early date. However, further confirmation of these brief observations is needed in order to corroborate the chronological claim.

The Acheulean

Hand axes are easily recognised, and immediately identified as significant finds during surveys by their size and characteristic morphology (Fig. 5). These are characteristic objects with a specific cultural label (Muhesen and Jagher 2011). In many cases, accompanying artefacts are often neglected or handled cursorily as the hand axe takes importance. However, it is pertinent to ask whether each of these tools is Acheulean and whether the presence of every hand axe denotes an Acheulean site.

In fact, about two-thirds of the sites that yielded hand axes are places where just a single tool of this type was found. Just eight out of 55 'Acheulean' sites produced more than six hand axes, with just one site yielding 19 such tools. It is difficult to specify a minimum threshold that would define a true Acheulean site (Muhesen and Jagher 2011). For this Jordan Valley survey, the standard in the interim has been set at more than six hand axes. Compared to the locations of the isolated finds, the places with abundant hand axes are concentrated in a well-defined area in the centre of the valley, in the Ṭabaqat Fiḥl and Jaffin areas (see Fig. 2.2). It is no surprise that hand axes are more frequent in the Jaffin sector where there is more plentiful raw material. The sites on the Ṭabaqat Fiḥl are at least 2–3 km away from the closest flint outcrop, a relatively short distance. The few sites where hand axes were present in a significant number can be assigned by their shape and style of finish to a later stage of the Acheulean, *i.e.*, the Upper Levantine Acheulean (Jagher 2016), with an approximate age between 700 and 350 ka. It is not possible to more accurately date these finds under the given circumstances (*i.e.*, that they are surface finds and occurring in limited numbers).

Clearly two sites, Ṭabaqa 20 and 21, are Acheulean, discovered on a similar stratigraphic level in the basal part of the Ṭabaqat Fiḥl travertine formation, although Ṭabaqa 20 is slightly above Ṭabaqa 21 (Fig. 6). Each produced about 500 artefacts with lithics perfectly preserved and edges in a pristine state. At both sites, artefacts

5. Hand axes from Acheulean contexts from different sites in the central area of the survey. Scale bar = 3 cm.

were still embedded in the rocks. However, their orientation (*i.e.*, inclination), as well as their nature within the original deposit, suggests some mechanical dynamics prior to definite embedding and sedimentation.

Preliminary observations indicate some characteristic features for each of the two sites, such as a much larger number of cores and dominant flake production in Ṭabaqa 20 and a much higher quantity of hand axes and associated reshaping flakes in Ṭabaqa 21. Retouched flakes are rare and quickly produced at both sites.

Despite the modest number of hand axes,

6. Surveying at the Ṭabaqa 21 Acheulean site stratified within the basal layers of the Ṭabaqat Fiḥl travertines, just above the Jordan Valley plain.

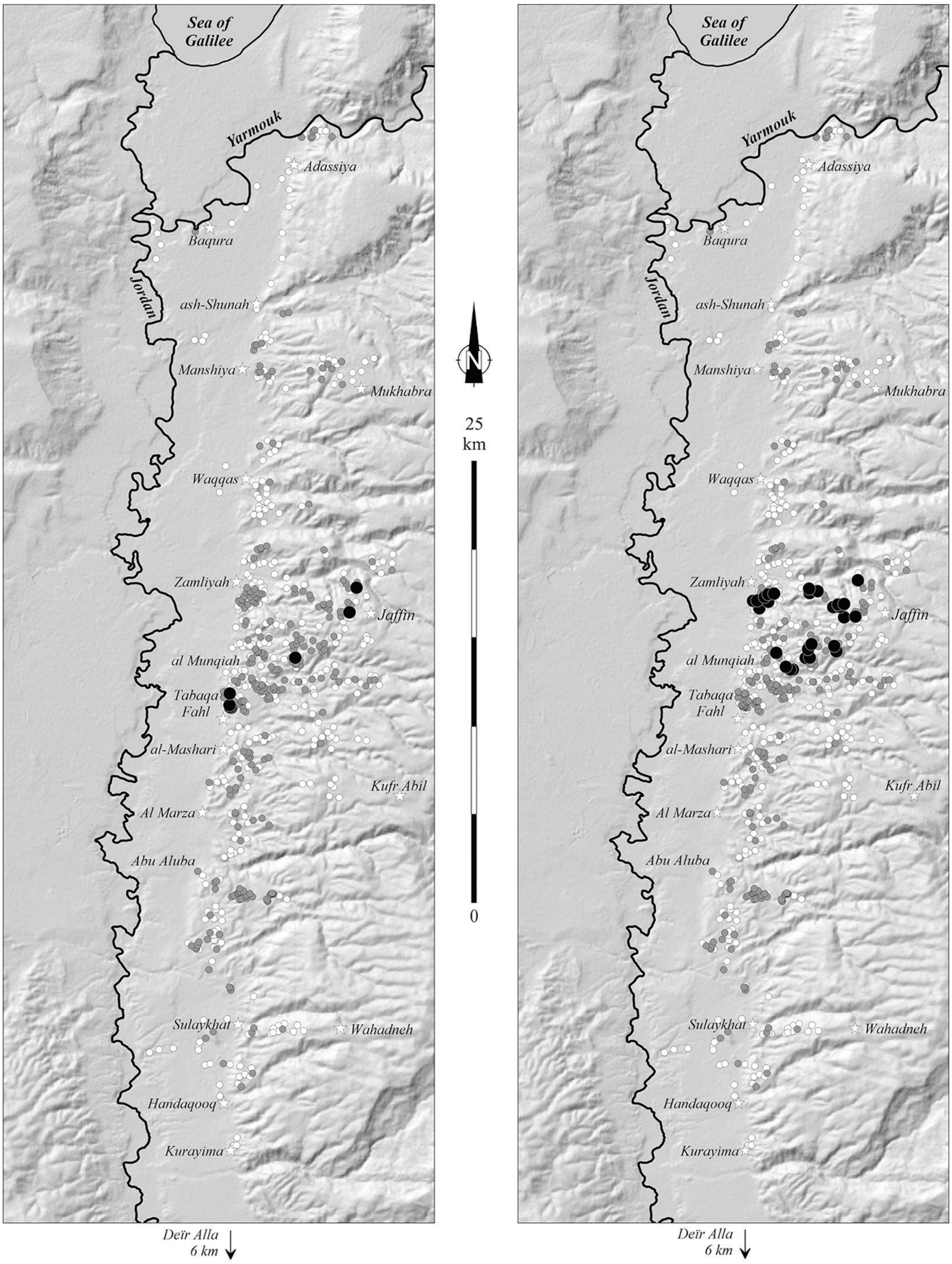
the important number of flakes produced from the curation of hand axes clearly demonstrates the importance of these tools in Ṭabaqa 21, which can be associated with the Levantine Upper Acheulean. In contrast, the Ṭabaqa 20 collection is clearly different, with a strong core and flake element, just a few hand axes, and no clear evidence of façonnage (*i.e.*, production) on the spot. The Ṭabaqa 20 material shows some affinities to the so-called non-hand-axe Acheulean of the Levant (Bar-Yosef 2006; Malinsky-Buller *et al.* 2016). However, this statement needs further confirmation.

The Yabrudian

The Yabrudian (dated *ca.* 320–240 ka) is best represented at the Ṭabaqat Fiḥl sites. Two sites (Ṭabaqa 4 and 5) are stratified and embedded in a massive travertine deposit whereas a third (Ṭabaqa 6), located just above the previous two, is exposed on the surface of the travertine plateau. The numbers and spectrum of artefacts qualify all three as major settlements (Fig. 7.1). On four occasions individual tools (*i.e.*, scrapers) of definite Yabrudian style were observed during the survey. An additional three less distinct artefacts of possible Yabrudian manufacture are not included here. These stray finds were located 3–7 km from sites in the Jaffin area of the Ṭabaqat Fiḥl, indicating the presence of Yabrudian people in an area of natural availability of flint, although it is a short-term presence.

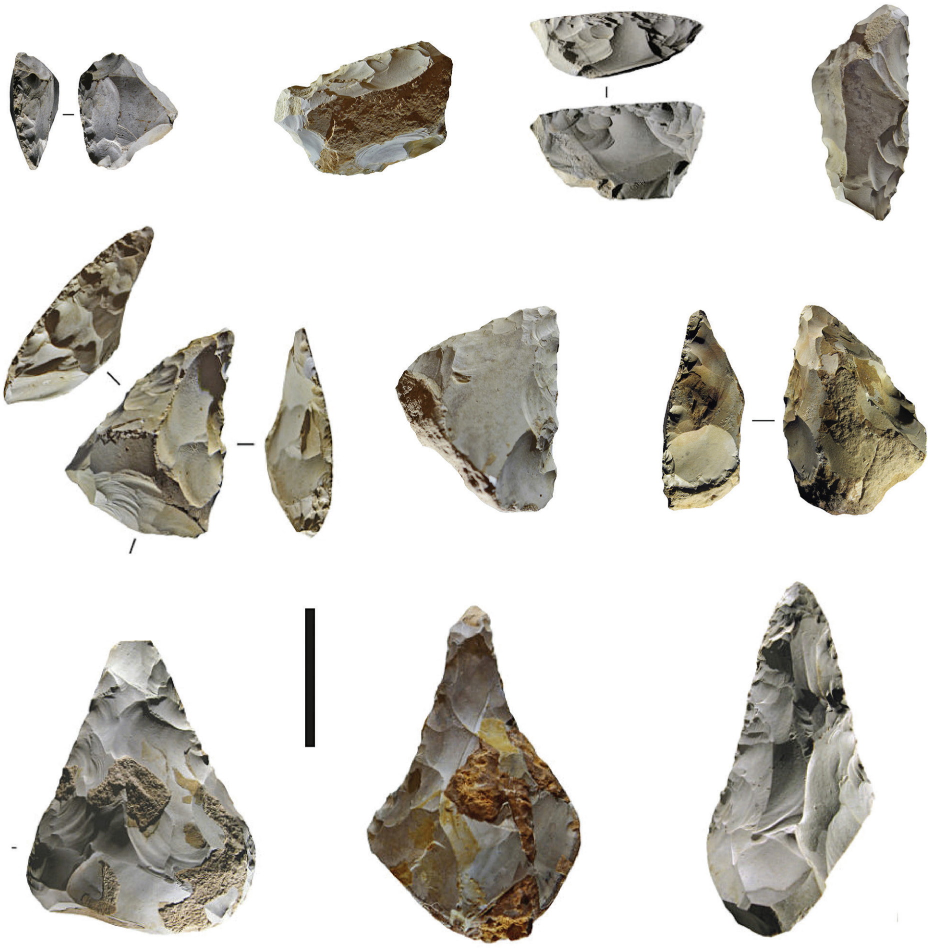
Characteristics of the Yabrudian

The Yabrudian shows a number of inherent characteristics with respect to technology, morphology, and style that distinguish it clearly from the preceding Acheulean. These include a new core reduction strategy, similar to the European Quina debitage to produce very thick flakes, including numerous transversal and offset blanks; a systematic production of side scrapers that subsequently underwent intensive stepped retouch and repeated resharpening; and a complex behaviour of curation, recycling and modification in



7.1. (Left) Location of Yabrudian sites (black dots). Only the discoveries at the Ṭabaqat Fiḥl are settlements, other observations are just isolated finds: surveyed places (white dots), locations with lithic artefacts (grey dots).

7.2. (Right) Distribution of Early Middle Palaeolithic blades sites (black dots): surveyed places (white dots), locations with lithic artefacts (grey dots).



8. Selection of Yabrudian tools from Ṭabaqa 6 site: on the top two rows are different types of scrapers with the typical Yabrudian step retouch and hand axes in the bottom row. Scale bar = 3 cm.

nearly all aspects of their lithic technology. Façonnage was only applied to a marginal extent. Levallois technology is non-existent in Yabrudian assemblages. The sum of these distinctive traits clearly separate the Yabrudian from the Acheulean.

The Ṭabaqat Fiḥl Yabrudian Sites (Ṭabaqa 4, 5, and 6)

The youngest site (Ṭabaqa 6) is located on top of the Ṭabaqat Fiḥl travertine formation. Its exact geological position is unknown, as the artefacts are exposed on a ploughed surface. Typical Yabrudian artefacts (Fig. 8), such as scrapers and hand axes, occur together with Levallois cores, flakes, and other flint implements. Part of the find area has been destroyed through historic buildings and fortifications from the 1967 six day war.

The main Yabrudian sites (Ṭabaqa 4 and 5) are located about 15 m below the surface of the Ṭabaqat Fiḥl plateau. Both sites are exposed along an outcrop of the travertine formation at its southern edge, along an erosional gully cutting through the deposits and deep into the underlying bedrock. These sites were originally located in 1989 by Philipp Macumber (1992; Macumber and Edwards 1997). The presence of a number of hand axes resulted in the attribution to a late Acheulean date at the time of their discovery. Except for these preliminary observations, no further investigations were undertaken at that time. The 2015 and 2016 observations permitted the confirmation of an *in situ* site with artefacts still embedded in the isolated travertine blocks. However, the precise location of the layers containing the original site has yet to be established.

When rediscovered, artefacts were exposed by erosion on the steep slopes of the southern flank of the Ṭabaqat Fiḥl among outcrops and scattered blocks of travertine eroding from the exposed rim of the plateau. Artefacts occur in more or less dense clusters regularly dispersed over a distance of about 150 m and about 50 m along the slope. In a preliminary approach, the terrain was divided into two sectors (Ṭabaqa 4 [East] and 5 [West]), and artefact density is somewhat lower on the eastern side than on the western side.

The artefacts from both sectors are in nearly pristine condition, with only minor edge damage, and are moderately patinated. Apart from the rich flint material, no palaeontological material was observed despite special attention. In total, 3,340 artefacts, including a substantial number of small pieces (< 3 cm), were collected over the three field seasons.

Field observations indicate the presence of extensive Yabrudian living sites. The presence of fireplaces is demonstrated by a few heavily burnt flints recovered from Ṭabaqa 5. Among the lithic material, the complete production sequence is present in both areas and includes primary and secondary production. The finds from Ṭabaqa 4 and 5 show only minor differences in their composition, with proportionally fewer cores in Ṭabaqa 5, where a higher proportion of small flakes is present. Flake production is in a typical secant way with plain butts and open angles of debitage according to the Quina technology *sensu* Bourguinon (1997; Sanson 2012). The local procedure produced rather thick polymorphic flakes, consuming the volume of the raw material in a fast and rather opportunistic way. Cores are mostly completely exhausted and of small dimensions, in contrast to the many large flakes. A keen sense of a maximal exploitation of the raw material is visible. Many of the big flakes and scrapers have been reused as cores to produce small flakes just a few centimetres long in a basic approach. This leitmotiv of recycling, reuse, and modification of existing tools is also visible in the typical re-sharpening of flakes from step-retouched scrapers, which are present in substantial numbers. A similar curation is also visible on the hand axes.

Hand axes and façonnage are another, yet less frequent, element in the tool sets of the Ṭabaqat Fiḥl sites. Overall, shapes and sizes show a wide spectrum including quite a number of relatively small tools. The latter are not the result of intensive reshaping, but have been conceived as such from the very beginning, demonstrated by their sections. A minority of the hand axes shows an elongated tip with straight or slightly concave sides of typical Micoquian morphology. Additionally, there is also a number of distal fragments of these hand axes, but in contrast distally broken tools are absent. To what extent this terminal damage was accidental or intentional remains undetermined. The loss of the slender tip had an important impact on the functionality of the tools, which obviously were not discarded in this state, but underwent a reshaping of the distal part. Again the inherent spirit of transformation and reshaping is perceptible.

The intense exploitation of the raw material at different levels is one of the characteristics of the Ṭabaqa 4 and 5 material (but also present at Ṭabaqa 6). In contrast, raw material of good quality was plentiful within a two-hour walk of the site. In this respect, the constant recycling, curation, and transformation constitute an inherent cultural expression of the Ṭabaqa Yabrudian.

The Yabrudian in the Levant

The discovery of these Yabrudian open-air sites in the Jordan Valley is of great importance, as except in the Azraq region in the Eastern Jordan Desert, no Yabrudian site has ever been found in the country (Le Tensorer 2006; Al Nahar and Clark 2009; Al Qadi 2016). The new discoveries clearly demonstrate the presence of the Yabrudian at open-air sites outside of a desert environment (Azraq and El Kowm, Central Syria) but also in the western Levant, where cave and rock shelter sites until today were considered predominant (Rust 1950; Jelinek 1982; Gopher *et al.* 2017 and literature therein). The lack of open air sites is probably a taphonomic problem or a lack of suitable surveys rather than prehistoric reality. In fact, just nine out of the 23 known Yabrudian sites in the Levant are in caves or rock shelters.

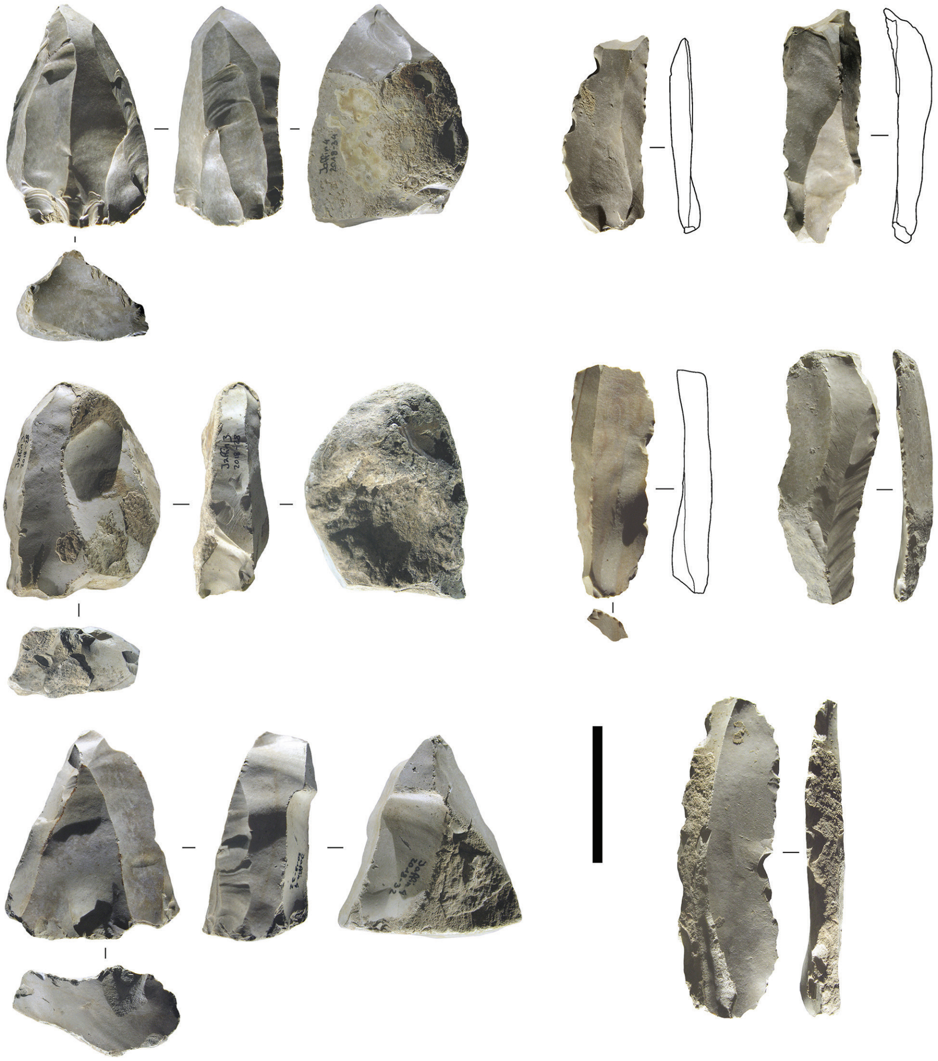
In the Levant, Yabrudian people occupied a wide range of ecological environments, from the coast to the mountains of the interior and deep into the open spaces of the Arabian desert. If the El Kowm cluster with its 11 sites of Yabrudian age is considered (Le Tensorer and Hours 1989; Jagher *et al.* 2015), more than half of the discoveries are located far from the ecologically favourable areas along the Mediterranean, demonstrating the adaptive capacities of the Yabrudian people. The history of the vast Middle Eastern deserts during the Pleistocene is still poorly understood. However, the oases of Azraq in Jordan and El Kowm in Syria clearly demonstrate a long human presence in the desert, not only during short favourable periods, but in a steady settlement pattern, coping perfectly well with this harsh environment.

The Middle Palaeolithic Blade Industries

The geographic location of sites attributed to the Middle Palaeolithic blade industries in the Jordan Valley is well outlined. All sites are located within a sector of roughly 4 x 4 km, the core of the az-Zumaylah-Jaffin area containing the best outcrops of raw material (see Fig. 7.2). Most of the sites are immediately adjacent to flint outcrops, and virtually all of them are located within just a few hundred metres of the next raw material zone. They were identified using a techno-typological approach. Wherever identifiable, locations with blade manufacturing are linked to a dominant element of characteristic blade production waste and with little evidence of blanks and retouched tools. In fact, none of these sites can be identified as a true settlement and are interpreted as factory sites for blade production. They are relatively frequent, 27 of the 140 Palaeolithic sites so far located show evidence of blade production. It seems that the blade makers exploited thoroughly the local raw material deposits to produce great numbers of blanks, ready to be shaped into tools of daily use. These were transferred to the yet unlocated settlements.

The lithic assemblages for blade production reveal no major differences overall. The knapping was aimed at producing elongated blanks regardless of their size and reduction strategy (Fig. 9). The common flaking technique was direct percussion with a hard hammer, as proven by a circular and well noticeable impact point, a convex bulb, and abundant radial defaults (Pelegrin 2000). The preliminary technological studies attest the simultaneous occurrence of a Laminar system of debitage with a particular core volume management, and also a Levallois debitage with the presence of cores and typical Levallois products.

However, sites which uncovered blade



9. Early Middle Palaeolithic blade industry, cores from the Jaffin area (left) and blades (right) from the Zamliya 6 site. Scale bar = 3 cm.

assemblages in the Jordan Valley are at the moment not directly dated and placing them within an exact cultural horizon is difficult, as we cannot use the full range of techno-typological features that usually describe lithic collections. Unfortunately, blanks and retouched pieces are rare in all collections. The assembled blades are often curved in profile and tend to be trapezoidal or triangular with a thick or slightly flattened section. The majority of blades are convergent and parallel. Many of them exhibit cortex on their dorsal surface. Their striking platforms are faceted, plain, or dihedral. The dorsal scar pattern indicates a prominent use of unidirectional debitage with random bipolar flaking including offset debitage, which is well known from the Hummalian industry (Wojtczak 2014; Wojtczak *et al.* 2014). The single platform reduction sequence present in all collections seems to have produced more blades than flakes, as is observed on the debitage surface of most of the discarded cores. Core convexity was sustained using twisted and overshot blades or thick, ridged blades, but rarely crested blades. All these elements demonstrate that blade production is the main characteristic of all the collected assemblages. Through the study of core, by-product, and (sporadic) end-product characteristics, all blade collections appear to fit within the cultural variability of the Middle Palaeolithic. Foremost, many elements observed in assemblages from az-Zumaylah, Munqiah, and Jaffin combine in the Early Middle Palaeolithic blade assemblages where the Levallois and Laminar reduction strategies (including off-set debitage) together with their characteristic products, CTEs, and cores are present (Meignen 1998, 2007, 2011; Wojtczak 2011, 2014; Goder-Goldberger *et al.* 2012; Wojtczak *et al.* 2014). However, lithic assemblages from the Jaffin area seem somehow set apart from the az-Zumaylah-Munquiah collections. The principal variation is the proportions of the Levallois and Laminar elements within each collected assemblage. It seems that lithic assemblies from the Jaffin region could also represent the transitional industry from Boker Tachtit Levels 1–4 with hard hammer percussion where both the Levallois and Laminar reduction strategies were exercised on site and the use of crested blades has also been reported (Marks and Volkman 1983). Additionally, many cores collected from the Jaffin sites are pyramidal in shape, with a large platform and lateral edges converging towards the distal end. It seems that these cores had to result in triangular-shaped pieces, which could be mistaken for Levallois products. Such elements were also recognised in the assemblage from Level 4 in Boker Tachtit and Rosh Ein More (Goder-Goldberger and Bar-Matthews 2019) and could suggest affinities between the lithic collections from the Jaffin area and the late Middle Palaeolithic lithic assemblages from the Levant. Going forward these hypotheses need to be tested.

Land-Use Patterns in the Early Middle Palaeolithic of Jordan

The Early Middle Palaeolithic blade collections have seldom been observed in Jordan, and those here showed no relationship to the transitional industry from Boker Tachtit Levels 1–4. There are a few locations with the presence of a blade assemblage that claim to be related to the Early Middle Palaeolithic, namely in the region of Azraq (Rollefson *et al.* 1997; Wojtczak 2015), at Tall Khanāsirī (Dietl 2010), and at ʿAyn ad-Dufla (Ain Difla) (Clark *et al.* 1997).

The rock shelter site of ʿAyn ad-Dufla (WHS 634) located in the Waādī al Ḥasā area in the desertic marginal zones of Jordan, showed stratified *in situ* Middle Palaeolithic deposits and the earliest Levantine Mousterian assembly identified in Jordan. Small size of cores (mainly exhausted) in relation to the blanks, numerous fragments of cores and CTEs, numerous debris, and lithic specimens smaller than 3 cm suggest that some flaking activities were undertaken on site. The primary elements of reduction are missing, but it should not be forgotten that the excavated site represents only the small part of a much larger rock shelter. The toolkit is very small: the retouched pieces constitute only 2% of the assemblage and it exhibits a low proportion of tools to debris (Clark *et al.* 1997). Such archaeological inferences indicate intensive or successive occupations where tools were at least partially manufactured and maintained on site.

In the Azraq basin, where constant fresh water was accessible throughout the Middle Pleistocene, paleosettlement was constant (Macumber 2001). Middle Palaeolithic scatters and deposits have been detailed (Copeland and Hours 1989; Rollefson *et al.* 1997) including the existence of Early Middle

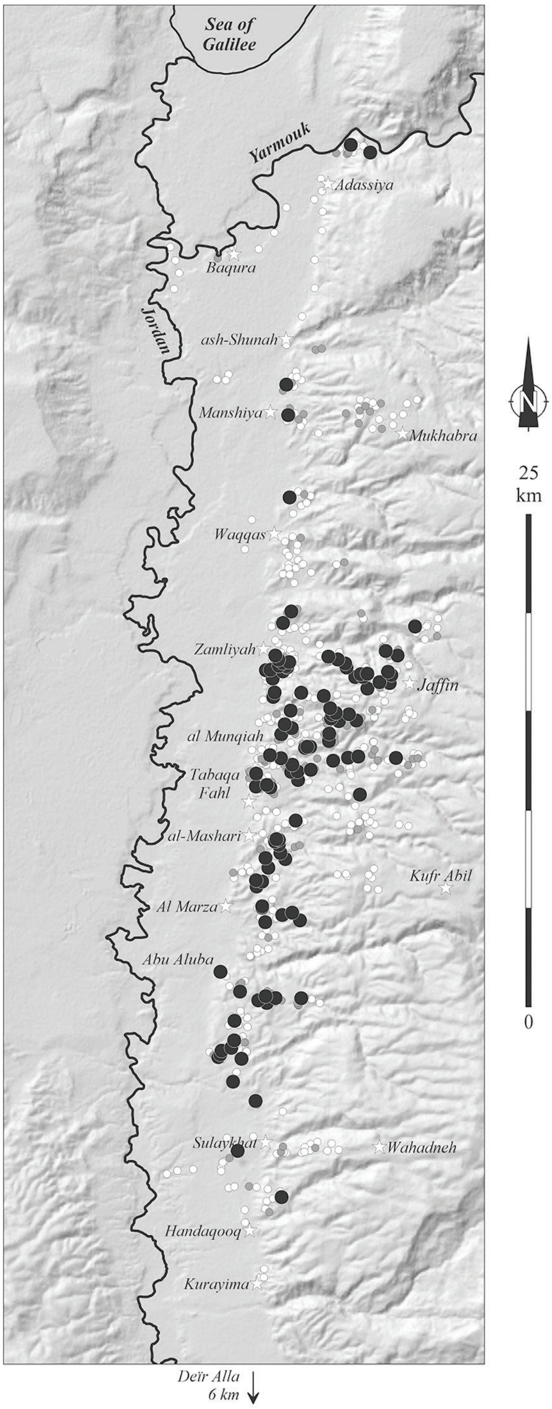
Palaeolithic lithic collections in the major spring of southern Azraq named Ayn Soda (Rollefson *et al.* 2004). These assemblages were examined by one of the authors (D.W.) thanks to the kind permission of Gary Rollefson. Primary investigation indicates a lack of cores and rare CTEs, abundant blank blades of different morphologies, and numerous blades modified by a regular retouch creating the elongated endpoints. All lithic pieces were manufactured by direct, hard hammer percussion and a few show the use of two off-set platforms during flaking. It appears that blanks were not produced on site but introduced from outside. Remarkably, the analyzed stone artefacts are very similar to the blanks and tools known from Hummalian sites from El Kowm (Wojtczak 2011, 2014) and similar industries (*e.g.*, Abu Sif; Hayonim, Misliya Cave). The site delivered a large, dense concentration of artefacts with no true stratigraphy, and it seems that due to post-depositional processes at the site, it is actually a palimpsest, representing a series of occupations.

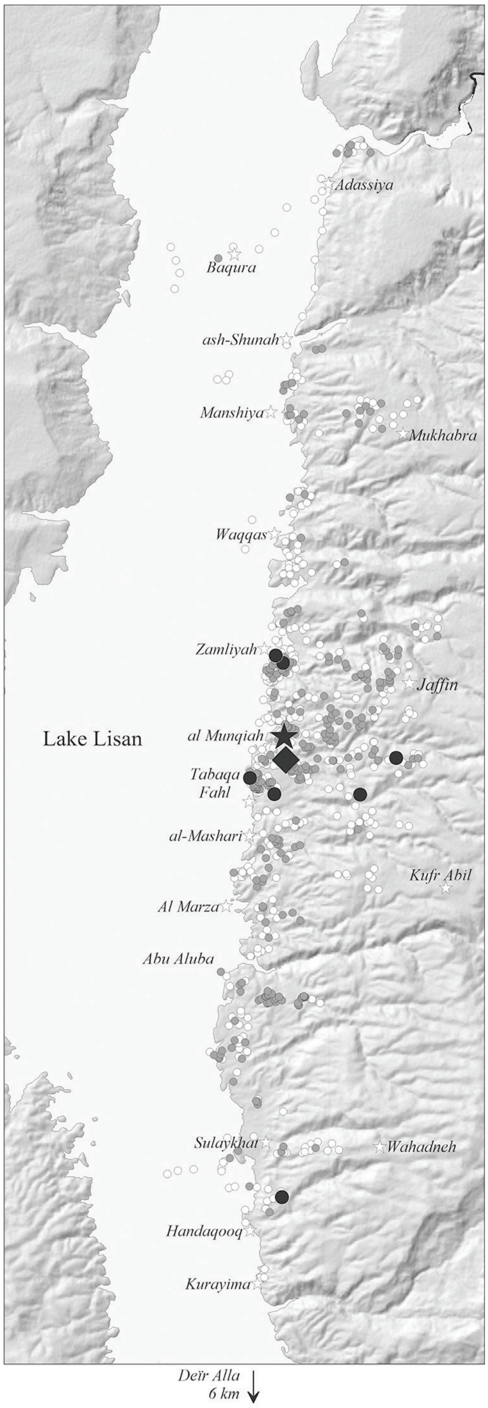
More Early Middle Palaeolithic locations were recognised about 95 km north of Azraq in the area of Tall Khanāsirī near the Syrian border. The region was defined as a transitional area of the southern Levantine steppe zone and the majority of Palaeolithic sites were documented in connection to *wadis* and their surrounds, which provided water and raw material over a vast area. So, high mobility of human groups and ephemeral site occupation during Early Middle Palaeolithic was proposed (Dietl 2010: 112–6). Generally, the Early Middle Palaeolithic and Levalloiso-Mousterian occupations appeared to show similar settlement patterns, but the Early Middle Palaeolithic hominid groups visited the region of Khanasiri sporadically. Only 10 Early Middle Palaeolithic locations have been recognised, and from those mostly single artefacts, usually cores or retouched/unretouched end-products, were observed, which were possibly transported between places in anticipation of planned labour, worn out and then abandoned. In comparison, 113 Levalloiso-Mousterian sites were discovered, with either a single artefact or locations where at least a partial lithic reduction process took place.

The presented data, together with newly discovered sites from the Jordan Valley, advocates high residential mobility in the region throughout the Middle Palaeolithic, with the people relocating through the landscape with a restricted toolkit. It seems that hominids came to the Jordan Valley to provision themselves with raw material or to produce the blanks for tools and possibly remain for a while. They left behind numerous stone artefacts, which establishes a possible cultural relationship. It also ascertains that these groups traversed the Jordan Valley, a crossroads of the Mediterranean and the arid interior of the Levant. Furthermore, there is confirmation of previous research from other parts of the Near East of a more intensive land-use pattern in the region during the late part of the Middle Palaeolithic period, in contrast to the ephemeral landscape use throughout the Early Middle Palaeolithic (Bar-Yosef 1998; Hovers 2001, 2009; Speth 2004, 2006; Speth and Clark 2006; Meignen *et al.* 2006). However, more information is required to propose better defined settlement patterns during the Early and Middle Palaeolithic period in Jordan.

The Levalloiso-Mousterian

In the Jordan Valley, as almost everywhere in the Levant, the Levalloiso-Mousterian sites by far outnumber those from all previous periods (see Fig. 10.1). The reasons remain a mystery; a demographic increase, a change in land use or settlement patterns, and questions of taphonomy have all been proposed. Remarkably, most (two-thirds) of the Levalloiso-Mousterian sites





10.1. (Left) Distribution of Levalloiso-Mousterian sites (black dots): surveyed places (white dots), locations with lithic artefacts (grey dots).

10.2. (Right) Location of Upper Palaeolithic sites (black star) and Kebaran stray finds (black dots). A black diamond indicates the cluster of Kebaran settlements discovered by P. Macumber and his team. Additionally, the extent of Lake Lisān during the Upper and Late Palaeolithic periods is mapped: surveyed places (white dots), locations with lithic artefacts (grey dots).

in the Jordan Valley are surprisingly small and indicate short lived settlements. The sites are distributed throughout the whole area south of az-Zumaylah except for the southernmost sector at Sulaykhat. To the north, a conspicuously low density is visible. However, this area tends to be a less well documented part of the survey. Here it can be stated that raw material provisioning differed and probably occurred over longer distances than previously. More than half of the rich sites of the Levalloiso-Mousterian are clearly disassociated from the main sources of flint. Levallois cores are well represented in these sites, and point to a considerable processing of the distantly acquired raw material. The evidence so far points to a lack of specialised sites as seen in the Yabrudian or Hummalian. At the Levalloiso-Mousterian sites, a complete production sequence, cores, preparation, and target flakes are present (see Fig. 11). Comparable high-density sites, such as those observed in preceding cultures, are also not present in the Levalloiso-Mousterian.

11. Levallois cores (left) and Levallois flakes (right) from the Tabaqa 12 "Olive Grove" site, scale bar = 3 cm.

The Upper and Late Palaeolithic

The Upper Palaeolithic remains ephemeral in the Jordan valley. A single site, just north of the Ṭabaqat Fiḥl, indicates at least a human presence in the valley during the Levantine Aurignacian. In this period the valley was occupied by Lake Lisān, with the site close to its shores (Fig. 10.2). The barrier of Lake Lisān limited movement and in the broader scheme of human distribution as this location represented something of an impasse.

During the Late Palaeolithic or Kebaran period, Lake Lisān is still in place and the ecological situation close to that of the Aurignacian. The Jordan Valley Palaeolithic Survey observed only isolated finds of the Kebaran at seven locations. Most of these isolated finds are microliths—probably insets of arrows—which might have been lost during hunting. One isolated discovery is located deep in the south, whilst the other six are located within an area of roughly 5 x 5 km. Conversely to the data presented here, previous investigations in the Jordan Valley indicate a stronger human presence during the Kebaran (Edwards *et al.* 1997). At the northern margins of the Ṭabaqat Fiḥl along the Wādī al Ḥammah, a concentration of six substantial Kebaran sites indicate a major, but locally limited, presence of Late Palaeolithic hunters and gatherers in the area along the shores of Lake Lisān.

Conclusions

Three field seasons of the Jordan Valley Palaeolithic Survey by a joint team from the Universities of Basel, Jordan, and Yarmouk revealed a rich Palaeolithic legacy along the eastern foothills of the Jordan Valley, dating from at least the Middle Pleistocene, approximately 500,000 years, and possibly much earlier. This is the first time such a long and continuous human presence along the Jordan Valley has been confirmed. Due to the climate changes that occurred during the Pleistocene, the ecology and appearance of the landscape also evolved. A number of huge lakes covered the Jordan Valley floor at numerous times during the Middle and Upper Pleistocene, creating a completely different environment from that known today.

Human occupation during the Palaeolithic was not ubiquitous along the valley, but seems to be focused on particular areas. A main hotspot was the Ṭabaqa-az-Zumaylah-Jaffin sector with an exceptional density of sites; all known periods are present here. North and south of this area, the cultural variety drops sharply with only the Levalloiso-Mousterian sites mainly present.

The Early Middle Palaeolithic sites are rare and the presence of factory sites tends to suggest that during this period the Jordan Valley was inhabited by a small number of human groups who visited specific areas occasionally and briefly. Conversely, data from the following Late Middle Palaeolithic is well represented and could be considered as a period of lower residential mobility, where sites embody sequential occupations or task-specific localities. The long-term successful subsistence behaviour of Late Middle Palaeolithic groups may be associated with the adaptation to a variety of resources and consequently to diverse land-use. Using these premises, it is proposed that there was demographic increase and a shift in settlement pattern during the Late Middle Palaeolithic Mousterian, as has been observed in many other regions of the Levant.

The very early presence of humans about 1.5 million years ago in the Jordan Valley has yet to be confirmed on the left bank of the Jordan, although at ʻUbeidiya, 5 km north of the confluence of the Yarmouk and Jordan Rivers, evidence is found. A close examination of Abū Hābīl was unable to confirm the claims of early Palaeolithic sites at this location (Huckriede 1966; Muheisen 1988b) as definitive evidence is absent.

Results from Abū al-Khas (Villiers 1980, 1983) are difficult to corroborate and should be treated with caution unless new finds are discovered. Nevertheless, promising geological and archaeological observations indicate the possibility of very old sites on the eastern shores of the Jordan Valley (*i.e.*, Abū Hābīl, az-Zumaylah, and ʻAdassiyya), though future work is still needed.

The most important discoveries of the Jordan Valley Palaeolithic Survey were the recovery, at the Ṭabaqat Fiḥl, of Yabrudian sites after Azraq (Copeland and Hours 1989). Also, locations of numerous sites of the Early and later Middle Palaeolithic type blade industries, concentrated in an important agglomeration between Munqiah, az-Zumaylah, and Jaffin were identified. It is the most important cluster of discoveries for this period in the whole of the Levant. Less than two dozen sites throughout the Levant represent the Yabrudian, Hummalian, and transitional industries from the Middle Palaeolithic (type Bocher Tachtit). Therefore, these new discoveries add substantially to our knowledge and understanding of these periods in the region.

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Hunter-Gatherer Art at al-Kharrānah IV

Abstract

Artistic objects are thought to be one of the hallmarks of the Natufian period, marking a florescence of artistic behavior appearing prior to the origins of agriculture. However, with continuing research into Early and Middle Epipalaeolithic sites in the Levant, new discoveries of 'symbolic' artifacts are increasing our understanding of even earlier artistic and symbolic pursuits. In this paper we present an engraved plaquette from the Middle Epipalaeolithic context of al-Kharrānah IV in eastern Jordan. Using imaging confocal microscopy, we analyze manufacturing traces to identify the gestures and tools used to create the plaquette. This artifact, although the only engraved piece recovered from al-Kharrānah IV thus far, links into wider networks of Epipalaeolithic interaction and cultural exchange. Placing the al-Kharrānah IV engraved object into regional context with other Early/Middle Epipalaeolithic artistic artifacts, we explore wider networks of interaction prior to the Natufian.

Introduction

Artistic objects are thought to be one of the hallmarks of the Natufian period, marking a florescence of artistic behavior appearing immediately prior to the origins of agriculture in Southwest Asia. However, with continuing research into Early and Middle Epipalaeolithic sites in the Levant, new discoveries of 'symbolic' artifacts are increasing our understanding of even earlier artistic and symbolic pursuits. In this paper we present an engraved plaquette from the Middle Epipalaeolithic occupational phase of al-Kharrānah IV in eastern Jordan. This engraved plaquette is the oldest 'art' object in Jordan from *in situ* cultural deposits. Using imaging confocal microscopy, we analyze manufacturing traces to identify the gestures and tools used to create the plaquette. This

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artifact, although the only engraved piece recovered from al-Kharrānah IV thus far, demonstrates important links with wider networks of Epipalaeolithic interaction and symbolic and cultural exchange.

Art in the Epipalaeolithic

The 20,000 or so years spanning the Epipalaeolithic period (EP; *ca.* 23,000–11,500 yrs BP) in Southwest Asia is characterized by a wide diversity of hunter-gatherer behaviors and lifeways. Broadly subdivided into Early, Middle, and Late phases, much research is devoted to understanding the complicated, non-linear transition(s) from hunting and gathering in the early and middle phases towards more settled village life and food production in the Late or Natufian phases (Maher *et al.* 2012). The Natufian period in the Levant is notable for a proliferation of stone architecture, burials with grave goods, and symbolic artifacts whose abstract and figurative designs are thought to represent a flourishing 'artistic' repertoire (Bar-Yosef and Valla 2013). Early excavations at Natufian sites from the region uncovered extensive cemeteries and artifact-rich sites with numerous stone-built structures and associated features. Many of these sites also revealed elaborately carved objects in stone and bone, such as the famous 'Ain Sakhri lovers' figurine (Boyd and Cook 1993), leading researchers to believe that the Natufian culture represented complex hunter-gatherers at the threshold of agriculture (see summary in Bar-Yosef 1998). In contrast, earlier Epipalaeolithic hunter-gatherers were seen as being more mobile, having more 'simple' social structures, and by comparison rather lacking in symbolic material culture (*e.g.*, Goring-Morris and Belfer-Cohen 1998). However, recent and ongoing research in Southwest Asia is providing clear evidence that Early and Middle Epipalaeolithic lifeways were rich and complex, with increasing evidence for human burials in association with habitation, long-distance trade networks, and symbolic artifacts.

We recognize here that the term 'art' in reference to prehistoric artifacts with decoration, adornment, embellishment, designs, or other seemingly 'non-functional'[1] modifications is highly problematic (Conkey 1987, 1997; Bednarik 2003; Nowell 2006, 2015; David and McNiven 2017). The dichotomy between utilitarian objects and artistic pieces is not culturally universal in the present or in the past. While an object may have aesthetic value, the distinction that an artifact was created purely for aesthetic purposes is a modern concept (*e.g.*, the concept "art for art's sake" was developed and used by a variety of artists and philosophers in the mid-19th century). Although here we describe an artifact from al-Kharrānah IV that has aesthetic properties and no clear utilitarian function, and thus we call it 'art,' it does not mean that other more 'everyday' objects from the site did not have aesthetic or symbolic value. As well, the incised plaquette from al-Kharrānah IV might have had a utilitarian function that eludes us. Until recently, distinctions were often made between the 'rich' artistic world of the Upper Palaeolithic of Europe and comparatively art-poor contemporary groups elsewhere (Boyle *et al.* 2010 and references therein; McBrearty and Brooks 2000 for counter arguments). However, many have also critiqued assessments of what this Upper

[1] We also draw attention here to the long-standing archaeological debate between the roles played by style and function in material objects (Wobst 1977; Sackett 1982, 1990; Wiessner 1984; Conkey and Hastorf 1990). While we make a distinction here between modifications to materials that relate to their operation/use for an intended physical task, such as cutting or sawing or piercing, and modifications to materials that relate to changing their symbolic, social, or ideological value, we recognize that many visual alterations to objects, alterations that might be termed as decoration, do indeed have important social and ideological 'functions.'

Palaeolithic cave and portable art 'means' to the people who created it (Nowell 2006, 2015; Nowell and Chang 2014; Fritz *et al.* 2016). Despite the obvious lack of cave art in Southwest Asia, figurative and abstract art is found at sites dating back at least to the Middle Palaeolithic (d'Errico and Nowell 2000), albeit rare through much of the Palaeolithic and Epipalaeolithic (d'Errico 1992; Goring-Morris and Belfer-Cohen 2002). Here, too, our understanding of the 'meaning' of these objects, art or otherwise, remains elusive.

Although artifacts ascribed as 'art' are known from several pre-Natufian sites, they are uncommon in the Epipalaoelithic archaeological record. One of the earliest discovered pieces was an engraved limestone pebble from the Early Epipalaeolithic Kebaran site of Urkan e-Rubb in the Jordan Valley (Hovers 1990). This piece is decorated with a series of 'ladder' motifs and parallel lines. Recent discoveries at the Middle Epipalaeolithic site of ʿAyn al-Kassīs (Ein Qashish) in the Marj Ibn ʿĀmir (Jezreel Valley) uncovered three engraved objects, all made from limestone (Yaroshevich *et al.* 2016). Two of the pieces have geometric designs, including 'ladders' and chevrons, while one has a figurative bird design. Other artistic representations include two incised chert nodules from the Geometric Kebaran site of Neve David in Israel (Kaufman *et al.* 2018), a modified chert nodule from the Geometric Kebaran levels at Wādī al-Maṭāḥah in southern Jordan (Gregg *et al.* 2011; Macdonald *et al.* 2016), and a stone with a ladder motif from the Early Epipalaeolithic site of Wādī al-Maqdamah (Byrd 2013). On several of these pieces, including the objects from ʿAyn al-Kassīs (Ein Qashish) and Urkan e-Rubb, 'ladder' motifs and parallel lines are present, suggesting the possibility for shared artistic traditions. We discuss this motif and its possible significance in terms of information exchange or sharing below.

The Early and Middle Epipalaeolithic Site of al-Kharrānah IV

Adding to this small, but growing, corpus of pre-Natufian Epipalaeolithic art, we introduce here new findings from the aggregation site of al-Kharrānah IV. al-Kharrānah IV is located along the western margins of the al-Azraq Basin in eastern Jordan (Fig. 1). Radiocarbon dates suggest the site was occupied between 19,830–18,600 cal BP, chronologically and typologically spanning the Early and Middle Epipalaeolithic periods. Detailed techno-typological analyses of the chipped stone tool assemblage from the deepest trench on-site, matched with radiocarbon dates, ascribe these occupations to Kebaran and Geometric Kebaran cultural groups (Macdonald *et al.* 2018).[2] It is the largest Epipalaeolithic site in the region at approximately 21,000 m^2, marked clearly on the desert landscape as a small mound of accumulated artifacts with a surface pavement of chipped stone tools and debris. Figure 3 shows the boundaries of the site, partially delineated by a barbed-wire fence and by a recently-built low mudbrick wall designed to unobtrusively prevent vehicular traffic over the site and protect the prehistoric deposits from destruction and minimize erosion. The site's large size and dense artifact accumulations indicate that it was a hunter-gatherer aggregation locale during occupation and a focal point for interaction in the region. Several seasons of excavation at the extremely well-preserved deposits at the site corroborate its intensive and complex settlement history.

Al-Kharrānah IV sits at the confluence of two river valleys, which are currently dry in the summer but exhibit seasonal flooding during wet winter months. Although

[2] Debates on the use of these terms as markers of social or cultural identity have been discussed elsewhere and will not be reviewed here (Richter and Maher 2013; Maher and Macdonald 2020).

1. Map showing the location of al-Kharrānah IV in relationship to the al-Azraq Basin.

the modern environment around al-Kharrānah IV is that of an arid to semi-arid desert, extensive geomorphological work at and around the vicinity of the site allows us to reconstruct a local Pleistocene paleoenvironment that was substantially different than that of today. Waterlain sediments, ostracods, and water-dependent flora and fauna studied from several off-site geological trenches and on-site excavation pits reveal ancient wetland and playa lake deposits immediately surrounding and episodically inundating the site (Jones *et al.* 2016a, 2016b; Martin *et al.* 2016; Ramsey *et al.* 2016; Henton *et al.* 2017). It seems that the occupants of al-Kharrānah IV had ready access to several permanent and semi-permanent water sources, and indeed, it is likely these would have contributed greatly to making it an attractive habitation locale 20,000 years ago. The history of archaeological work at the site has been discussed in detail elsewhere and will not be reviewed here (Maher and Macdonald 2020). The Epipalaeolithic Foragers in Azraq Project commenced excavations in Area A in 2008, re-opening an area noted by M. Muheisen to contain horizontally extensive Middle Epipalaeolithic (Geometric Kebaran) deposits during his initial work at the site in the 1980s. He noted the presence of pits, possible hearths, and post-holes accompanied by dense concentrations of chipped stone and faunal remains (Muheisen 1988a, 1988b). The renewed excavations in 2008 quickly re-located his original trench here and extended horizontally from it to discover well-preserved, stratified Early and Middle Epipalaeolithic deposits (Macdonald *et al.* 2018). We focus here on excavations in the Middle Epipalaeolithic Area A relevant to the discovery of the stone plaquette.

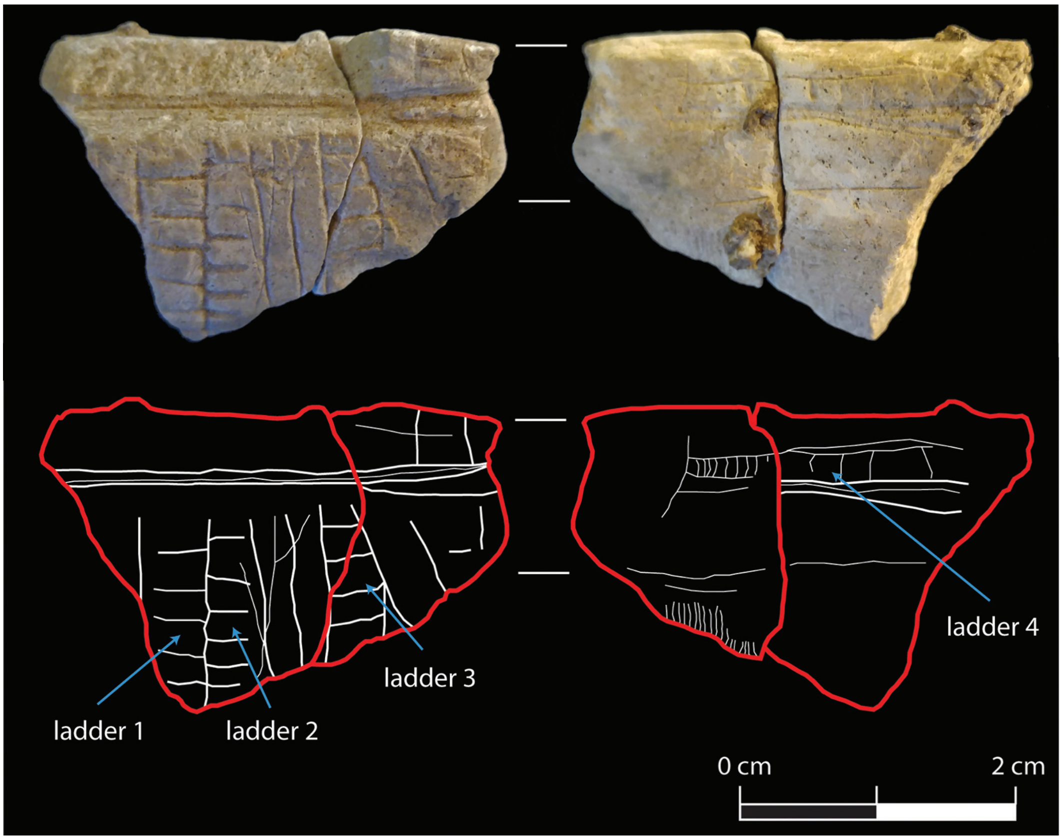
The material culture from the Middle Epipalaeolithic deposits is extremely dense. The majority of material is chipped stone tools and associated debris, and the lithic assemblage includes a range of geometric microlith types typical of Middle Epipalaeolithic assemblages. Muheisen (1988b) noted several types of geometric pieces, namely 'variant' trapeze forms, atypical to most Geometric Kebaran sites; however, our analysis of a large assemblage of these and comparison with contemporary sites elsewhere in the region suggests the wide variety of geometric types noted here likely relates to some combination of aggregation and dispersal movements and information exchange between mobile hunter-gatherer groups (Maher and Macdonald 2013, 2020). Large accumulations of fauna suggest that the Middle Epipalaeolithic inhabitants of the site preferentially targeted abundant local gazelle populations, but also hunted a wide array of other species, such as aurochs, wild ass, fox, hare, tortoise, waterfowl, and migratory birds (Spyrou 2019).

In addition to this material evidence of occupation, there is also a wealth of symbolic artifacts at the site. This includes thousands of perforated marine shells, imported from the Mediterranean and Red Seas, up to 200 km away, and likely used as personal ornamentation or decorations on objects like bags or clothing. More than 50 pieces of engraved or otherwise modified animal bone have been recovered from al-Kharrānah IV. These bones are usually fragments of long bones, ribs, or mandibles, from medium-sized mammals like gazelle and large animals like aurochs. These pieces exhibit repeated 'motifs' consisting of a series of parallel notches incised along one edge or surface, forming regular, continuous, or clustered patterns. The large number of perforated shell beads and notched bones indicates a rich expression of symbolic material life.

The Incised Plaquette from al-Kharrānah IV

Perhaps the most unique object discovered so far at al-Kharrānah IV comes in the form of a small engraved plaquette (Fig. 2). This artifact is 32 × 21 × 10 mm in size and is made from a piece of local soft, calcareous limestone. It was discovered during the 2009 excavation season, retrieved from the heavy fraction during flotation, and comes from a deposit interpreted as a compact, trampled, earthen surface that contains *in situ* lithic and faunal material. Two pieces of the plaquette were recovered and refit together. This modern break bisects the plaquette and occurred during excavation. When refitted, it is clear that the plaquette was also broken in antiquity, on both sides and the bottom, leaving only one edge intact. This intact edge has been ground or beveled to a flat surface.

The incisions on the plaquette reveal an intricate pattern of lines carved onto both the front and back face of the stone (the intact edge is oriented 'up' and the face with more prominent incisions is labeled as the 'front'). Two different 'motifs' are identified: a primary motif of ladders and a secondary motif of individual lines (both thick and thin). On the 'front' are three 'ladder' patterns. Two of the 'ladders' share a 'center rail' between the sets of rungs, and the rungs are off-set from each other. The rungs do not articulate with the outside 'rails' on either ladder. The third ladder is wider than the others and is separated from the first two. Between the sets of ladders is a single parallel line. Several thin lines intersect this primary motif on the front. Running horizontally across the top of



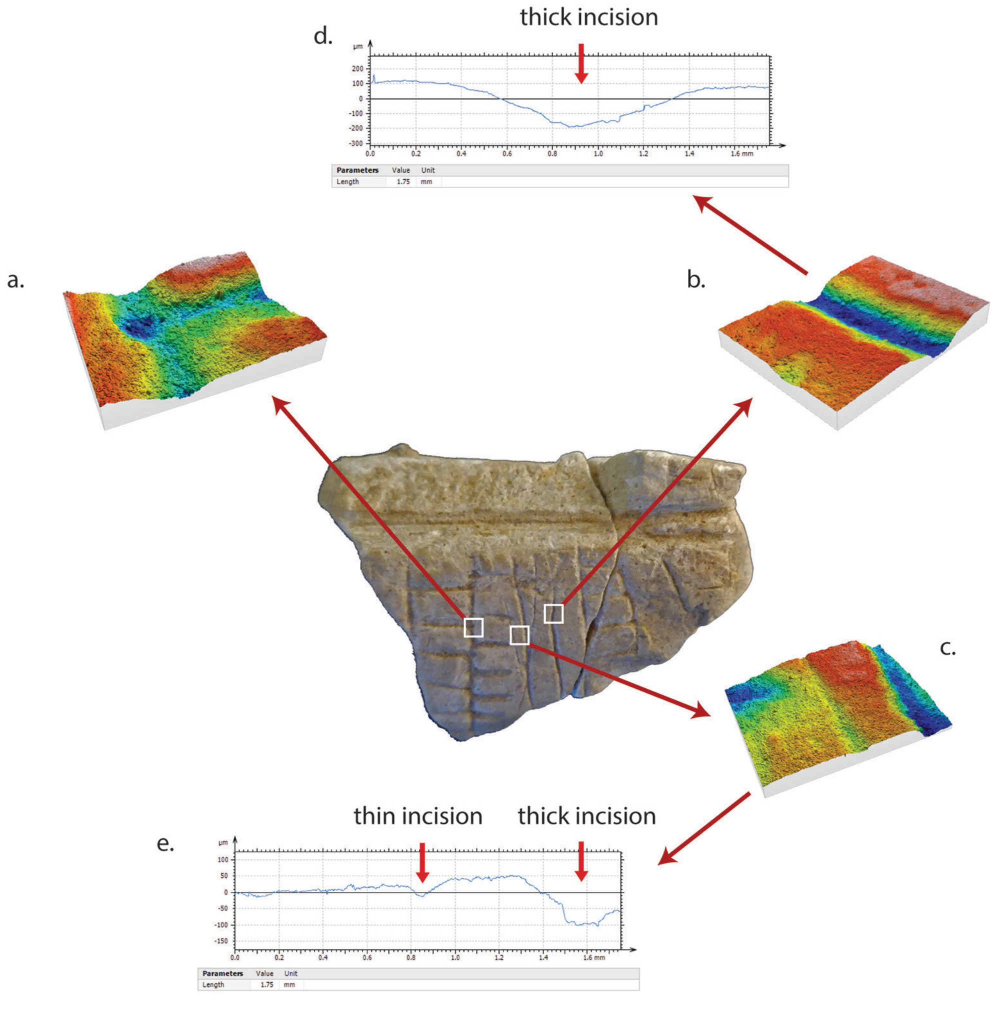
2. The incised plaquette (front and back) from al-Kharrānah IV. Lower image shows a schematic of the plaquette with the locations of Ladders 1–4.

the plaquette is a deeply incised groove, creating a 'rim' along the top. The back face has another 'ladder' running parallel to the top of the plaquette. The rungs towards one end are closely spaced, and they gradually widen. This ladder is made with shallow, thin incisions. Two thicker incisions run just below the 'ladder' creating the bottom rail. A long, thin incision runs parallel to the ladder on the back face, and below this are a series of very fine, thin lines, which might be the result of grinding the plaquette's surfaces. There is no other evidence of grinding on the front or back face of the plaquette, however the traces could be obscured by the incisions or have been very fine and obliterated by post-depositional processes.

The plaquette was analyzed microscopically to better understand how the object was manufactured, including in what order the various modifications were made. First it was assessed with stereomicroscopy to document and optically identify different features. Next, individual components of these features were selected for further, high-resolution analysis. Surfaces and incisions were imaged and measured with a Sensofar Imaging Confocal Microscope using the 10× objective. These microscopes are used in precision engineering and surface metrology to measure small-scale surface topographies at the scale of nanometers.

The images were collected using blue light, which is at the shorter end of the light spectrum, minimizing chromatic aberration and producing higher resolution images than those collected from the complete white-light spectrum. The microscope produces a three-dimensional (3D) image of the surface, calibrated to ISO standards for the measurement of surface texture.

Analyzing the entire surface of the plaquette with high-resolution confocal microscopy is too time-consuming and impractical, thus, the plaquette's features were sampled for detailed examination. In total, 16 different areas were sampled to collect 3D models of the incision cuts. This study presents the analysis of a preliminary sample of the incisions and more analysis is ongoing. Each sampled region results in a 3D topographic 'map' of the surface. These images allow for detailed visual identification of the incisions. In addition to the optical powers of the three-dimensional models, profile paths can be extracted to analyze the



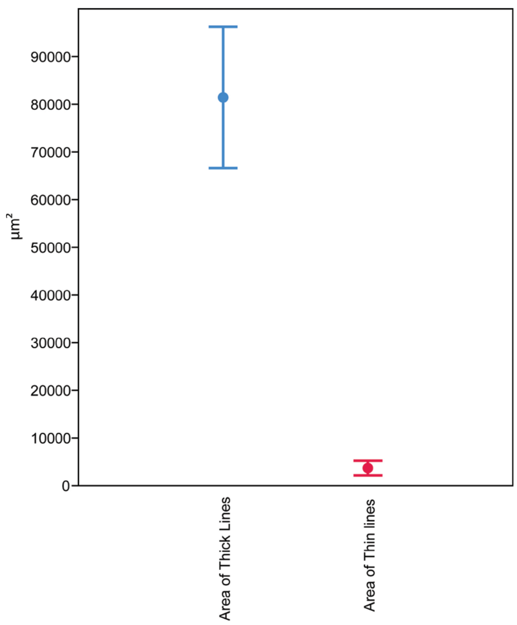
3. Front of the incised plaquette with 3D confocal images of incisions: a) two intersecting 'thick' incisions at the center rail of ladders 1 and 2, b) thick incision, c) thin incision and a thick incision, d) profile of thick incision, e) profile of thin and thick incision.

shape and depth of the incision. Of these areas, several of the incisions that were visually classified as 'thick' were sampled, as were several that were classified as 'thin' using stereomicroscopy. Incisions on the front and back face were also sampled.

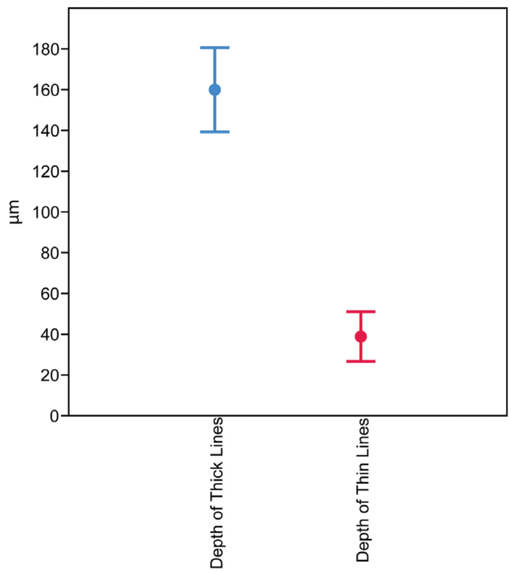
The thick incisions are wide and deep, with a rounded v-shape to the cut. In contrast to the thick incisions, the thin incisions are much shallower and narrower (Fig. 3). The 3D images and extracted profiles in Figure 3 show the difference in these incisions, with the 'thin' incisions being much shallower, narrower, and with a sharper v-shaped cross section.

A profile, or cross-section, was extracted from each of the 16 scanned areas to better understand the relationship between the thick and thin lines. The profiles were extracted from the area with the highest point in the microtopography to consistently sample the surfaces. From these extracted profiles, the 'area of the hole', or the area of the cut, was calculated. The area was calculated under the peak lines, representing the top of the cut. A comparison of the means of the incision area using a t-test shows a strong statistically significant difference between the means of the thick and thin incision samples ($p= 0.027$; Fig. 4). Likewise, the depth of the thick and thin incisions were compared (Fig. 5). The difference in the means between these two samples were also shown to be statistically significant, with the thick incisions significantly deeper than the thin ones ($p= 0.016$).

Through a detailed microscopic analysis of the plaquette, several manufacturing features were elucidated. First, there are two different groups of incisions, thick and thin, that are found on both faces of the plaquette. These lines have different average areas



4. Whisker plot showing the difference in means between the area of the thick lines and the area of the thin lines.



5. Whisker plot showing the different in means between the depth of the thick lines and the depth of the thin lines.

and different average depths. In addition, the thin incisions tend to have a more v-shaped profile. This suggests that either the incisions were made with two different tools, potentially at different times, or there was a different reason why these incisions were made. For example, were the thinner incisions meant to have less permanence? The 'ladders' on the front are all made with 'thick' incisions, making them highly visible. A few of the thin incisions on the front face cross over the thick ones, suggesting that the thicker incisions were made first, followed by the thinner cuts. In contrast, the ladder on the back is primarily made from thin incisions, except the lower rail. The thin incisions on this ladder might represent a 'sketch' before the ladder was deeply etched. Or perhaps this ladder was meant to fade away with time or be less visible than the other ladders on the plaquette?

The deepest incised lines on the plaquette run horizontal across the top of the object creating a 'rim' around the top. The line appears to be incised several times in the same place, creating the deep groove and the extracted profile shows that the bottom of the cut has several different incisions. This suggests that this line was made with numerous gestures, enforcing the placement and permanence of the incision.

Some information can also be gained about the order of incisions, or the sequence of actions taken to make the patterns on the plaquette. On the front face the three rails of ladders 1 and 2 were first incised. The rungs all intersect with the center rail; however, only the top rung on the left side of the ladder intersects with the outer rail. None of the rungs on the right side of the ladder intersect with the outside rail. This suggests that the center rail was drawn first, then the left rail. The right rail might have been drawn next, or potentially the rungs drawn, followed by the rail which is thinner and less permanent than the other rails. There are two small lines above one of the rungs, suggesting that the artist was thinking about a different placement before settling on the current position. In contrast, all of the rungs on ladder 3 on the front face intersect with both rails. Thus, the rails may have been drawn first to act as a guide for the rungs. A single line is positioned between the two ladders, suggesting it was drawn afterwards. Two thin lines cross-cut ladder 2, indicating that they were drawn last. Although very faint, the rungs on ladder 4 (on the back face), mostly intersect with the two rails. This suggests that the rails were drawn first, followed by the rungs in between.

Discussion and Conclusions: al-Kharrānah IV Art in Context

Bringing the al-Kharrānah IV plaquette back into context with other Levantine Epipalaeolithic art illuminates some interesting patterns. Despite the fact there have been very few pieces of art found in pre-Natufian Epipalaeolithic contexts, the ladder motif is represented at several sites. For example, engraved objects with ladder motifs have been found at Urkan e-Rub, 'Ayn al-Kassīs (Ein Qashish), and Wādī al-Maqdamah (see above). Adding the al-Kharrānah IV plaquette to this Epipalaeolithic artistic corpus shows repeating patterns of ladders in Pre-Natufian art. Across the Levant, incised ladders represent more than half of the artistic patterns from this period (Hovers 1990; Byrd 2013; Yaroshevich *et al.* 2016). To date, there have only been two pieces of pre-Natufian art found in Jordan, the plaquette at al-Kharrānah IV and the incised stone at Wādī al-Maqdamah. The incised plaquette is the only piece from an *in situ* context, representing the earliest known 'art' object from a secured context in Jordan.

In European Palaeolithic art, ladders have been interpreted as notational schemes, external memory systems containing encoded information (*e.g.*, Marshack 1991; d'Errico *et al.* 1994). Recently, arguments have been made that the ladder plaquette from ʿAyn al-Kassīs (Ein Qashish) represents a device for recording hunter-gatherer aggregation events or the availability of resources (Yaroshevich *et al.* 2016). Each rung might represent a new aggregation meeting, or the seasonal cycle of gazelle hunting. Is the al-Kharrānah IV 'ladder' plaquette a similar device? If indeed the thick and thin incisions were made with different tools, then the al-Kharrānah IV plaquette can be placed in a temporal framework where the incisions might have been made at different times, recording different events or similar events at different times.

It is unknown whether we will ever be able understand the symbolic 'meaning' of the ladder motif on the Pre-Natufian Epipalaeolithic plaquettes, or whether these meanings are even knowable. Despite these unknowns, the repeating pattern of ladders found on plaquettes from the Jordan Valley all the way to the al-Azraq Basin indicates participation within a wide regional interaction sphere of information exchange. As well, this motif suggests that there is temporal cultural continuity, as the 'ladder' motif is passed through generations. Symbolic motifs shared regionally and temporally suggest cultural interaction and perhaps a shared sense of cultural affiliation between different communities across the Levant. As an aggregation site, al-Kharrānah IV is uniquely situated as a place on the landscape for inter-community interaction and information exchange, where symbolic meanings are transmitted, and important moments are recorded in stone.

Acknowledgements

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The Origins of a Natufian 'Anomalous Giant': New Evidence from Wādī Ḥammeh 27

Introduction

Wādī Ḥammeh 27 is an Early Natufian site in northwestern Jordan, dating from 12,000 to 12,500 cal BC (Edwards 2013a). It is representative of the first large, open-air, residential settlements to appear in the Levant, and more generally in the wider world. These settlements might be considered as the first villages, yet this label sits somewhat uncomfortably, reflecting lingering uncertainty about the interpretation of these sites. The larger Natufian settlements were founded by hunter-gatherers, whereas the term 'village' was originally associated with agricultural peoples. Thereby, Natufian sites have also been termed 'base-camps' (Bar-Yosef and Goren 1973) although this label seems to underplay the manner by which they overshadow the earlier small sites of the region. In recent theory, discussion has centred on unusually large urban and Neolithic settlements that have been variously termed as 'anomalous giants' (Fletcher 2019), 'great anomalous places', and even 'big, weird sites' (Chapman and Gaydarska 2016). Compared to the earlier small, ephemeral Early and Middle Epipalaeolithic camps in Wādī al-Ḥammeh, Wādī Ḥammeh 27 can be thought of as such an anomalous giant on account of its great bulk of contents compared to the thin, diminutive, occupation layers that preceded it, its complex material cultures, and its novel arrays of clustered stone houses. The Natufian settlements entrenched the lithification of architectural practice. Geographically, too, Wādī Ḥammeh 27 remains an anomaly in the Mediterranean region of Jordan, since no other similar site has yet been discovered.

This paper outlines the results of a recent fieldwork project conducted from 2014 to 2016 called 'Ice Age Villages of the Levant: Sedentism and Social Connections in the Natufian Period'. It was designed to

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understand more about how Wādī Ḥammeh 27 was founded. Principal aims were to explore more of the basal deposits of Wādī Ḥammeh 27 in order to elucidate conditions pertaining at the time of the settlement's foundation. In the event of further human burials being discovered, we planned to characterise their biological and physical nature, to analyse their relationships through palaeogenetic studies, and to explore their geographic origins through strontium isotope analysis. We also intended to gain information on social connections with other regions by tracking the sources of key raw materials imported to the site.

The New Excavations

The original excavations at Wādī Ḥammeh 27, conducted between 1983 and 1990, cleared broad areas of the uppermost Phase 1 (Edwards 2013b). Only a small pit (the XX F Sondage) was sunk through the Phase 2 and 3 domestic occupations to Phase 4, which contained a burial (Edwards 2013c). The new excavations removed a larger volume of deposits within the perimeter wall of Structure 1 (Plot XX F), clearing down to the base of Phase 4. The XX F Sondage showed evidence of four constructional phases with a burial at the base, dug into natural rock. Next to the burial was a pit filled with superimposed layers of stone and burnt sediment. Later features were repeatedly built on this spot through all the later phases, as if marking the location of a significant place. The experience of the previous excavations, particularly of the XX F sondage stratigraphy, was used as a guide for the new excavations. This pit borders the northern half of Structure 1 (in Phase 1) and our excavation plan for the new venture was to strip back the layers, one by one, to its west.

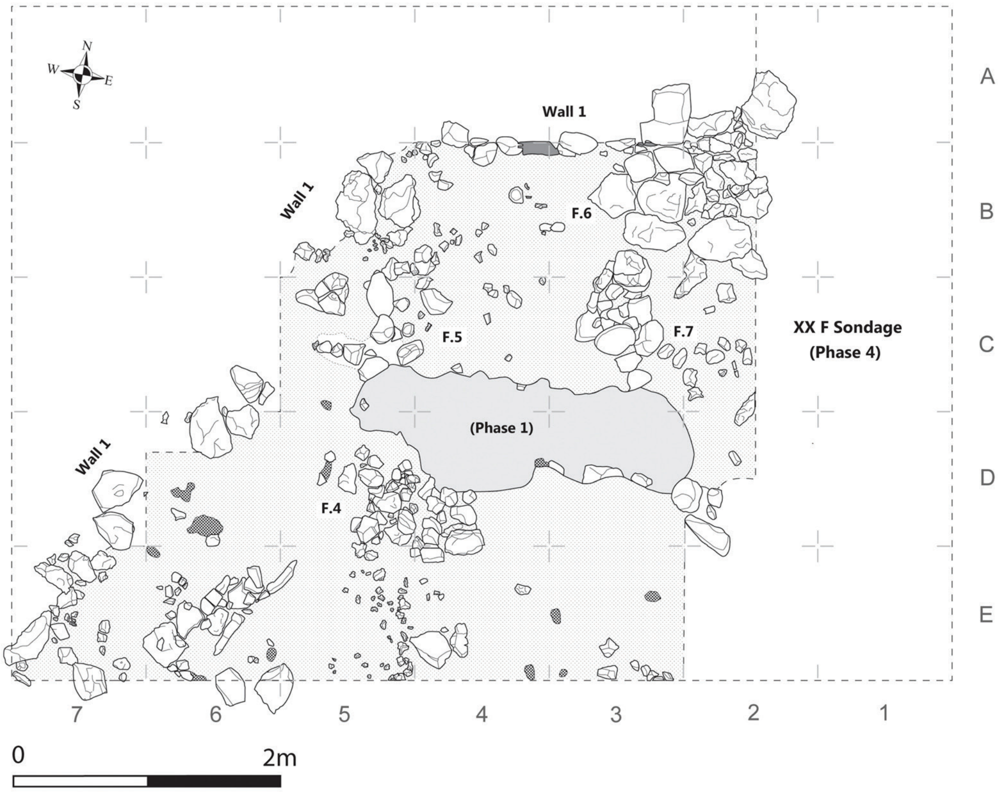
Consideration of the main features of Structure 1 in Phase 1 is useful at this point to establish comparisons with features discovered in the lower phases. The peripheral wall of Structure 1 in its northern sector is substantial (Fig. 1). It broadens in its mid-section where stones are set into mud mortar. Two stone rings are prominent in this phase. One (Feature 8 [=F. 8]) was built against the interior face of Wall 1, which may also have functioned as a post support, and a second stone circle (F. 6) may have functioned as a work station, since a basaltic pestle was found inside it. Structure 1 also contained an oblong platform of limestone slabs and blocks (F. 7) to the south of these constructions. Feature 7 was set into a slightly raised base of clay, with some of the border stones set on edge. Excavation revealed an elongated pit underlying Feature 7, which did not feature any significant mortuary or artefactual finds.

A summary of the stratigraphic and architectural details of each phase (Phases 2, Upper 3, Lower 3, Upper 4, and Lower 4) are given in the following sections, accompanied by descriptions of some of the most significant artefacts and features unearthed in each phase. A comprehensive micromorphological analysis of the deposits is also underway (discussed by Lauren Prossor in this volume). Analysis of the great bulk of the finds—the flaked stone tool component—has been undertaken by Adam Valka (also in this volume).

The Phase 2 Settlement

The clearance of Phase 2 in Plot XX F revealed an earthen occupation surface extending over the entire excavated area (Edwards *et al.* 2018a), which lay about 0.20 metres below the Phase 1 floor of Structure 1 (Fig. 2). Several notable stone features were found and the encompassing deposit (Locus 2.5) produced a high density of finds, similar to the levels recorded for the uppermost Phase 1 (Edwards and Hardy-Smith 2013). The peripheral Structure 1 wall of Phase 1 was already utilised in Phase 2—at least in part. It is associated with Phase 2 occupation surfaces in Squares B2, B3,

1. View west across the XX F sondage to the Phase 1 surface of Structure 1, during the 1980s excavations at Wādī Ḥammeh 27.



2. Phase 2, Plot XX F, Wādī Ḥammeh 27.

B5, and C5 but not in Square B4, where its constituent stones are pedestalled above the Phase 2 floor. Two stone rings were built on the Phase 2 floor, predecessors to the similar ones built later in the same places in Phase 1 (Edwards 2013b: 73). Feature 7 (Square C3) in Phase 2 was built up two courses high. Feature 5 is a sinuous stone arrangement bedded in mud mortar and comprised of adjoining stone arcs, which open respectively to the north (Square C5) and to the south (Square C4). Feature 4 (Square D5) is an oblong stone platform found on the Phase 2 floor, apparently a predecessor to the platform in Phase 1, although displaced to the southwest of it. A flat stone placed at the centre of this feature may have functioned as a post-support.

Three deliberately placed caches of objects or 'artefact clusters' were found in the Phase 2 excavations. Seventeen such artefact clusters were found in the 1980s excavations—predominantly in Phase 1 (Artefact Clusters 1–17) with an eighteenth in Phase 2 (Artefact Cluster 18; Edwards and Hardy-Smith 2013: 105). From the new excavations, Artefact Cluster 19 (Square C3-1, Locus 2.5) consisted of a pair of large flint blades about 10 cm long; Artefact Cluster 20 (Square E3-2, Locus 2.5) comprised a stockpile of stone resources, including three lightly reduced and apparently heat-treated

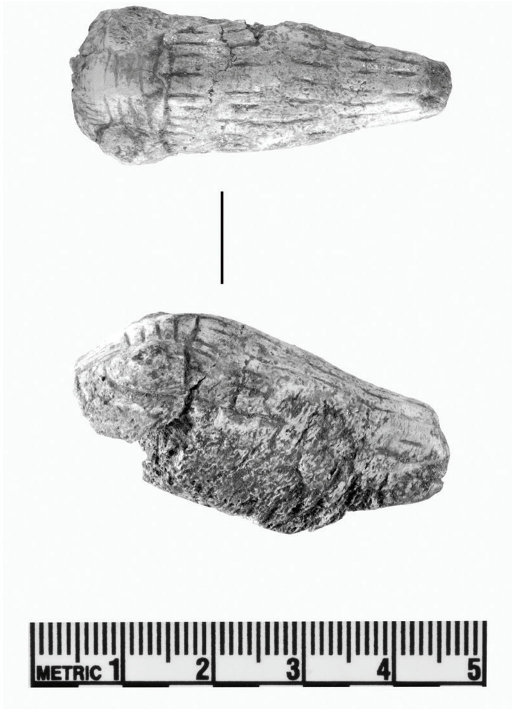
3. Artefact Cluster 21 (scatter of Dentalium shells) on the Phase 2 floor, Plot XX F, Wādī Ḥammeh 27.

flint cores and two limestone cobbles; and Artefact Cluster 21 consisted of a cache of 138 Dentalium (*Antalis* sp.) fragments (not counting further fragments discovered in the sieve residues) overlying a pair of retouched blade tools, including a Helwan-retouched awl (Fig. 3).

Significant Finds from Phase 2

New types of basaltic pestles were recovered from Phase 2, including a zoomorphic pestle (RN 140049) and a phalliform type (RN 140053). Some basaltic handstones were also discovered, with two of them augmenting a previously attested association of this tool-type with pigmented earths. One example (RN 140059) was coated in yellow ochre, with stains covering nearly all the areas of both faces, whereas the margins are completely free of them. Another broken limestone handstone (RN 140024) also bore traces of yellow colouration. Three miniature basaltic bowls were excavated, adding to the corpus of this unusual artefact type which is largely restricted to Wādī Ḥammeh 27.

Four art items bearing both iconic (representational) and geometric motifs were recovered from Phase 2. Two of them concern the above-mentioned pestles. One (RN 140049) is a short pestle with a raised band around the shaft near the distal end and an obliquely shaped terminus, features which suggest an ungulate or equine hoof. The piece finds several parallels in objects from Mount Carmel and Western Galilee, such as a basalt pestle with concentric raised bands and a hoof-shaped terminal from *El Wād* (Garrod and Bate 1937: Pl. XV, 4; Major 2018: 146–7), as well as examples from Hayonim Cave (Belfer-Cohen 1991: Fig. 7:1, 3, 5). The other pestle (RN 140053) bears a raised band and groove near its distal end and the resulting form gives the impression of a phallic object. A long, shaped and tapered (33.5 cm), sub-conical piece of limestone (RN 140225) also indicates the intention to form a phallic symbol. A natural white colouration caps the thinner proximal end of the piece, whereas the rest of the object is light grey to dark grey.



4. Carved and incised bone animal head (RN 140226), Phase 2, Wādī Ḥammeh 27. 5.

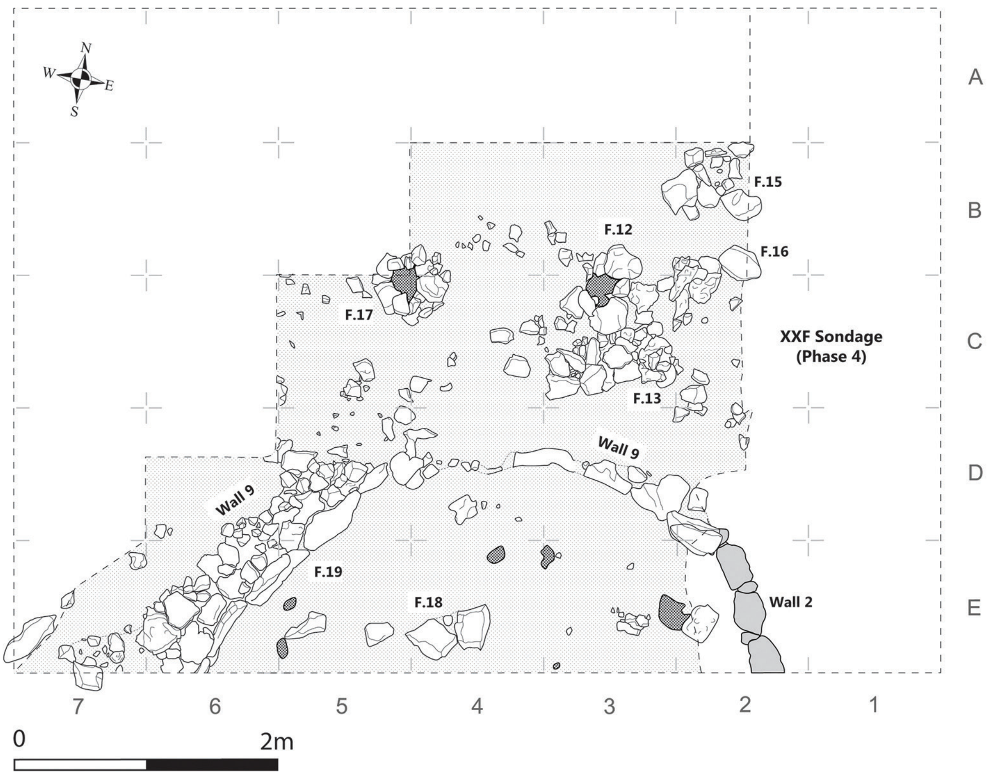
A carved and incised bone animal head (RN 140226) is the likely remnant of a decorated sickle haft (Fig. 4). It was badly damaged by fire, as was the surviving zoomorphic piece. It forms the head of an ungulate animal, probably a gazelle (Robertson *et al.* 2019). RN 140226 has parallels with objects from Kebara Cave (Turville-Petre 1932) and El Wad Cave, Layer B (Garrod and Bate 1937: Pl. XIII, 3).

The Phase 3 Settlement

The principal feature of Phase 3 is an oval house (Structure 3) defined by the substantial stone Wall 9. This peripheral wall emerges from the south baulk of the trench in Square E6 and loops around in a semi-circle, returning to the south baulk in Square E2, further to the east (this part was discovered in the XX F Sondage in the 1980s). With its north-facing entrance, Structure 3 has a different orientation than the overlying Structure 1, which opens to the west. Phase 3 is divided into upper and lower sub-phases. Upper Phase 3 includes an upper floor in Structure 3 and associated external features and deposits to the north of the structure. Lower Phase 3 denotes the lowest floor associated with the establishment of Structure 3, plus external features and deposits outside to the north.

Upper Phase 3

The uppermost floor of Structure 3 (Locus 6.1) intercepts Wall 9 midway up its surviving height and so partially covers its lower wall stones (FIG. 5). An entrance was positioned on the northern side of the structure; opposite this on the interior floor a stone cairn was placed on a raised clayey knoll (Feature 18 [F.18]). The Upper Phase 3 floor lay, on average, about 20 cm below the Phase 2 one (Edwards *et al.* 2018b). Two circular stone features occur to the north of Structure 3; firstly (in Square C5) there is a stone ring (Feature 17) built on the floor surface, positioned directly below a later circular feature (F. 5) in Phase 2. This feature was, in turn, positioned under a similar feature (F. 8) in the uppermost Phase 1. Feature 12 is a stone-ringed post-hole, two courses high, located further east (Square C3). The two features seem to be placed symmetrically about the entrance to Structure 3.



5. Upper Phase 3, Plot XX F, Wādī Ḥammeh 27.

6. Bone pendants from Upper Phase 3, Wādī Ḥammeh 27: RN 150007 (left) and RN 15005 (right).

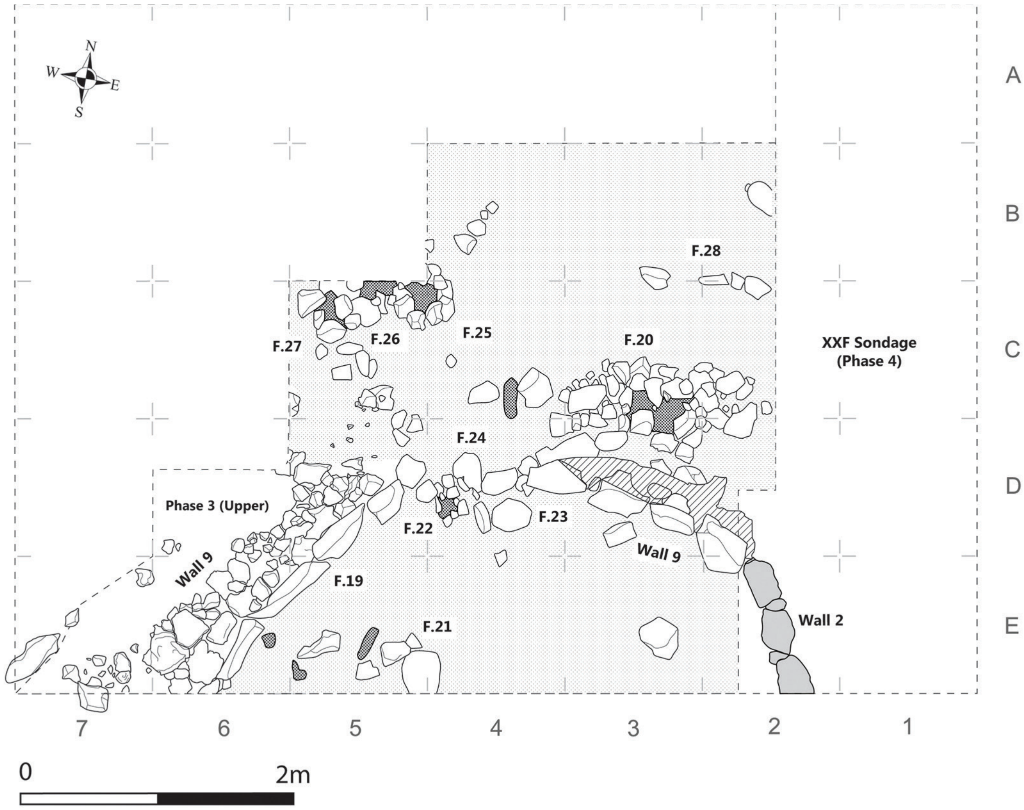
Significant Finds from Upper Phase 3

Upper Phase 3 yielded several unusual items fashioned from limestone. One is a small, drilled 'bead' (RN 150015). There is also a limestone ball finished almost to a perfect sphere (RN 150020) and an unusual limestone cylinder (RN 150021) resembling an artist's crayon. In bone, new types of pendants emerged, including an ovoid type (RN 150007, Fig. 6), almost intact except for a damaged perforation, and a small, sub-rectangular example (RN 150054). Additionally, a bone piece (RN 150172) is decorated with a series of opposed short incised strokes, emanating from the left and right distal margins on the proximal section of the piece.

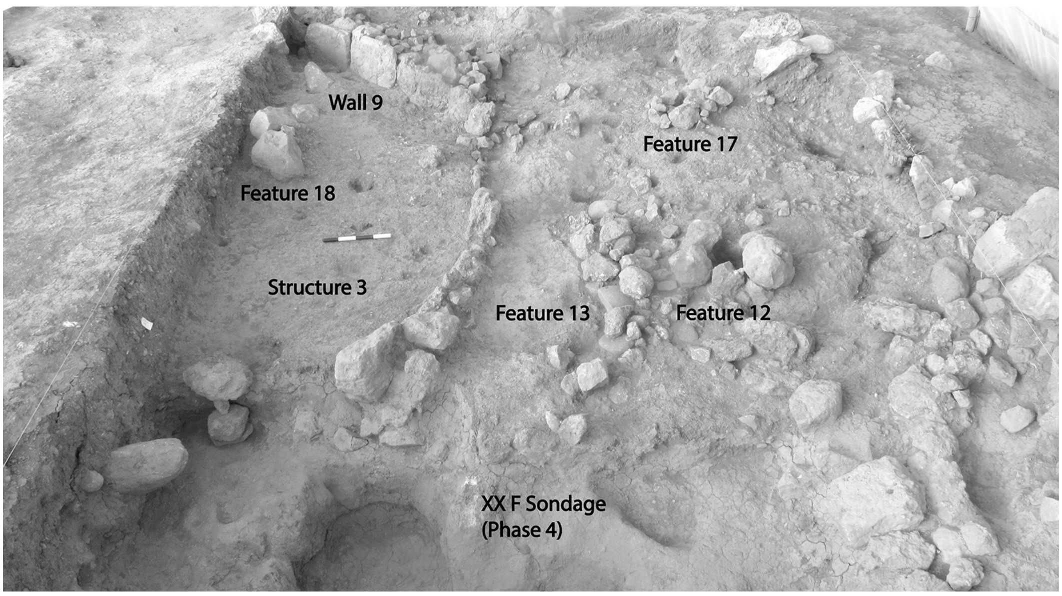
Lower Phase 3

The lowermost floor in Structure 3 (Locus 8.1) articulates with the base of the enclosing Wall 9 (Fig. 7). The excavation of the lower floor also established Feature 24 as a clear, north-facing entrance to the house (Edwards *et al.* 2018c). Clearance of the house's interior deposits confirmed that the inner face of Wall 9 (F.z19) is lined by a row of shaped, rectangular limestone slabs (Fig. 8), first revealed during the excavation of Upper Phase 3, and standing almost vertically. The slabs are supported by a backing of small to medium-sized limestone pieces. Feature 19 is a precursor to the larger, decorated stone slabs of Phase 1 (Edwards 2013d: 28–9). The Natufian site of Shubayqa 1 in east Jordan also features naturally-shaped basalt slabs erected vertically as part of a house wall (Richter *et al.* 2012), whereas the Wādī Ḥammeh 27 examples have been extensively worked to form a similar effect. Since the settlements are contemporaneous, it is interesting to consider whether there is a direct cultural link or borrowings to account for the two architectural traditions—especially when we consider that both sites participated in an east-west exchange system, according to the evidence of Mediterranean Dentalium shells found in both sites.

The interior of Structure 3 is lower than its outside surface (Locus 9.1). A small stone-lined posthole (F. 22) lay at the interior of its entrance. Further inside, a stone construction (F. 21) directly underlay the larger stone cairn (F.18) founded on the Upper Phase 3 floor. A large stone circle (F. 25) was positioned on the exterior surface at the north-west extremity of the excavations, directly underneath Feature 17 built in the overlying Upper Phase 3. To the north-east of the excavation area, a short, single-coursed wall segment (F. 28) runs westwards from the easterly limit of excavation. This feature partially underlay an overlaying stone circle in Upper Phase 3 (F. 12). The largest external construction is Feature 20, an oblong stone platform. Feature 20 is the original version of similar platforms that were built over the top of it or nearby, in all succeeding constructional



7. Lower Phase 3, Plot XX F, Wādī Ḥammeh 27.



8. View west across Phase 3, Plot XX F, Wādī Ḥammeh 27, during excavation.

phases. A large, roughly circular cavity occurs at its centre, and the provision of a curved, basaltic vessel fragment (RN 160249) to frame its south-easterly margin reinforces the likelihood that it served as a support for a sizeable post.

Significant Finds from Lower Phase 3

Several fossils were discovered in Phase 3, including an unusual fossil echinoid, or sea urchin (RN 160138). Weathering of the fossil has resulted in the abrasion of its surficial features, highlighting the sutures between the plates. The echinoid is likely to be a stomechinid type belonging to the genus *Leioechinus*. This taxon has not previously been recorded in a Natufian site or in a Levantine archaeological context.

The Phase 4 Settlement

Phase 4 includes the deposits and features positioned on and dug into the basal travertine rock layer.

Phase 4 has also been divided into upper and lower sub-phases, with Upper Phase 4 represented by the occupation surface below Phase 3. This surface overlies a series of pits and features, which constitute Lower Phase 4.

Upper Phase 4

The Upper Phase 4 surface (Locus 8.3) runs underneath the Structure 3 perimeter wall. Numerous stone features, isolated rocks, and large and small artefacts lay strewn across its surface (Locus 8.3). In the western corner of the plot, near the intersection of Wall 9 and the south baulk, a stone cluster (F. 30) formed a third, successive version of the overlying ones, Features 18 and 21 (of Upper and Lower Phase 3 respectively). Three new AMS radiocarbon dates from Upper Phase 4 are 12,290 ± 28 BP (Wk-46914; 12,166 –12,310 cal BC), 12,383 ± 29 BP (Wk-46912; 12,285–12,593 cal BC) and 12,438 ± 28 BP (Wk-46913; 12,434–12,765 cal BC).

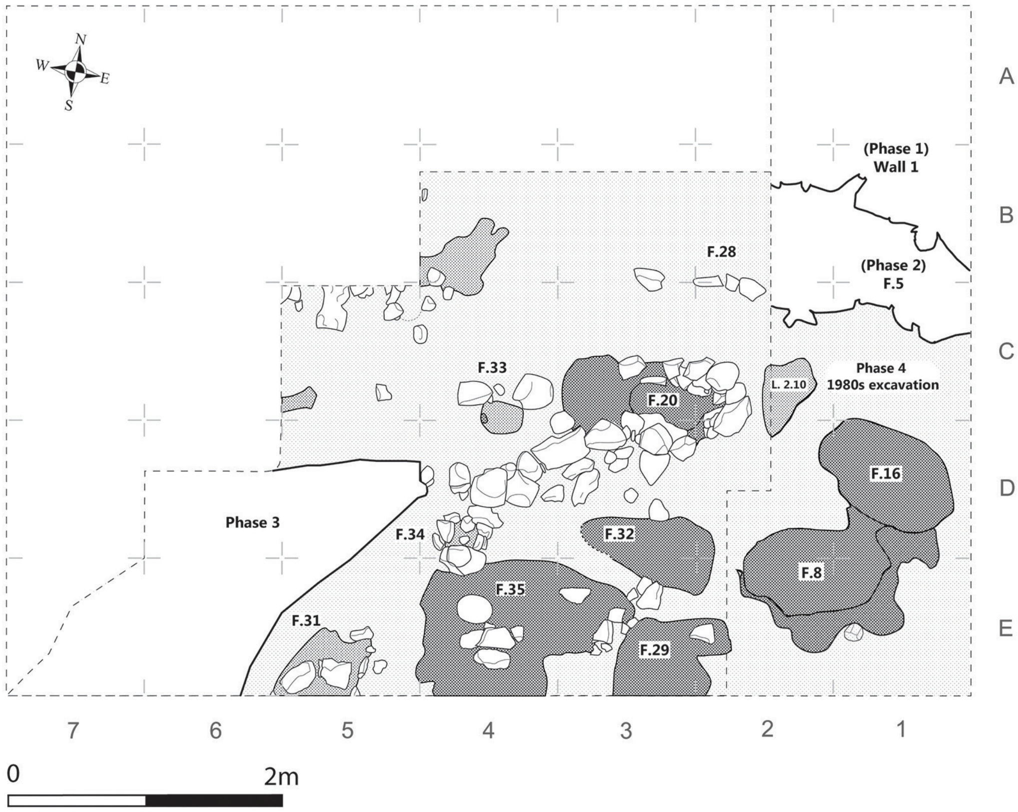
Significant Finds from Upper Phase 4

Upper Phase 4 yielded interesting finds from a technological point of view: a lozenge of vesicular basalt (RN 160248) and an incomplete basaltic vessel (RN 160420). These objects are the first signs that basaltic artefacts were made on-site at Wādī Ḥammeh 27 and not always imported as finished pieces. Another novelty for the site is a bone fish-hook (RN 160278). The fish-hook is a common type in more westerly sites but this example is the first one from Wādī Ḥammeh 27 in an assemblage of 550 bone artefact items.

Lower Phase 4

Lower Phase 4 comprises a number of pits and stone features dug into the natural travertine deposits. These features are primarily clustered underneath the later Structure 3 and three of them contain human skeletal remains (Fig. 9). Other significant features were located in the area outside Structure 3 (to its north). The chief one among them is the stone platform (Feature 20). Further excavation revealed it to be a deep, stone-lined pit with a significant infill of burnt sediment. This situation is reminiscent of the Feature 16 pit that accompanied the neighbouring F. 8 burial in the XX F Sondage (Webb and Edwards 2013). Feature 20 appears also to have been placed to mark the graves to its south (Features 29 and 32). Versions of the stone platform were then rebuilt throughout all the later phases of the settlement over a period of some 500 years.

The most important find emanating from the pits under Structure 3 was a double burial (F. 29) containing two primary, superimposed child inhumations. *Homo 9* was found overlying *Homo 10.* The latter individual was wearing a Dentalium necklace, and both individuals had been interred in individual containers of soft material. Human remains were also discovered in two other pits, but



9. Lower Phase 4, Plot XX F, Wādī Ḥammeh 27.

time did not permit their excavation. A human vertebra was found in Feature 32. Additionally, a human maxilla was found on the northeastern slope of the large pit, Feature 35 (Bocquentin, in Edwards *et al.* 2018c). In this context, it is also notable that burnt fragments of human crania, originally found scattered throughout the Phase 1 sediments in the 1980s excavations (Edwards and Hardy-Smith 2013; Webb and Edwards 2013), have also been found in all of the lower phases during the new excavations. New AMS radiocarbon dates of 12,379 ± 30 BP (Wk-46916; 12,270–12,590 cal BC) and 12,404 ± 30 BP (Wk-46915; 12,350–12,680 cal BC) for Lower Phase 4 clarify the timing of the foundation of the settlement. Both determinations come from pits dug into the underlying bedrock.

Significant Finds from Lower Phase 4

The most noteworthy finds from Lower Phase 4 are five bone points, placed as a cluster in the burial pit, Feature 32. One specimen is a long, gracile point (RN 160365), measuring 19.5 cm in length, but only a few millimetres wide (Fig. 10). RN 160364 is a similar example, with a length of 15 cm. RN 160360 is a long, curved point, possibly made on a rib. All three of these objects are unique in the Wādī Ḥammeh 27 repertoire.

The Origins and Development of the Settlement

The new excavations at Wādī Ḥammeh 27 have provided an enhanced understanding of the establishment and

10. Gracile bone point (RN 160365) from Feature 32, Lower Phase 4, Wādī Ḥammeh 27.

development of the site. Around 12,500 BC its settlers founded a burial ground on the alluvial travertine sediments in lower Wādī al-Ḥammeh, digging pits into the bedrock. No specific habitations are indicated for this phase, yet the settlers had already developed all of the characteristic material forms of Early Natufian culture. Its inventories included diverse forms of flaked chert tools, bone tools and ornaments, heavier artefacts in basaltic and limestone, and portable art pieces. The burials were bordered by two complex features that originated as deep pits filled with burnt materials. The features were capped with stone platforms, at least one of which framed a large posthole, possibly to hold erect a memorial post.

Relatively quickly, as far as we can discern from the evidence of the radiocarbon dates, a house (Structure 3) was built over the burials. The structure was rapidly reoccupied when a second floor was established. On the exterior, the marker features were continually renovated and embellished. To the north of the house, two stone circles were placed. Even after Structure 3 went out of use and the area was incorporated into a much larger house (Structure 1, Phases 1 and 2), the commemorative monuments and the stone circles were rebuilt and reused throughout the lifespan of the site, which ended around 12,000 BC. Thereby, memories of founding figures and their resting places were maintained until the end of the settlement's lifetime.

Community Connections: Analyses of Human Skeletal Remains

In order to examine the interrelationships of the community members, bioarchaeological and palaeogenetic analyses of the human skeletal remains are underway, the former undertaken by Fanny Bocquentin (aided by Marie Anton) and the latter carried out by Cristina Valdiosera. Isotopic studies of human bone by Louise Shewan are also continuing, in order to discover something of the geographic origins of the settlers at Wādī Ḥammeh 27. Strontium (Sr) isotope ratios in the human remains are being compared with a baseline reference map of bioarchaeological strontium, which Shewan has compiled in western Jordan. For these purposes, Shewan has collected over one hundred samples of rock, soil, plants, and surface water in western Jordan (between the Syrian border and the southern margins of the Dead Sea). The range of Sr isotopic variability observed so far ranges from 0.70916 near Wādī al-Ḥammeh at Kufur Rākib to 0.70449 at Mukawir, further south by the Dead Sea (Shewan in Edwards *et al.* 2018b).

Social Connections: Tracking Raw Materials

This project also aimed to understand more about the social connections of Wādī al-Ḥammeh and other regions by tracking the sources of key raw materials imported to Wādī Ḥammeh 27. To investigate the origins of basaltic rock arriving at the site, John Webb undertook the first comprehensive mapping of basaltic rock sources in western Jordan, by portable X-Ray Fluorescence. Nine basaltic provinces were isolated and distinguished in western Jordan (between northern Jordan and the Dead Sea basin). Multiple samples of each source were taken in the field. Ratios of non-weathering trace elements (Yttrium/Niobium and Zirconium/Niobium) were used to distinguish each source. Some of the sources overlap significantly, but there is also a clear trend of differentiation from south to north. Comparing the analyses of Wādī Ḥammeh 27 basaltic artefacts with the outcrop analyses shows that the artefacts were derived from a variety of outcrops. Most of the artefacts are similar to the nearby basalts at Umm Qays and Irbid, but several were obtained from basalt outcrops to the south around the Dead Sea (Webb, in Edwards *et al*. 2018b).

Chert (flint) cobbles are ubiquitous in the channels of Wādī al-Ḥammeh and chert veins outcrop widely in the eastern foothill of the Jordanian plateau. Chert was by far the most abundant and important daily resource utilised at Wādī Ḥammeh 27. Given the plentiful sources of chert located along the Jordan Valley margins, it is not necessarily the case that the material was imported from long distances, since there are plenty of local types available. Nevertheless, we have had little reliable knowledge of chert sources used in the Epipalaeolithic period in northwestern Jordan. To address this lacuna, Christophe Delage conducted a wide-ranging survey and analysis of chert sources in western Jordan. Delage has found that of all the many types of suitable flint available the occupants of Wādī Ḥammeh 27 strongly favoured a yellow/light brown chert of uncertain provenance which they collected as a series of secondary nodules (Delage in Edwards *et al*. 2018b).

Integrating Local Archaeology

Debates about the degree of sedentism practiced in the Natufian period often focus on the presentation of generalist behavioural models, or archaeological or scientific indicators which are often taken to be universally applicable. Thus, we have arguments derived from refuse disposal patterns (Hardy-Smith and Edwards 2004) and the association of commensal animals with Natufian settlements (Weissbrod *et al*. 2017). In conclusion, I digress from these interests and draw attention instead to some pertinent aspects of northwestern Jordan's archaeological record.

Wādī al-Ḥammeh forms a long, narrow valley, bounded by high hills. It extends from the Jordan Valley floor and rises to the Jordanian plateau 2.5 km to the east. The valley forms a natural passage from the lowlands to the highlands. Numerous microenvironments are contained within it and adjacent to it. They include the Mediterranean forests of the Jordanian plateau with their nut trees; the craggy sides of Wādī al-Ḥammeh—suitable for ungulates such as goats; the broad red soils of the of Ṭabaqat Faḥl plateau, forming an expansive home for wild cereals, and lastly the marshy embayment of Sayl al-Ḥammeh and its opening to the Jordan Valley. The communication routes along the valley were important to the inhabitants of Wādī Ḥammeh 27 (Edwards 2015).

The *ahupua'a*, a landholding unit of ancient Hawaii, offers some useful parallels to the east-west trending *wadis* that debouche into the Jordan Valley (Cordy and Kaschko 1980). The *ahupua'a w*as often located as a slice of land running from the mountains to the seashore. Thereby it contained all of the resources necessary for life: a seashore for fishing, a river for irrigating farms, and forested uplands for timber and wild foods. Hawaiian polities excluded other communities from their home territories because a second polity in place would interfere with their access to critical resources and communication routes. A home settlement was positioned strategically within the *ahupua'a* in order to exercise control by good visibility over the holdings and maintain close proximity to resources.

Maintaining control in this fashion over the linearly positioned resources of Wādī al-Ḥammeh would have been important for the viability of the hunter-gatherers from Wādī Ḥammeh 27. The situation may have reinforced a growing sense of territorial ownership and the 'social tethering' (Ames and Maschner 1999) of the community to specific plots of land, leading to the decision to stay for the long term at the strategically located settlement of Wādī Ḥammeh 27. Wādī al-Ḥammeh has been intensively surveyed and it does not show traces of any other comparable Natufian sites.

We may trace the origin of the Natufian kind of social tethering to the nearby valley just 5 km to the north, to Wādī Ziqlāb and its remarkable Middle Epipalaeolithic site of 'Uyūn al-Ḥammam, dating *ca.* 15,300–14,400 *cal* BC. 'Uyūn al-Ḥammam is an open-air burial ground, unassociated with any specific settlement or landmark. It has yielded eleven adult burials within eight graves, some with the remains of fox bones included among the grave offerings (Maher *et al.* 2011). Movement of bone elements from grave to grave indicate returns to, and maintenance of, the site over extended time periods. Wādī Ziqlāb is also a well-surveyed valley, and other sites like 'Uyūn al-Ḥammam, which also lies in a strategic position in the valley, are not yet in evidence.

Some two thousand years later, a Natufian community also founded a burial ground at Wādī Ḥammeh 27, as a means of claiming a significant cultural place in their home territory. Yet, this time, they took the process a step further and built a house on top of their burial ground. As a signal of their determination to remain there for the long term, they took the trouble to build in stone. Although their settlement grew rapidly and was periodically reoriented, they continued to commemorate their founding kinsfolk. They may have been prompted to sedentize in reaction to the onset of a busier and more complex social world near the end of the Pleistocene, although this model is difficult to demonstrate. Still, the question of why people first settled down remains elusive to archaeology.

Acknowledgments

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Five Hundred Years of Technological Change and Continuity at an Early Natufian Settlement: The Lower Lithic Assemblages of Wādī al-Ḥammeh 27

Introduction

The site of Wādī al-Ḥammeh 27, situated atop a narrow plateau at the junction between the wadis al-Ḥammeh and al-Ḥimar at the eastern edge of the Jordan Valley (Fig. 1), represents a classic example of an Early Natufian architectural 'base-camp' settlement. It was originally excavated in the 1980s by Phillip Edwards as part of the broader University of Sydney Pella excavations, with this stage of investigations being primarily focused on uncovering a broad exposure of the final, Phase 1 occupational surface, ultimately resulting in two exceptionally large, curvilinear stone structures (Structures 1 and 2) being uncovered (Edwards 2013b). In contrast, investigations into the underlying deposits were limited to a single sondage in Area XX F of the site (Edwards 2013a: 47). While the sondage succeeded in establishing the stratigraphy of the site, including secure radiocarbon dates spanning a 500-year period between 12,500–12,000 cal BC (Edwards 2013a: 62–3), the lithic samples collected from the earlier phases were far smaller than the large Phase 1 collection (Edwards 2013c), limiting the range and resolution of investigations into diachronic technological and typological change onsite.

Excavations resumed at Wādī al-Ḥammeh 27 for three seasons between 2014–2016 as part of the 'Ice Age Villagers of the Levant: sedentism and social connections in the Natufian Period' ARC Discovery grant (Edwards *et al.* 2018a). In contrast to the original project, these renewed excavations were focused on uncovering a broader exposure of the three lower structural phases, with excavations focused on a broad area immediately to the east of the XX F sondage. The results of these excavations are detailed in Edwards' chapter within the current volume. All four lower structural phases are associated with rich artefactual assemblages, including

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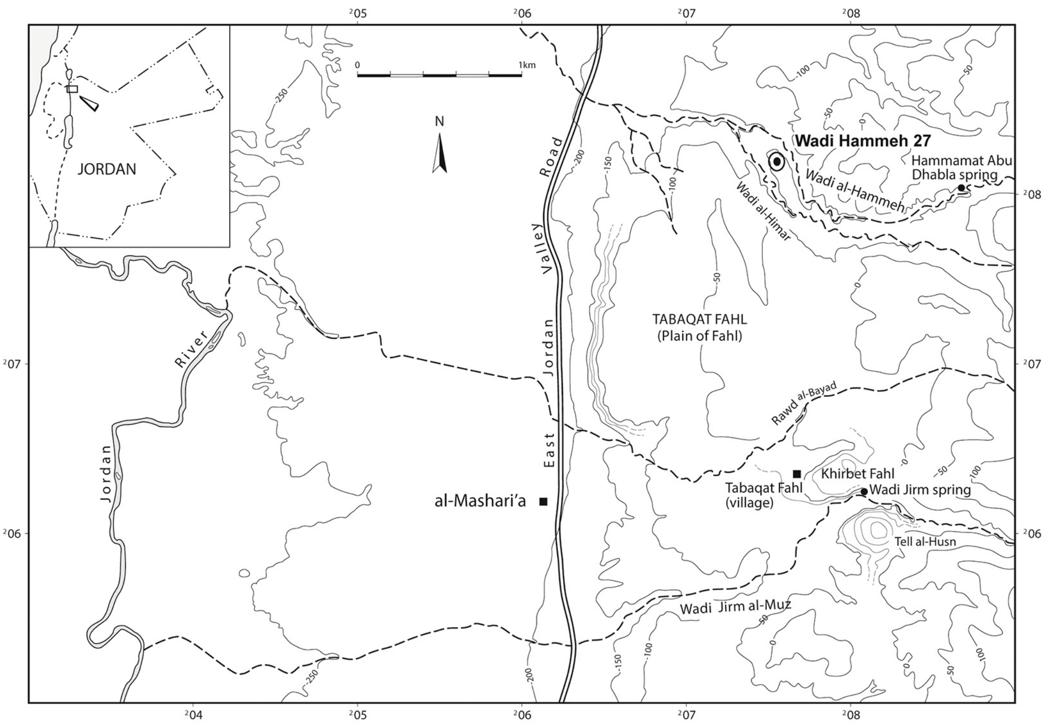


1. Location of Wādī al-Ḥammeh 27 in north-east Jordan.

substantially larger samples of flaked stone artefacts than had been available from the corresponding deposits in the previously excavated sondage.

Investigations into flaked-stone technological developments within the course of the Early Natufian period have been hampered by several factors, with the ongoing excavations of el-Wad Terrace in the Mount Carmel region providing the only other example of a detailed, intra-site diachronic study being performed at a 'base-camp' site (Kaufman *et al.* 2015; Weinstein-Evron *et al.* 2018). These limitations have included the excavation methods utilised being far too broad to allow any sort of interpretive resolution, such as in the case of Perrot's (1960) excavations of 'Ayn Mallaha, or the presence of significant assemblage intermixture, as at Hayonim Cave (Bar-Yosef and Goren 1973: 54; Belfer-Cohen 1988: 47). In contrast, the fine-scale excavations utilised at Wādī al-Ḥammeh 27 combined with its clearly stratified architectural sequence makes Wādī al-Ḥammeh 27 an ideal candidate to investigate whether technological or typological changes are detectable within a single Early Natufian settlement. This viability is further emphasised by the fact that Wādī al-Ḥammeh 27 was established directly upon a three meter deep layer of limestone travertine (Edwards 2013a: 33), preventing any artefactual contamination from the underlying Kebaran site of Wādī al-Ḥammeh 26.

The Assemblages

The renewed excavations at Wādī al-Ḥammeh 27 produced a wealth of flaked stone artefacts, with a total of 490,891 flaked stone artefacts recovered from 7 m^3 of sediment. This assemblage was catalogued in its entirety over a ten-month period in Amman, and one-third of the intact debitage, cores, and retouched artefacts from each phase were subject to detailed attribute analysis. The Area XX D lithics previously analysed by Edwards (2013c) was employed as a Phase 1 comparative assemblage, as this was of a comparable size (n=91,671) to each of the newly uncovered assemblages.

The Phase 4 deposits presented the smallest artefact assemblage, both in terms of total artefact count (n=71,296) and artefact density (50,926 artefacts per m^3). Artefact densities were highest in the Lower (72,925 per m^3) and Upper (86,803 per m^3) Phase 3 deposits, before declining somewhat in Phase 2 (60,109 per m^3). The assemblages were primarily uncovered in the context of dense, midden-like primary refuse deposits which were allowed to accumulate in a domestic setting. This pattern indicates that the lack of refuse disposal described in Phase 1 by Hardy-Smith and Edwards (2004) is not reflective of the final abandonment of the site, but was a continuous characteristic throughout its occupation.

Raw Material Usage

The cherts utilised at Wādī al-Ḥammeh 27 remain consistent across the four assemblages, with the majority of artefacts manufactured from fine grained, homogenous, yellowish-brown cherts. These are consistent with the Muwaqqar Chalk Marl type 4 (MCM-04) cherts previously identified as being favoured by the Natufian inhabitants of Wādī al-Ḥammeh (Edwards *et al.* 2018a: 249, 2018b: 263), demonstrating that they possessed access to a reliable source of this material throughout the span of its occupation.

A much smaller number of artefacts were manufactured from a translucent chert resembling chalcedony, consistent with one of the chert varieties found in a primary context in local Amman Silicified Limestone (ACL) outcrops (Edwards *et al.* 2018b: 261–2). Pieces manufactured from these cherts almost exclusively took the form of small flake and bladelet cores and their associated debitage, an unsurprising find given that this type of brecciated chert tends to fracture into blocks no larger than 5 cm in maximum dimension (Edwards *et al.* 2018b: 262). The ultimate aim of this parallel *chaine opératoire* appears to have been the manufacture of lunates, as geometric microliths were the only class of retouched artefacts to be manufactured from this chert type in any significant frequency. Artefacts manufactured from translucent cherts were most common in Phase 4 (4.1%, n=47), before abruptly dropping in Lower Phase 3 (1.9%, n=20), with this percentage remaining largely static across the subsequent two assemblages.

Debris and Debitage

Each lithic assemblage at Wādī al-Ḥammeh clearly represents a complete reduction sequence, with each corresponding artefact class—from the initial large, cortex-rich primary flakes down to the minute composite tool fragments and pressure flaked debris—being produced onsite as part of a 'Juncture 1' assemblage (Pecora 2001). Each assemblage between Phase 4 and 2 is numerically dominated by debris artefacts, with chips and chunks consistently comprising three-quarters of each assemblage (Table 1). The remainders of each assemblage are mostly comprised of debitage artefacts, with the percentages of cores and retouched artefacts consistently hovering at 0.2% and slightly over 1% of each assemblage respectively.

The lower phases at Wādī al-Ḥammeh 27 are characterised by large numbers of flakes measuring less than 2 cm in maximum dimension, which comprise one-

Table 1. The Wādī al-Ḥammeh 27 assemblage (Phase 1 data from Edwards 2013c).

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Phase 1 (XX D)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Debris										
Chunks	3,649	5.1	13,582	8.5	11,422	6.5	13,166	15.9	12,830	14.0
Chips	49,067	68.8	102,529	63.9	121,683	69.1	49,472	59.6	37,256	40.6
Sub-total	**52,716**	**73.9**	**116,111**	**72.4**	**133,105**	**75.5**	**62,638**	**75.5**	**50,086**	**54.6**
Debitage										
Flakes	1,248	1.8	2,691	1.7	2,919	1.7	1,554	1.9	10,174	11.1
Flakes (< 2 cm)	6,724	9.4	15,113	9.4	14,081	8.0	6,658	8.0	1,736	1.9
Broken flakes	4,003	5.6	12,282	7.7	11,343	6.4	4,383	5.3	16,220	17.7
Blades	16	0.0	28	0.0	27	0.0	24	0.0	160	0.2
Bladelets	335	0.5	664	0.4	768	0.4	505	0.6	2,873	3.1
Broken blades and bladelets	4,104	5.8	9,207	5.7	9,192	5.2	4,897	5.9	7,346	8.0
Bladelets (< 2 cm)	574	0.8	1,015	0.6	1,106	0.6	540	0.7	169	0.2
Core trimming elements	252	0.4	610	0.4	506	0.3	198	0.2	158	0.2
Burin Spalls										
Plain	170	0.2	314	0.2	468	0.3	346	0.4	520	0.6
Truncation	103	0.1	173	0.1	194	0.1	74	0.1	89	0.1
Microburin technique										
Microburins	1	0.0	2	0.0	14	0.0	15	0.0	64	0.1
Piquant triédres	2	0.0	1	0.0	1	0.0	2	0.0	1	0.0
Sub-total	**17,532**	**24.6**	**42,100**	**26.2**	**40,619**	**23.1**	**19,196**	**23.1**	**39,283**	**43.1**
Cores	121	0.2	278	0.2	307	0.2	166	0.2	368	0.4
Retouched tools	927	1.3	1,945	1.2	2,180	1.2	950	1.1	1,707	1.9
Total	**71,296**	**100.0**	**160,434**	**100.0**	**176,211**	**100.0**	**82,950**	**99.9**	**91,444**	**100.0**

third of each debitage assemblage between Phase 4 and 2. While some of the smaller, more extensively worked flake cores would have produced flakes falling within these dimensions, experimental studies have demonstrated that such microflakes are often created as knapping by-products (Shott 1995: 63–6; Edwards 2013c: 121). It is thus highly likely that large proportions of these artefacts represent a form of knapping shatter rather than intentionally produced debitage blanks. These pieces are supplemented by consistently large quantities of broken flakes and broken blades and bladelets. Conversely, intact debitage objects are relatively uncommon, with flakes comprising slightly under 2% of each assemblage, while the proportions of intact bladelets range between 0.4% and 0.6% of each assemblage.

The only incremental typological shifts in the debitage assemblages related to the burin spalls. The proportions of these artefacts gradually increase over time, correlating neatly with the rising share of burins in the corresponding retouched tool assemblages. This correlation is further strengthened by an increased emphasis on 'plain' spalls over the 'truncation' variety, corresponding with the shifting emphasis towards dihedral burins between Phases 4 and 2.

The dimensions of the analysed debitage artefacts remain largely consistent across the four analysed assemblages. The flakes analysed exhibit a wide range of dimensions, ranging from 8.7 mm to 71.7 mm in length and weighing between 0.2 to 66.6 g. The mean dimensions and weight of the flakes nonetheless remain relatively low, with the wider range of dimensions representing variation amongst the largest outliers. Plain platforms were the most common type in all four assemblages, ranging from 27.0% of the Phase 4 flakes to 30.8% of those from Phase 2. These are supplemented primarily by flakes with punctiform platforms in Phases 4 (19.8%) and Lower Phase 3 (18.2%), before being replaced by flakes with absent platforms in Upper Phase 3 (16.2%) and Phase 2 (19.5%). Flake shapes vary in each phase, with no single type reaching a quarter of each assemblage. The most common shape also varies by phase, with ovoid flakes being the most common type in Phase 4 (24.4%), canted flakes in Lower (23.9%) and Upper Phase 3 (24.3%), and rectangular flakes in Phase 2 (23.1%). Flakes with a unidirectional dorsal scar orientation characterise each assemblage, with this dominance steadily rising from 41.1% in Phase 4 to 52.7% of the Phase 2 flakes. These are supplemented primarily by flakes with 90º change of orientation layouts, which consistently comprise a third of each assemblage. The number of dorsal scars on flakes remains largely static, with an average of four scars on the Phase 4 and 3 flakes, before dropping slightly to three scars in Phase 2. The amount of cortical coverage on flake dorsal surfaces remains consistently low, with around 60% of each flake assemblage completely lacking cortex on their dorsal surface. Flakes with feathered terminations dominate each assemblage, ranging from 56.5% in Phase 4 to 48.2% of Upper Phase 3.

A combination of Marks' (1976: 372–3) *sensu lato* and *sensu stricto* definitions were utilised for the blades and bladelets, with both types being defined primarily by their length being twice that of their width, while a length of 50 mm serves as a dividing line between the two debitage types. The division between identifying a blade or a bladelet is thus purely an etic one, with the lower range of blades and upper range of the bladelets both straddling the 50 mm mark. Despite this, the size of the bladelets is largely homogenous over time, with the length, width, thickness, and weight for the bladelets exhibiting low standard deviation levels. Some attributes vary across phases, with absent platforms being most common in Phase 4 (30.6%) and Phase 2 (31.1%), punctiform platforms being most common in Lower Phase 3 (36.2%), while punctiform and crushed platforms are equally as common in Upper Phase 3 (28.6%). Other attributes retain a dominance across time, with feathered terminations and unidirectional dorsal scar orientations characterising each bladelet assemblage. Bladelets with cortex are consistently scarce, with three-quarters of each bladelet assemblage being completely free of cortex. At the same time, small numbers of bladelets with cortex running along one lateral margin are present in each assemblage, demonstrating that a portion of each bladelet assemblage was produced through the primary reduction of small, cortex-rich cobbles, rather than being restricted to the secondary stage of larger, more intensively worked blocks of chert.

Several key variations are observed between the final Phase 1 assemblage and the four earlier assemblages. Debris artefacts are notably less common in Phase 1, comprising slightly over half of the assemblage. This decline is reflected purely by a drastic decrease in the proportion of chips, while the proportion of Phase 1 chunks (14.0%, n=12,830) remains consistent with the preceding Phase 2 assemblage (15.9%, n=13,166). These proportions of chunks nonetheless represent a notably increased representation compared with the Phase 3 assemblages, suggesting that a shift in refuse disposal strategies occurred between the occupation of Structure 3 and the two larger structures occupied in the final two phases.

While broken debitage artefacts outnumber their intact counterparts in each assemblage, this dominance is noticeably less pronounced in the Phase 1 assemblage. This abrupt shift is particularly evident when examining the blades and bladelets of each assemblage, which drop from a consistent breakage rate of over 90% between Phase 4 and 2, to slightly over 70% in Phase 1 (Table 2). The flakes exhibit a similar pattern, if not as pronounced, with the percentage of broken flakes ranging between 73.8% and 82% in the lower four assemblages, before dropping to 61.5% of the total number of flakes in Phase 1.

The replacement of essential tools in a permanently occupied setting is often far less expensive than in mobile, rotational societies, due to the ability of sedentary communities to maintain a stockpile of cores or debitage blanks for immediate replacement whenever the need arises (Bamforth 1991: 229). These stockpiles may subsequently be affected by the process of 'draw down', wherein an existing stockpile is depleted in the lead up to a planned abandonment of the site (Deal 1985: 269; Schiffer 1987: 97). The increased proportions of debitage surviving intact as *de facto* refuse in Phase 1 at Wādī al-Ḥammeh 27 may thus represent an example of stockpiling, indicating that the final abandonment of the site was executed with an anticipated return, which never

Table 2. Percentage of broken debitage at Wādī al-Ḥammeh 27. Flakes and bladelets under 2 cm in length excluded.

	Flakes		Blades and bladelets	
	No.	% broken	No.	% broken
Phase 4	5,251	76.2	4,455	92.1
Lower Phase 3	14,973	82.0	9,899	93.0
Upper Phase 3	14,262	79.5	9,987	92.0
Phase 2	5,937	73.8	5,426	90.3
Phase 1 (XX D)	26,394	61.5	10,379	70.8

manifested for reasons unknown. This idea is supported by the comparatively large number of discrete *de facto* refuse clusters which were recovered in a functional context in Phase 1. These caches included the only large, finely-worked basaltic mortars to be recovered intact from the site as a whole (Edwards and Hardy-Smith 2013), with the caching of such high value, relatively immobile objects onsite serving as an ethnoarchaeological benchmark for episodes of seasonal abandonments with an anticipated return (Graham 1993).

By-products relating to the microburin technique remain exceedingly rare throughout the archaeological sequence of Wādī al-Ḥammeh 27, a find consistent with the broader Early Natufian archaeological record between the Northern Jordan Valley and Mt. Carmel regions (Belfer-Cohen and Goring-Morris 2013: 550; Grosman 2013: 623). Nonetheless, the representative percentage of these pieces does slightly increase over time at Wādī al-Ḥammeh 27, rising from three pieces in Lower Phase 3 (0.007% of the debitage) to fifteen in Upper Phase 3 (0.037%). This rises further in Phase 2 (0.089%, n=17), before peaking in Phase 1 (0.165%, n=65). This increased share nonetheless remains dwarfed compared to the proportions of microburins at contemporaneous Natufian sites in southern Jordan and the Negev, suggesting that use of this technique remained adventitious throughout the occupation of Wādī al-Ḥammeh 27.

The percentages of burnt artefacts remain consistent across the four analysed assemblages, both in terms of the overall percentage of burnt artefacts as well as by artefact type. For example, the chips and chunks consistently exhibit rates of burning unrivalled by any of the debitage types, with the percentage of burnt debris only slightly falling below 70% in Lower Phase 3. Conversely, the intact blades and bladelets consistently exhibit some of the lowest percentages of burnt artefacts, indicating that a conscious effort was made to keep these pieces intact.

Cores

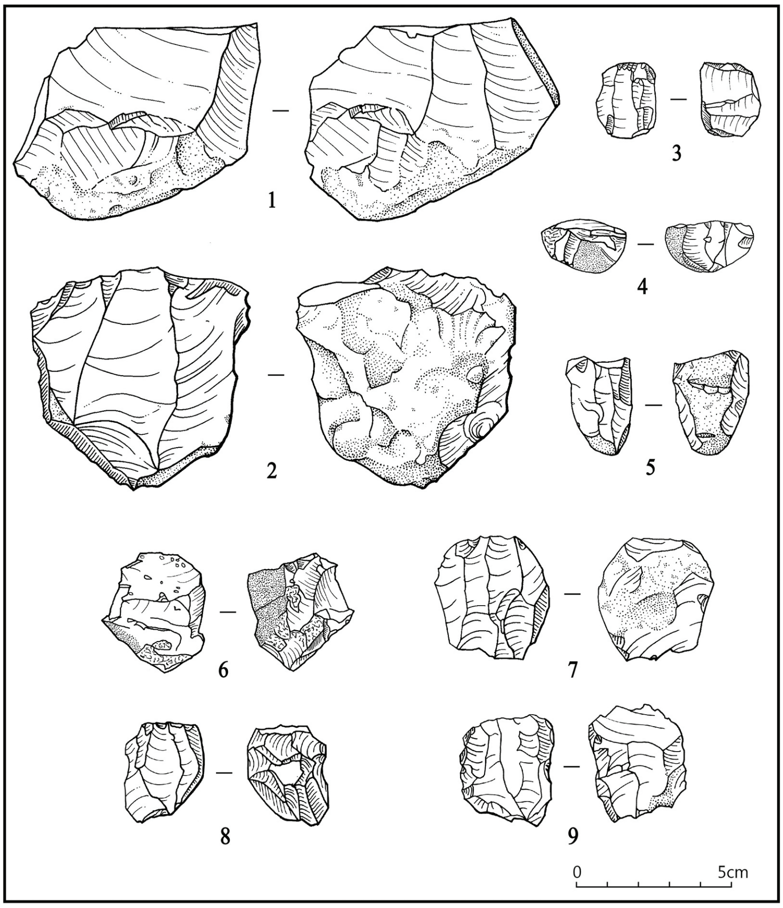
The identification of bladelet cores was made on a fairly liberal basis, with the presence of a single flake scar with bladelet dimensions serving as the diagnostic benchmark. As such, many of the bladelet cores at Wādī al-Ḥammeh 27 actually feature a combination of flake and bladelet scars, and would thus fall under the label of 'mixed cores' in certain typological systems. As with the debitage, the division between blade and bladelet core was ultimately an arbitrary, etic one, being measured purely through the length of the longest flake scar.

Bladelet cores are consistently the most common group of cores in each assemblage at Wādī al-Ḥammeh 27 (Table 3). The extent of this dominance varies significantly over time, with a unidirectional increase in bladelet cores at the expense of the flake cores. The proportions of these two core groups remain static between Phase 4 and Upper Phase 3, with bladelet cores comprising slightly over half of each assemblage, core fragments excluded. Conversely, there is a marked emphasis on bladelet cores beginning in Phase 2, where they comprise slightly under three-quarters of the intact cores. This trend continues in Phase 1, which was comprised almost entirely of bladelet cores. The proportions of extant blade cores remain insignificant over time, indicating that these pieces were consistently being further worked in order to knap microliths, as originally suggested by Edwards (2013c: 145–6) for the Phase 1 assemblage.

Amongst the flake cores, the proportions of the multiple platform type (Fig. 2:6) steadily rise between Lower Phase 3 (35.5%, n=27) and Phase 2 (51.7%, n=15) at the expense of the change of orientation and

Table 3. Core types at Wādī al-Ḥammeh 27 (Phase 1 data from Edwards 2013c).

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Phase 1 (XX D)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Flake Cores										
Single Platform, Unfacetted	3	2.5	7	2.5	11	3.6	3	1.8	0	0.0
Single Platform, Facetted	2	1.7	13	4.7	15	4.9	3	1.8	0	0.0
Opposed Platform, Same Side	2	1.7	2	0.7	3	1.0	1	0.6	0	0.0
Opposed Platform, Opposite Side	3	2.5	3	1.1	1	0.3	2	1.2	0	0.0
Opposed Platform, Combination	4	3.3	4	1.4	1	0.3	1	0.6	0	0.0
Change of Orientation	10	8.3	18	6.5	20	6.5	4	2.4	0	0.0
Multiple Platform	14	11.6	27	9.7	39	12.7	15	9.0	1	0.3
Other	1	0.8	2	0.7	0	0.0	0	0.0	4	1.1
Sub-total	**39**	**32.2**	**76**	**27.3**	**90**	**29.3**	**29**	**17.5**	**5**	**1.4**
Blade Cores										
Single Platform, Unfacetted	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3
Single Platform, Facetted	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0
Opposed Platform, Same Side	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0
Opposed Platform, Opposite Side	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Opposed Platform, Combination	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0
Change of Orientation	0	0.0	0	0.0	1	0.3	1	0.6	0	0.0
Multiple Platform	2	1.7	1	0.4	0	0.0	0	0.0	0	0.0
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**2**	**1.7**	**2**	**0.7**	**2**	**0.7**	**2**	**1.2**	**1**	**0.3**
Bladelet Cores										
Single Platform, Unfacetted	8	6.6	12	4.3	24	7.8	18	10.8	91	25.1
Single Platform, Facetted	10	8.3	23	8.3	22	7.2	8	4.8	31	8.5
Opposed Platform, Same Side	5	4.1	5	1.8	7	2.3	8	4.8	18	5.0
Opposed Platform, Opposite Side	2	1.7	4	1.4	5	1.6	3	1.8	4	1.1
Opposed Platform, Combination	2	1.7	2	0.7	3	1.0	4	2.4	2	0.6
Change of Orientation	9	7.4	37	13.3	30	9.8	16	9.6	44	12.1
Multiple Platform	15	12.4	21	7.6	19	6.2	19	11.4	31	8.5
Other	0	0.0	0	0.0	0	0.0	0	0.0	33	9.1
Sub-total	**51**	**42.1**	**104**	**37.4**	**110**	**35.8**	**76**	**45.8**	**254**	**70.0**
Core Fragments	29	24.0	96	34.5	105	34.2	59	35.5	103	28.4
Total	**121**	**100.0**	**278**	**99.9**	**307**	**100.0**	**166**	**100.0**	**363**	**100.1**

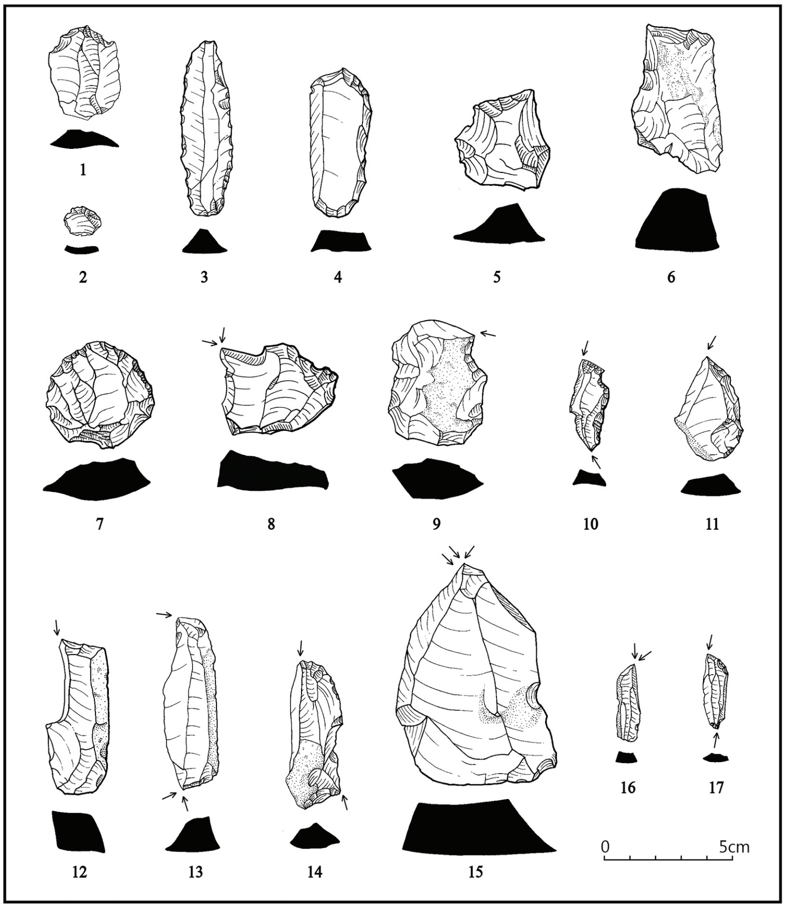


2. Cores from Wādī al-Ḥammeh 27: 1. Single platform flake core, facetted (Phase 4); 2. Single platform blade core, facetted (Upper Phase 3); 3. Change of orientation bladelet core (Phase 2); 4. Single platform bladelet core, facetted (Phase 2); 5. Single platform bladelet core, unfacetted (Upper Phase 3); 6. Multiple platform flake core (Phase 2); 7. Opposed platform bladelet core, same side (Phase 2); 8. Multiple platform bladelet core (Phase 2); 9. Opposed platform bladelet core, same side (Phase 2).

opposed platform (combination) types. In addition to their overall decline in number, an overall trend towards smaller flake cores is observable. This drop corresponds with a decline in the mean number of flake scars they possessed, falling from 12 in Phase 4 to nine in Phase 2. Scar patterning on the flake cores also varied over time, with divergent scar patterns being consistently outnumbered by parallel and convergent patterns between Phase 4 and Upper Phase 3, before abruptly rising in the Phase 2 assemblage. This change indicates that the flake cores present in Phase 2 represent a more expedient knapping strategy, placing further emphasis on bladelet production in the later phases.

At the same time, the percentage of unfacetted single platform bladelet cores (Fig. 2:5) rises between Lower Phase 3

(11.5%, n=12) and Phase 1 (35.8%, n=91) at the expense of the change of orientation type (Fig. 2:3). Single platform bladelet cores are likewise the most common bladelet core orientation in Phase 1, albeit to a greater extent (48.0%) than in any of the underlying assemblages. Bladelet core dimensions remain largely static, being consistently smaller than their flake core counterparts in each assemblage aside from Phase 2, where the two core groups are similar in size. Scar numbers likewise remain consistent, with bladelet cores possessing convergent patterns dominating each assemblage. Bladelet cores tended to retain less cortex than the flake cores, indicating an overall greater core reduction intensity. This was particularly prevalent with the change of orientation and multiple platform bladelet cores, which featured mean areal coverages of 10.9% and 9.6% respectively. The single bladelet cores



3. Scrapers, multiple tools, and burins from Wādī al-Ḥammeh 27: 1. Endscraper (Upper Phase 3); 2. Thumbnail scraper (Phase 2); 3. Endscraper on retouched blade (Lower Phase 3); 4. Sidescraper (Phase 2); 5. Rounded scraper (Phase 2); 6. Narrow carinated scraper (Upper Phase 3); 7. Nucleiform scraper (Upper Phase 3); 8–9. Burin/scrapers (Phase 2); 10. Burin/notched piece (Lower Phase 3); 11–12. Burins on oblique truncation (Phase 2); 13. Double mixed burin (Upper Phase 3); 14. Double burin on truncation (Upper Phase 3); 15. Dihedral burin (Lower Phase 3); 16. Offset dihedral burin (Upper Phase 3); 17. Double burin on truncation (Upper Phase 3).

Table 4. Retouched tool groups at Wādī al-Ḥammeh 27 (Phase 1 data from Edwards 2013c).

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Phase 1 (XX D)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Scrapers	38	4.1	45	2.3	69	3.2	31	3.3	92	5.4
Multiple tools	43	4.6	83	4.3	73	3.3	21	2.2	5	0.3
Burins	126	13.6	283	14.6	406	18.6	157	16.5	400	23.4
Retouched blades	14	1.5	27	1.4	18	0.8	13	1.4	65	3.8
Truncations	21	2.3	91	4.7	88	4.0	14	1.5	37	2.2
Non-geometric microliths	104	11.2	184	9.5	239	11.0	108	11.4	404	23.7
Geometric microliths	147	15.9	311	16.0	336	15.4	201	21.2	253	14.8
Notches & Denticulates	117	12.6	223	11.5	279	12.8	148	15.6	228	13.4
Awls and Borers	12	1.3	14	0.7	14	0.6	19	2.0	34	2.0
Bifacial Tools	2	0.2	3	0.2	5	0.2	0	0.0	10	0.6
Retouched flakes	42	4.5	85	4.4	97	4.4	33	3.5	91	5.3
Retouched fragments	250	27.0	589	30.3	550	25.2	204	21.5	59	3.4
Informal tools	11	1.2	7	0.4	6	0.3	1	0.1	29	1.7
Total	**927**	**100.0**	**1,945**	**100.3**	**2,180**	**99.8**	**950**	**100.2**	**1,707**	**100.0**

conversely exhibited a significantly higher mean cortex coverage (20.0%). A small portion of the single platform bladelet cores (6.3%) featured cortex on over half of their total surface area, demonstrating that the chert cobbles utilised for these pieces were specifically selected for immediate bladelet production, rather than being reduced from a larger block as part of a two-stage process, as observed by Edwards (2013c: 145) for the Phase 1 assemblage.

Retouched Artefacts

Scrapers (Fig. 3:1–7) are consistently uncommon at Wādī al-Ḥammeh 27, reaching their greatest proportions in Phase 4 (4.1%) and Phase 1 (5.4%; Table 4). Despite these low numbers, each assemblage was typologically diverse, indicating a consistently low degree of standardisation. The dominant scraper type fluctuated by phase, with basic endscrapers and sidescrapers being tied for the most common types in Phase 4 (18.7%, n=7), while the Lower Phase 3 assemblage was characterised by an unusually high percentage of broad carinated scrapers (33.3%, n=15). Sidescrapers are likewise the single most common type in Upper Phase 3 (21.7%, n=15), before being surpassed by endscrapers in Phase 2 (19.4%, n=6), and especially Phase 1 (51.1%, n=47). Scraper dimensions are controlled primarily by the debitage blank utilised, with scrapers manufactured from medium-large flakes being predominant in each assemblage, followed by a smaller number of scrapers made on long, fairly thick blades.

Table 5. Blank selection for retouched artefacts at Wādī al-Ḥammeh 27.

	N	Flake		Blade		Bladelet		Other		Indeterminate	
		No.	%	No.	%	No.	%	No.	%	No.	%
Scrapers											
Phase 4	18	13	72.2	0	0.0	0	0.0	3	16.7	2	11.1
Lower Phase 3	28	21	75.0	3	10.7	0	0.0	2	7.1	2	7.1
Upper Phase 3	27	19	70.4	0	0.0	0	0.0	7	25.9	1	3.7
Phase 2	19	14	73.7	3	15.8	0	0.0	2	10.5	0	0.0
Multiple tools											
Phase 4	28	17	60.7	1	3.6	1	3.6	2	7.1	7	25.0
Lower Phase 3	41	20	48.8	9	22.0	2	4.9	2	4.9	8	19.5
Upper Phase 3	28	16	57.1	4	14.3	1	3.6	2	7.1	5	17.9
Phase 2	15	11	73.3	0	0.0	1	6.7	1	6.7	2	13.3
Burins											
Phase 4	95	45	47.4	14	14.7	3	3.2	11	11.6	22	23.2
Lower Phase 3	103	45	43.7	8	7.8	3	2.9	10	9.7	37	35.9
Upper Phase 3	113	64	56.6	13	11.5	9	8.0	10	8.8	17	15.0
Phase 2	53	21	39.6	8	15.1	8	15.1	3	5.7	13	24.5
Geometric microliths											
Phase 4	102	0	0.0	0	0.0	54	52.9	0	0.0	48	47.1
Lower Phase 3	103	0	0.0	0	0.0	62	60.2	0	0.0	41	39.8
Upper Phase 3	105	1	1.0	0	0.0	64	61.9	0	0.0	40	38.1
Phase 2	62	1	1.6	0	0.0	38	61.3	0	0.0	23	37.1
Notches & denticulates											
Phase 4	33	18	54.5	1	3.0	12	36.4	2	6.1	0	0.0
Lower Phase 3	39	21	53.8	0	0.0	17	43.6	1	2.6	0	0.0
Upper Phase 3	34	19	55.9	2	5.9	11	32.4	2	5.9	0	0.0
Phase 2	23	8	34.8	3	13.0	12	52.2	0	0.0	0	0.0
Awls and borers (all phases)	24	3	12.5	12	50.0	6	25.0	2	8.3	1	4.2

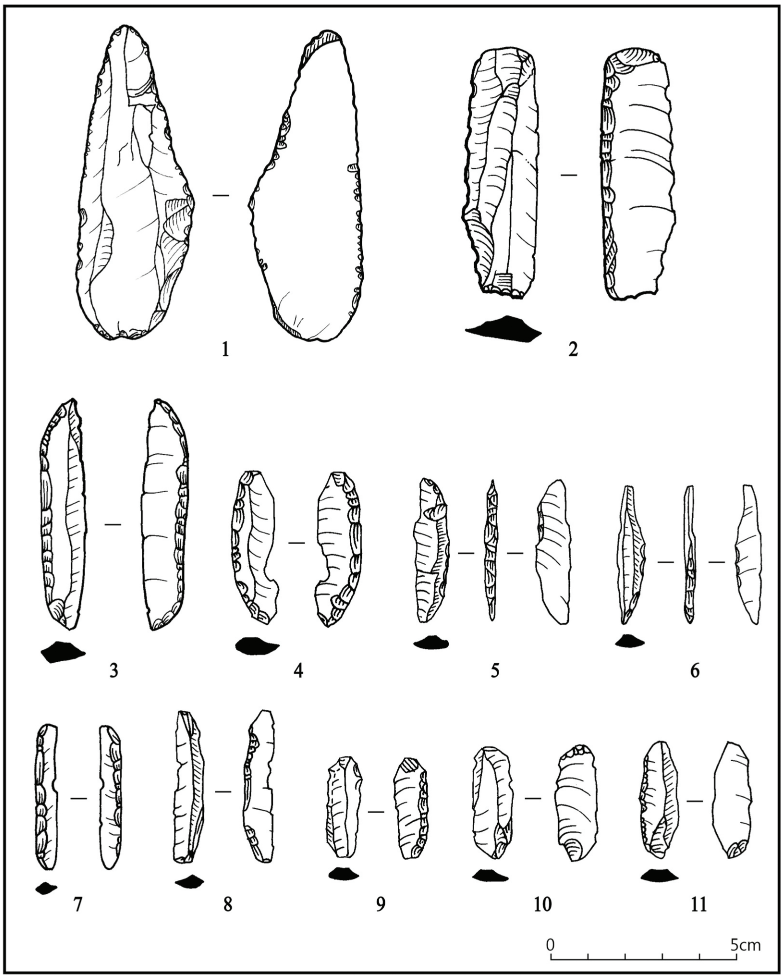
Multiple tools (Fig. 3:8–10) reach their greatest proportions in Phase 4 (4.6%), before gradually declining over time to the point of being almost absent from Phase 1 (0.3%). The blanks utilised for these pieces also varied over time, with the proportion of multiple tools manufactured from flake blanks rising from 50% in Lower Phase 3 to just three-quarters of those in Phase 2 (Table 5).

Given that all three multiple tool types represent burin hybrids ('burin/scraper', 'burin/notched piece', and 'burin/truncation') their decline has several implications. Numerous ethnographic and experimental studies (Keeley 1982: 799; Shott 1995: 58; Tomka 2001: 211–2) have demonstrated that many flaked stone tools that may at first glance appear as handheld tools actually function more efficiently as hafted composites, these including end-scrapers, knives, awls, and picks. At the same time, the modifications applied to a tool in order to facilitate hafting may often be indistinguishable from regular scraper or burin retouch (Keeley 1982: 801). The possibility is thus raised that many of the multiple tools and double burins in Early Natufian assemblages may actually represent examples of hafted tools. This identification is strengthened by the seemingly superfluous nature of many of the notches and truncations seen on many of the scrapers and multiple tools. If this identification is valid, the decline in multiple tools in favour of greater proportions of burins would represent a shift towards non-composite, relatively expediently manufactured burins in the later occupational phases.

The proportions of burins (Fig. 3:11–17) grow incrementally over time, increasing from 13.6% of the Phase 4 tools to 23.4% of those from Phase 1. They also comprise the most common tool group in Phase 1 and Upper Phase 3 (18.6%). The single most common burin type is consistently the 'burin on natural surface', a type which also incorporated burins struck from a snap or the original platform of the blank. These pieces comprised between 17.3% (Lower Phase 3) and 23.9% (Upper Phase 3) of each burin assemblage. The burins exhibit a greater degree of variability in blank selection than the scrapers or multiple tools. While flakes are still the preferred blank in each assemblage, they only comprised a majority in Upper Phase 3 (56.6%), with burins on flakes being noticeably less common in Phase 2 (39.6%). These are supplemented primarily by pieces with an indeterminate blank, while burins manufactured from blades are relatively uncommon, reaching their greatest proportion in Phase 2 (13.2%).

At the same time, however, a drastically different picture is revealed when the burins are abridged by mode of retouch. The Phase 4 assemblage exhibits a clear bias towards pieces struck from a truncated end, with these five types comprising just under half (45.2%, n=57) of the burins from this phase. This dominance subsequently declines incrementally across the following three assemblages, reaching their low point in Phase 2 (26.1%, n=21). This decline in truncation is mirrored by a gradual increase in the proportion of dihedral burin types between Phase 4 (11.9%, n=15) and Phase 2 (25.5%, n=40), where the two retouch modes occur in roughly even numbers. However, the proportion of truncation burins surges again in Phase 1 (45.8%, n=183), although this primarily corresponds with a decline in the 'double mixed burin' type between Phase 2 and 1, rather than a relapse in the proportion of dihedral burin types. The burins themselves exhibit a wide variety of sizes, ranging from 17.5 mm to 107.4 mm in length, although this variation has little diachronic or typological bearing.

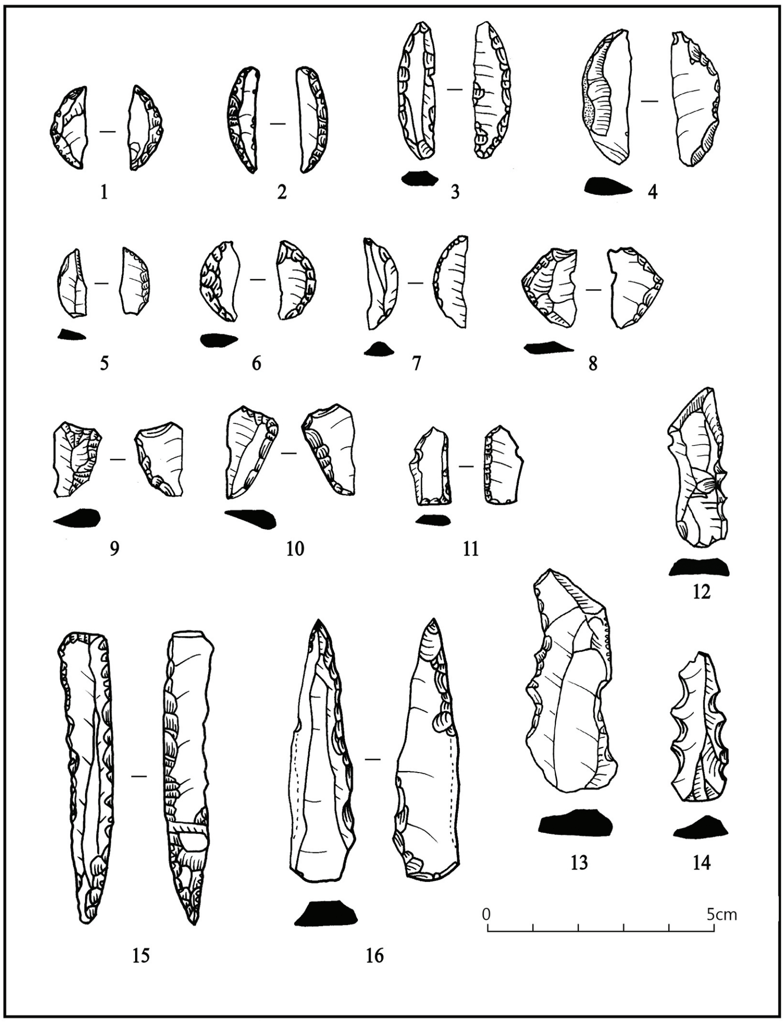
Retouched blades (Fig. 4:1–3) are consistently rare in the lower assemblages of Wādī al-Ḥammeh 27, with this tool group never reaching 2% of any tool assemblage between Phase 4 and 2. Conversely, the proportion of retouched blades was almost doubled in Phase 1 (3.8%, n=65). The 'Helwan blade' type is consistently represented in each assemblage. Pieces belonging to this type almost certainly represent composite sickle elements which happened to exceed 5 cm in length, a notion which is supported by their relatively gracile form compared to other artefacts in this tool group. Other blades, particularly those



4. Retouched blades and non-geometric microliths from Wādī al-Ḥammeh 27: 1. Blade retouched on both edges (Phase 2); 2. Inverse retouched blade (Upper Phase 3); 3. Helwan blade (Upper Phase 3); 4. Helwan bladelet (Phase 2); 5. Curved backed bladelet (Phase 2); 6. Narrow, curved, pointed backed bladelet; 7. Helwan bladelet (Phase 2); 8. Inverse bladelet (Upper Phase 3); 9. Inverse bladelet (Phase 2); 10. Convex truncation bladelet (Phase 2); 11. Obliquely truncated retouched bladelet (Upper Phase 3).

belonging to the 'blade retouched on both edges' type, represent some of the largest retouched pieces to be recovered from the site, and most likely served as handheld knives.

The proportions of non-geometric microliths (Fig. 4:4–11) remain largely static across the lower assemblages, ranging from 9.5% in Lower Phase 3 to 11.4% in Phase 2, before abruptly surging in Phase 1 (23.7%). Helwan bladelets remain the most common type across each assemblage, comprising around a quarter of each assemblage between Phase 4 (29.8%, n=31) and Upper Phase 3 (26.8%, n=64). This dominance of Helwan retouch subsequently rises in the



5. Geometric microliths, denticulated pieces, and awls from Wādī al-Ḥammeh 27: 1–3. Helwan lunates (Phase 2); 4–5. Inverse lunates (Phase 2); 6. Helwan lunate (Lower Phase 3); 7. Alternating lunate (Phase 2); 8. Isosceles triangle (Upper Phase 3); 9–10. Scalene triangles (Upper Phase 3); 11. Irregular microlith (Phase 2); 12–13. Denticulated pieces (Phase 2); 14. Denticulated piece (Lower Phase 3); 15. Helwan retouched awl (Phase 2); 16. Alternately retouched awl (Phase 2).

Phase 2 assemblage (39.8%, n=42), before becoming further emphasised in Phase 1 (47.5%, n=192).

Geometric microliths (Fig. 5:1–11) are the most common formal tool group in Phase 4 (15.9%), Lower Phase 3 (16.0%), and Phase 2 (21.2%). As with the non-geometric microliths, lunates with Helwan retouch are consistently the most commonly occurring type, albeit to an even greater extent than was seen with the microliths. The Helwan lunates further reflected their non-geometric counterparts in that a noticeable rise in their proportions occurred between Upper Phase 3 (61.9%, n=208) and Phase 2 (73.1%, n=147). Conversely, lunates with alternating retouch are found in their greatest proportions in the earliest two assemblages (14.9%–14.8%), before exhibiting a decline across Upper Phase 3 (9.2%) and Phase 2 (6.3%). Lunates with abrupt retouch are twice as common in Phase 1 than in any of the earlier assemblages—a notable find given that such lunates characterise most Late Natufian assemblages (Yaroshevich *et al.* 2013). Lunates at Wādī al-Ḥammeh 27 are overwhelmingly manufactured from bladelet blanks, with only two geometric microliths—an Upper Phase 3 irregular microlith and Phase 2 isosceles triangle—being conclusively identified as flake products.

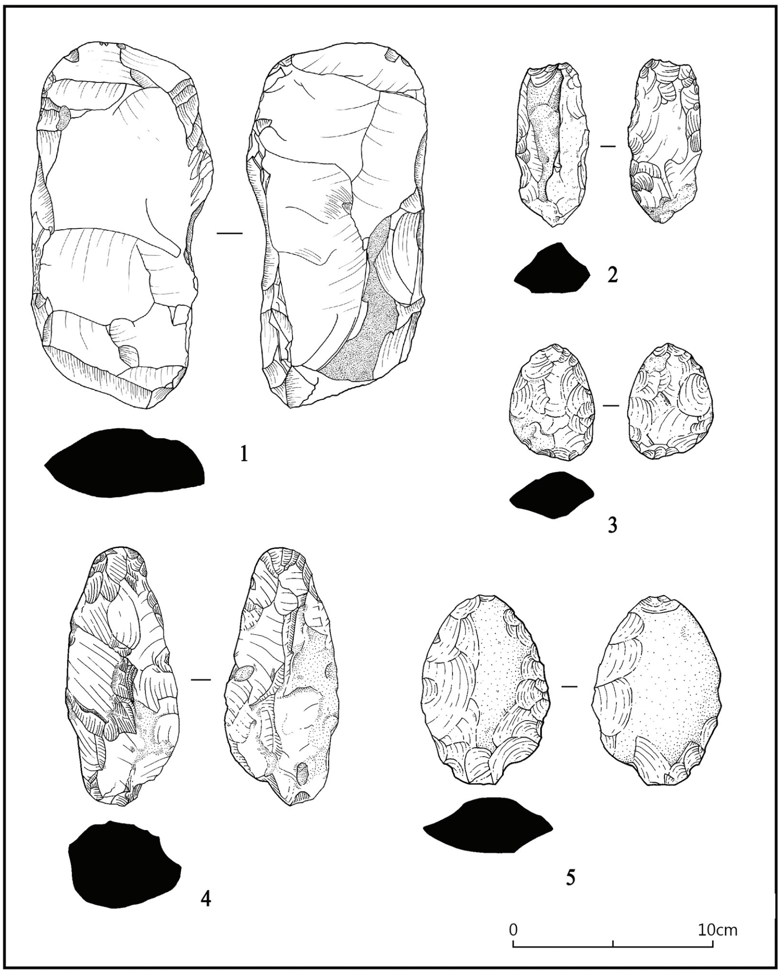
This being said, the blanks utilised for over one-third of the geometric microliths (40.6%) were listed as indeterminate due to the intensiveness of the retouch involved in their manufacture, and as such microflakes may have played a slightly larger role than it appears at face value.

The proportions of notched and denticulated pieces (Fig. 5:12–14) remains largely static over time, ranging between 11.5% (Lower Phase 3) and 15.6% (Phase 2) of each assemblage. The 'piece with small notch' types declines in prominence over time, being the most common type in this tool group between Phase 4 (40.2%, n=47) and Upper Phase 3 (31.9%, n=89), before declining to their lowest point in Phase 1 (7.5%, n=17). Denticulated pieces are instead the most common type in Phase 2 (35.8%, n=53), while pieces with multiple notches characterised Phase 1 (41.2%, n=94). This typological shift corresponds with an unambiguous change in blank selection, with flake preferred for the Phase 4 and 3 assemblages, before being surpassed by bladelet blanks in Phase 2.

Awls and borers (Fig. 5:15–16) occur in consistently low numbers throughout time at Wādī al-Ḥammeh 27, never exceeding 2% of any tool assemblage, with the overwhelming majority manufactured from blade (52.0%) or bladelet blanks (24.0%). While burin spalls are rarely utilised as blanks for retouched tools at Wādī al-Ḥammeh, a few examples are found in the form of a small number of 'trihedral awls' in the Phase 4 and 3 assemblages, which were retouched from all three facets in order to create a rounded bit.

The single most numerous tool group in each assemblage between Phase 4 and Phase 2 are the 'retouched fragments', which comprised between 20–30% of each lower assemblage at Wādī al-Ḥammeh 27. This tool group represents the pieces bearing retouch which are too fragmentary to be safely assigned to a formal type, including the 'broken retouched blade', 'broken backed blade', 'broken retouched bladelet', and 'broken backed bladelet types. Most are clearly microlithic in origin, and most likely reflect refuse from the maintenance of composite sickles and projectiles (Neeley and Barton 1994: 284; Shott 2007: 138)

Bifacial tools (Fig. 6) are rare at Wādī al-Ḥammeh 27, with only ten examples being recovered during the three seasons of renewed excavations. Of note was a large tranchet axe recovered from Upper Phase 3; the only example of this type to be recovered from the lower deposits of Wādī al-Ḥammeh 27. Measuring 19 cm in length and weighing over a kilogram, this was the second largest flaked stone artefact to be recovered from Wādī al-Ḥammeh 27, being only slightly outsized by a similar axe from Phase 1 (Edwards 2013c: 172). This artefact was discovered as part of the lower course of an elongated stone feature (Feature 6), providing a rare example of a flaked stone artefact being recycled as an architectural component, something that was mostly applied to groundstone artefacts at Wādī al-Ḥammeh 27. Also notable are two small, ovoid bifaces, from the Phase 4 and Lower Phase 3 deposits respectively. The pieces are unique in that they are the only artefacts to be manufactured from quartzite from the



6. Bifacial tools from Wādī al-Ḥammeh 27: 1. Tranchet axe (Upper Phase 3); 2. Pick (Lower Phase 3); 3. Irregular quartzite biface (Lower Phase 3); 4. Pick (Lower Phase 3); 5. Irregular quartzite biface (Phase 4).

entire Wādī al-Ḥammeh 27 ensemble, the lack of corresponding debris or debitage indicating that they were imported to the site as finished products. They are also the smallest bifaces to be recovered from Wādī al-Ḥammeh 27, with the Lower Phase 3 specimen being only 42 mm in length.

Evidence of Heat Treatment

The presence of dual lustre (a combination of lustrous and dulled flake scars) has been recognised as one of the most reliable means of identifying that an artefact has been heat treated (Delage and Sunseri 2004: 165; Domanski and Webb 2007: 156–8). Artefacts featuring dual lustre are particularly prevalent in the Phase 4 assemblage, where they comprised 7.5% of the analysed debitage sampled (Table 6). This proportion drops in the Phase 3 assemblages, before all but disappearing in Phase 2, where they comprise only 1.6% of the debitage. Conversely, the percentage of cores and retouched tools exhibiting dual

Table 6. Percentage of analysed artefacts featuring dual lustre.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2	
	No.	%	No.	%	No.	%	No.	%
Flakes	33	7.6	8	3.2	12	4.4	3	1.8
Blades	1	11.1	2	13.3	1	7.7	0	0.0
Bladelets	16	7.0	7	3.4	9	4.3	1	0.8
Core trimming elements	5	7.7	7	10.6	8	14.0	1	4.3
Total debitage	*55*	*7.5*	*24*	*4.5*	*30*	*5.4*	*5*	*1.6*
Cores	8	11.9	17	16.2	11	10.3	1	2.0
Retouched artefacts	22	6.5	29	6.9	25	6.4	3	1.3
Total	**85**	**7.6**	**70**	**6.6**	**66**	**6.3**	**9**	**1.5**

lustre remains largely static between Phase 4 and Upper Phase 3 assemblages, before abruptly plunging in Phase 2. These trends are consistent with the Phase 1 assemblage, where evidence of heat treatment was similarly limited (Edwards 2013c: 144).

These figures, of course, cannot be viewed as absolute measurements of the number of artefacts knapped from heat-treated cores, as the degree of core reduction intensity would have resulted in many heat-treated artefacts retaining none of the original, dulled surface from when the core was subjected to heat treatment. Furthermore, many of the cherts utilised at Wādī al-Ḥammeh 27 are fairly lustrous in their natural state to begin with. As such, the percentage of artefacts featuring dual lustre cannot be viewed as an absolute measurement of the number of heat-treated artefacts, but rather their lowest range. The decline in heat treatment at Wādī al-Ḥammeh is consistent with the broader archaeological evidence, with evidence of this technique being absent from most Late Natufian assemblages in the Jordan Valley (Delage and Sunseri 2005: 164). The apparent decline in the application of heat treatment between Upper Phase 3 and Phase 2 is curious, however, given that one of the primary benefits of heat treatments is to reduce the tensile strength of the raw material utilised (Patterson 1995: 72). This process would have thus significantly aided the knapping of gracile bladelets and the pressure flaking of Helwan retouch (Delage and Sunseri 2005: 164), both of which occurred in greater frequencies in Phase 2 compared to the underlying deposits.

Wādī al-Ḥammeh 27 in a Broader Context

The composition of the Wādī al-Ḥammeh 27 retouched artefact assemblages unsurprisingly bears the most resemblance to the toolkits from other large Early Natufian settlements situated between the Northern Jordan Valley and Mount Carmel (Table 7). The proportions of burins at Wādī al-Ḥammeh 27 are exceptionally high for an Early Natufian site (particularly in its later phases) with only Hayonim Cave exhibiting a larger proportion of this tool group. This fact is notable given that these two sites present the highest densities of carved and incised artistic artefacts for the

Table 7. Proportions of retouched artefact groups between assemblages, in percentiles.

	Wādī Hammeh 27 (Phases 3–4)	**Wādī Hammeh 27 (Phases 1–2)**	Ain Mallaha (IVa)	Azariq XV	Beidha (Area C-01)	Dederiyeh Cave (Phases 1–2)	El-Wad Terrace (Phases W-3–W-7)	Hayonim Cave (Phases 1–2)	Jeftelik	Tabaqa	Wadi Judayid 2	Yutil al-Hasa (Area D)
Scrapers	**3.0**	**4.6**	2.0	9.8	5.9	8.2	1.3	7.1	18.4	8.5	1.9	1.3
Multiple tools	**3.9**	**1.0**	0.6	0.9	1.1	0.0	0.2	3.7	0.0	0.4	0.3	0.3
Burins	**16.1**	**21.0**	10.2	2.3	6.4	2.5	14.3	28.3	3.6	2.6	3.1	5.6
Retouched blades	**1.2**	**2.9**	2.1	5.1	-	-	-	1.0	-	4.1	0.2	5.0
Truncations	**4.0**	**1.9**	3.0	0.9	8.1	1.3	2.5	2.1	3.6	3.0	5.2	2.3
Non-geometric microliths	**10.4**	**19.3**	16.3	22.3	5.4	26.4	16.1	16.2	14.5	25.2	2.9	28.5
Geometric microliths	**15.7**	**17.1**	9.7	25.6	27.4	41.5	21.2	7.0	15.8	30.0	60.5	21.2
Notched and denticulated pieces	**12.3**	**14.2**	13.9	23.7	15.0	8.2	2.9	5.0	3.6	12.2	9.6	17.5
Awls and borers	**0.8**	**2.0**	3.1	0.0	1.6	2.5	2.0	3.3	2.8	0.4	1.8	1.3
Bifacial tools	**0.2**	**0.4**	0.3	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0
Retouched flakes	**4.4**	**124**	3.3	0.9	9.1	6.3	38.6	14.9	32.1	8.9	14.5	9.9
Informal tools/ Varia	**0.5**	**4.7**	2.8	4.2	1.6	2.5	0.9	8.2	5.6	0.0	0.2	0.3
Retouched fragments	**27.5**	**9.9**	32.6	4.2	18.3	0.6	-	-	-	3.3	-	6.3
Artefact no.	**5,052**	**2,657**	1,764	215	186	159	3,613	1,876	468	270	651	302
Reference	-	-	Valla 1984: 40–42	Goring-Morris 1987: 488–489	Byrd 1989: 53	Nishiaki *et al.* 2017: 16	Kaufman *et al.* 2015: 148	Belfer-Cohen 1988: 80	Rodríguez *et al.* 2013: 67	Olszewski 2013: 420–421	Henry 1995: 324	Olszewski 2013: 420–421

Early Natufian period (Major 2018: 138), suggesting that burins were regularly utilised for the manufacture of these pieces at both sites. The proportions of burin spalls in the Wādī al-Ḥammeh 27 debitage assemblage are also consistent with other assemblages with large burin assemblages (Valla 1984: 34; Belfer-Cohen 1988: 70; Kaufman 2015: 148), indicating the burins themselves were routinely manufactured onsite.

The proliferation of small-medium unretouched flakes in assemblages where bladelets were favoured as blanks for tools is a phenomenon well attested to in the Late Epipalaeolithic Levant (Byrd 1988: 260; Byrd and Colledge 1991: 267). Assemblages from similar architectural Early Natufian sites in the Jordan Valley and along the Mediterranean coastline are likewise numerically characterised by flakes (Valla

Table 8. Debitage ratios from various Early Natufian assemblages (rounded).

	Debitage no.	Core no.	Tool no.	Cores: debitage	Tools: debitage	Cores: tools
Wadi Hammeh 27 (XX D Phase 1)	**39,510**	**368**	**1,707**	**1:107**	**1:23**	**1:5**
Wadi Hammeh 27 (XX F Phases 2–4)	**119,447**	**872**	**6,002**	**1:137**	**1:20**	**1:7**
ʿAin Mallaha	11,496	142	1,764	1:81	1:7	1:12
Beidha (Area C-01)	2,025	42	186	1:48	1:11	1:4
El-Wad (Phases W-3–W-7)	47,171	1,191	3,613	1:40	1:13	1:3
Dederiyeh Cave (Phases 1–2)	934	28	159	1:33	1:6	1:6
Hayonim Cave (Phases 1–2)	14,902	753	1,876	1:20	1:8	1:2
Tabaqa	5,391	62	270	1:87	1:20	1:4
Wadi Judayid 2	12,107	209	651	1:58	1:19	1:3
Yutil al-Hasa (Area D)	2,857	44	302	1:65	1:9	1:7

1984: 34; Belfer-Cohen 1988: 70; Kaufman *et al.* 2015: 148). While it is possible that some of these were retroactively selected to serve as expedient cutting tools (Holdaway *et al.* 2015: 46–7) as was the case with slightly under 10% of the Early Natufian flakes from Ain Mallaha (Valentin *et al.* 2013: 222), it seems most likely that the majority of these pieces were simply unwanted refuse, and further attest to the widespread lack of refuse disposal in the Early Natufian period.

The core to debitage ratios at Wādī al-Ḥammeh 27 are extremely high compared with other Early Natufian sites (Table 8), with ʻAyn Mallaha exhibiting the second highest ratio (1:80) for an architectural site. Conversely, the core to debitage ratios at al-Wad Terrace (1:40) and Hayonim Cave (1:20) were notably lower. This variation may be indicative of considerable inter-site variation in core reduction intensity, different refuse disposal strategies, or a combination of the two factors.

The inter-assemblage consistency at Wādī al-Ḥammeh 27 is curious in the case of the Phase 4 assemblage, wherein the same range of knapping activities were carried out in order to manufacture a largely similar range of tools, despite the complete absence of lithified domestic architecture seen in subsequent phases. It is possible that Wādī al-Ḥammeh 27 served much the same function in Phase 4 as sites like Kebara Cave or Late Natufian Nahal Oren, which likewise exhibit burial grounds accompanied by thick artefact deposits indicative of a significant domestic occupation (Bocquentin and Bar-Yosef 2004: 20–1; Grosman *et al.* 2005: 17). Alternatively, it is entirely possible that main Phase 4 domestic settlement is located slightly outside the limited sample area, with this settlement being either reorientated or expanding in size to encompass the area of the XX F cemetery in later phases.

Blade and bladelet based assemblages have been associated with mobile, rotational hunter-gatherer economies due to their low weight and ease of retouch into a wide range of tools (Delage 2005). Likewise, numerous studies have advocated for a positive relationship between a ready access to high quality raw materials and the utilisation of informal knapping strategies (Parry and Keely 1987; Andrefsky 1994) or the production of expedient, unhafted tools (Keeley 1982: 803). Such models are clearly not applicable to the archaeological situation at Wādī al-Ḥammeh 27, however, with the increased reliance on bladelet cores in the latest two phases instead coinciding with increased levels of architectural permanence, while no evidence exists for a restricted access to the high-quality cherts favoured for knapping. Instead, this increased production of bladelet cores was most likely driven by a functional prerequisite for the creation of hafted tools (Jeske 1989: 36), in this case composite sickles. At the same time, this shift in targeted blank production would not have hindered their hunting capacity to any large extent, as evidenced by the increased proportion of lunates identified as bladelet products in the later phases.

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Soil Micromorphological Investigation of Trampled Floors at Early Natufian site Wādī Ḥammeh 27, Jordan

Introduction

The Early Natufian period witnessed intensified settlement persistence compared to previous periods. Closely associated with this is an increase in frequency and variety of material culture, including dwellings of stone, a high frequency of ground stone artefacts, burials, *objets d'art*, and personal ornamentation such as shell beads and pendants of stone and bone (Richter *et al.* 2017). The explosion of material culture in this period indicates nuanced activities were undertaken on a daily basis, unintentionally leaving archaeological remains such as architecture and artefacts, as well as microscopic residues, within the sediment for us to identify and interpret; making a 'social interpretation of sedimentation . . . just as necessary as a social view of the artefacts contained [with]in the soil' (Gosden 1994: 193). More frequently, sediments are investigated as an additional type of material culture, 'which are shaping and being shaped by human behaviour' (Matthews 2010: 109).

Sediments are an archive constantly capturing residues of past human activities and can be viewed as artefacts in and of themselves. Activities repeated on a daily basis, and more ephemeral activities or those rarely practiced, can subsequently be identified, analysed, and interpreted using geoarchaeological techniques to investigate archaeological sediments. Techniques allowing us to view mesoscale and microscale components simultaneously with sediment structures are best suited to these tasks. The aim of this research is to apply high-resolution analysis of microstratigraphic sequences to evaluate macroscale identifications of floors at Wādī Ḥammeh 27. Excavations at Wādī Ḥammeh 27 were renewed for three seasons beginning in 2014 and finishing in 2016 under the "Ice Age Villagers of the Levant: Sedentism and Social Connections in the Natufian

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Period" (IAV) project. The directors include Phillip Edwards (La Trobe University), Louise Shewan (Monash University/ University of Warwick), and John Webb (La Trobe University). Geoarchaeological sampling was undertaken during November of the 2016 field season. Archaeological micromorphology was applied to investigate and characterise the sediments and microstratigraphy to identify whether microscopic floor and trampling characteristics were present.

Archaeological micromorphology provides microscale descriptions of archaeological sediments and microstratigraphy and is undertaken with the aim of reconstructing both depositional and post-depositional processes and archaeological events (Courty *et al.* 1989; Stoops 2003; Goldberg and Macphail 2006; Mallol *et al.* 2007; Ayala *et al.* 2007; Stoops *et al.* 2010). The technique involves the observation of *in situ* samples where texture, orientation, vertical, and horizontal relationships of constituents on thin section slides are described and interpreted (Courty *et al.* 1989). Detailed analysis of primary and secondary formation processes of each micro-stratum is important to provide a holistic understanding of site formation (Goldberg and Macphail 2006). More generally, micromorphological investigations of floors and occupation surfaces have provided important information on human behaviour (Courty *et al.* 1989; Gé *et al.* 1993; Matthews and Postgate 1994; Matthews 1995; Matthews *et al.* 1996, 1997; Boivin 2000; Tsatskin and Nadel 2003; Wattez 2012; Stahlschmidt *et al.* 2017; Tsatskin *et al.* 2017; Maher 2018).

Occupation surfaces can either be specifically constructed as floors or develop as unconstructed surfaces, that is to say, as trampled surfaces developed over culturally accumulated deposits and/or bodies of natural sedimentation (Gé *et al.* 1993). Different human behaviours produce each surface type. Trampled occupation surfaces and floors have received significant attention in the literature because micromorphology permits high-resolution examination of activities and traces preserved on ancient surfaces. On the microscale, trampling and human activity causes redistribution and parallel orientation of longer or elongated components—*i.e.*, the orientation and inclination of components are realigned by repetitive movement (Schiffer 1985).

Trampled surfaces in moist sediments are frequently identified in thin section using a series of structures including compaction; parallel bedding of larger micro-components with the underlying surface; sub-horizontal fissures; an embedded related distribution; vertical patterns in variety, size, and frequency of micro-fragments of cultural material; pressure fractured cultural components; and unsorted deposits with random orientation of components resembling a gravity flow deposit (Davidson *et al.* 1992; Gé *et al.* 1993; Matthews *et al.* 1997; Macphail and Goldberg 2010, 2018; Rentzel *et al.* 2017; Karkanas and Goldberg 2019). Conversely, well-expressed porous microstructure comprised of pellet-shaped aggregates separated by especially wide pores has been attributed to trampling of sediments in dry conditions (Stahlschmidt *et al.* 2017; Weinstein-Evron *et al.* 2018). However, compaction and a pelletal microstructure could also be indicative of bioturbation. Secure identifications of trampled surfaces require the presence of several of the above criteria to be present in the one feature. Differentiating between trampled surfaces and the later bioturbation of a deposit is complex and much additional work is required to investigate this issue.

Very few archaeological micromorphological studies of Natufian sites and features have been published to date (Goldberg 1979; Goring-Morris *et al.* 1999; Weinstein-Evron *et al.* 2007, 2018; Nadel *et al.* 2008, 2013; Colleuille 2012; Wattez 2012; Stahlschmidt *et al.* 2017; Tsatskin *et al.* 2017). The majority of these have largely concentrated on caves, rockshelters, and sites located upon terrace landforms outside cavemouths, rather than open-air encampments. A targeted micromorphological investigation of surfaces at Saflulim is the one published exception (Goring-Morris *et al.* 1999). Wādī Ḥammeh 27 is now the first such settlement located in the Mediterranean zone of the southern Levant to undergo such an enquiry. Micromorphology is applied as a microscale yardstick for the characteristics of the three specific trampled surfaces identified during excavation of the XX F Sondage (Floors 2.5, 2.6=2.7, 2.8; Table 1; see Fig. 3: 1), and indeed investigate whether further occupation surfaces exist, which might not have been readily visible during excavation. The present study corroborates field identification of occupation deposits and two (Floors 2.6 and 2.8) of the three trampled floors (Floors 2.5, 2.6=2.7, 2.8) identified within the eastern profile of Plot XXF by applying archaeological micromorphological analysis to reconstruct depositional history.

Background

There were four distinct occupation phases at Wādī Ḥammeh 27, an Early Natufian base-camp site in northwest Jordan dating to 12,500 to 12,000 years cal BC. Each phase was constructed upon the location of the previous one, demonstrating considerable intergenerational memory within the 500-year occupation period and the importance of place at Wādī Ḥammeh 27 to Early Natufian cultural groups (Edwards 1989). After three construction phases, overlying the fourth and earliest burial phase, Natufian occupation at Wādī Ḥammeh 27 ceased. Early Natufian archaeological deposits at Wādī Ḥammeh 27 have not been disturbed by subsequent human occupation of the site, making it essential to studies of both the Early Natufian period and the origins of sedentism in the Levant.

During excavation and subsequent analysis, Hardy-Smith and Edwards (2004) identified six trampled surfaces within the stratigraphy of Wādī Ḥammeh 27. These were identified using seven macro-scale characteristics including: sediment compaction, sediment colour, architectural features resting upon surfaces, artefact clusters resting on surfaces, bedded artefacts parallel with the surface, increase in artefact diversity, and an increase in artefact frequency. Floors identified within Plot XXF Sondage include the Occupation Phase 1 floor (Floor 2.3), Occupation Phase 2 floor (Floor 2.5), Occupation Phase 3 floor (Floor 2.6=2.7), and Phase 4 (Floor 2.8).

Edwards (2013) described the Phase 2 floor (Floor 2.5) as a grey clay deposit of variable hardness which was more compacted than the Phase 1 floor (Floor 2.3). Heavy artefacts were also scattered atop the surface of Floor 2.5. The Phase 3 floor (Floor 2.6) was bedded immediately underneath the Phase 2 Floor. It was located in the northern part of the sondage only and is synonymous with Floor 2.7. Floor 2.6 was comprised of a dry, grey crumbly deposit produced from weathered travertine rock combined with trampled sediments. The travertine surface was uneven; clay deposits and detritus infilled depressions and provided a relatively even surface. The Phase 3 surface (Occupation Surface 2.7=5.2)—located in the southern part of the sondage—comprised dark humic clays. Numerous stones and boulders including stone rings (Features 12 and 13) were on the surface. Floor 2.8 is the Phase 4 travertine bedrock at the base of Wādī Ḥammeh 27.

Constructed floors of limestone gravel, rudimentary lime plaster, and imported orange silty clay have been identified using micromorphology at Early and Late Natufian sites. Both gravel and rudimentary plaster floors were identified at El Wad

Table 1. Wadī Ḥammih 27 micromorphological (thin section) sample data and preliminary interpretations of Floors 2.5, 2.6=2.7, and Floor 2.8.

Phase / Locus (Context)	Thin section (relative depth); preliminary interpretation	Inside/ Outside
Phase 2 Floor 2.5	XXF10.1 0–7/18 mm: thin layer of redeposited sandy sheet wash.	Inside Structure 1
	XXF10.2 7/18–75 mm: Calcareous silty clay supporting flint, shell, bone, charcoal, geogenic calcareous components, and basalt fragments. Occupation deposit resembling a gravity flow deposit with some horizontal bedding of larger flint fragments. Larger flint fragments.	
	XXF11 0–75 mm: Very heavily bioturbated (floral and meso-faunal) occupation deposit. Calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments. Green autofluorescence possibly indicates flavins or phosphorous in the sediment. Smaller archaeological components.	
	XXF12 0–75 mm: Heavily bioturbated (floral and meso-faunal) occupation deposit. Calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments.	
	XXF13 0–75 mm: Very heavily bioturbated (floral and meso-faunal) occupation deposit. Calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments. Larger archaeological components lacking bedding.	
Phase 3 Floor 2.6=2.7	XXF14.1 0–25 mm: Calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments. Occupation deposit resembling a gravity flow deposit with some horizontal bedding of larger flint fragments. Bedded, large flint fragment. XXF14.2 25–50 mm: Granular micro-structured (trampled?), calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments. XXF14.3 50–75 mm: Calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments. Occupation deposit resembling a gravity flow deposit with some horizontal bedding of larger flint fragments. Bedded, calcareous boulder (referred parallel with base of micro-stratum and bedded flint in XXF14.1 – Floor?).	Outside Structure 3
Phase 4 Floor 2.8	XXF18.1 0–59 mm: Very heavily bioturbated (floral and meso-faunal) occupation deposit. Calcareous silty clay supporting flint, shell, charcoal, geogenic calcareous components, and bone fragments. Larger archaeological components frequently horizontally bedded. XXF18.2 59–75 mm: Travertine bedrock. Micrite cemented packstone – Trampled, natural bedrock floor surface. XXF18.3 59–75 mm: Compacted, calcareous silty clay supporting silt sized flint and bone fragments and geogenic calcareous sand. Organic residues trampled into the surface and dusty coatings atop the surface – Floor.	Outside Structure 3

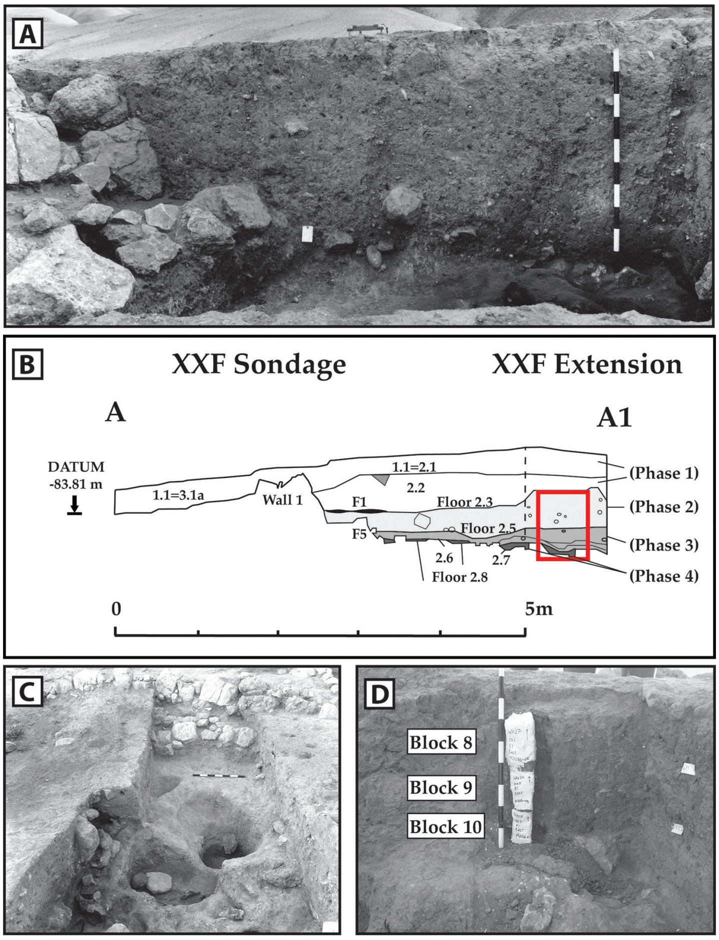
Terrace (Tsatskin *et al.* 2017; Weinstein-Evron *et al.* 2018). Phosphatic crusts on the underside of gravels from Early Natufian sediments were used to identify the floor (Tsatskin *et al.* 2017). A very disintegrated "dirty" calcareous material, preserved within post depositional infilling of microsparite and sparite, in Square N6 of Unit 2 (also an Early Natufian deposit) was identified as rudimentary plaster (Weinstein-Evron *et al.* 2018: 27). People during the Early Natufian period had knowledge of the process of producing quick lime for plaster. A hearth structure within Hayonim Cave contained a "... 20 cm thick-layer of white porous material" and was interpreted as a lime burning kiln during excavation (Kingery *et al.* 1988: 223). Saflulim, a Late Natufian base camp, provides another example of a constructed plaster floor. Sample SF L20a 175 contained quartz and calcareous silts with a lower proportion of coarse and fine charcoal and bone fragments are absent. The material was denser than the occupation deposit, containing little porosity and was identified as a rudimentary plaster floor, one of the earliest plaster floors in the region (Goldberg and Goren in Goring-Morris *et al.* 1999: 58–60). At Baaz rockshelter, (a Late Natufian site in Syria), an example of intact constructed floors within unit GH 3b.2- showed little sign of bioturbation or other post-depositional alteration and were composed of imported orange silty clay (Stahlschmidt *et al.* 2017). These examples provide increasing insight into the complexity of construction activities undertaken during the Natufian period.

These Natufian constructed floors can be juxtaposed with a sequence of overlying and non-constructed trampled surfaces at Late Natufian Hayonim Terrace (Wattez 2012) and within Early Natufian Hayonim Cave (Goldberg 1979). Cyclical couplets of occupation sediments containing general refuse, and either immediate (no post-depositional alteration) or delayed (indicated by significant meso-faunal burrowing) trampling of these sediments dominate microstratigraphy at Hayonim Terrace (Wattez 2012). It would be interesting to see if the microstratigraphy within Wādī Ḥammeh 27 shares similarities with that within Hayonim Terrace. However, due to infrequent micromorphological investigations of Natufian sediments, a somewhat restricted pattern of occupation habits only hints at geographical differences. Additional micromorphological investigations are required to provide a more complete interpretation of patterns in Natufian floor construction and trampled occupation surfaces. By applying archaeological micromorphological analysis to reconstruct depositional history, this study investigates field identifications of a series of trampled occupation floors at Early Natufian Wādī Ḥammeh 27.

Samples and Method

In order to to evaluate field identifications of trampled floors (Edwards 2013), geoarchaeological sampling was undertaken at the eastern profile of the Plot XXF Sondage during the 2016 field season (see Fig. 3:2). To clarify, this sampling location was originally excavated during the 1980s and was subsequently reported upon by Edwards (2013), unrelated to the sediments from the 2014–2016 excavations described in Edwards (this volume). The eastern profile of the Plot XXF Sondage was chosen as the sampling location because it was the only place where the site was excavated to bedrock, so it contains a full sequence of layers and phases (Phases 2, 3, and 4, below the previously excavated Phase 1), including the series of trampled, occupation floors (Floors 2.5, 2.6=2.7 and the travertine surface: Floor 2.8). Edwards and colleagues (2018) provide a more detailed account of the geoarchaeological sampling methods applied at Wādī Ḥammeh 27.

A total of nine thin sections, measuring 55 × 75 millimetres, were prepared from three oriented blocks (Blocks 8, 9, and 10) extracted from the eastern profile of the Plot XXF Sondage (Table 1 and Fig. 1). Thin sections were scanned in plane polarised (PPL) and crossed polarised light (XPL) using an Epson v700 'Photo-scanner'

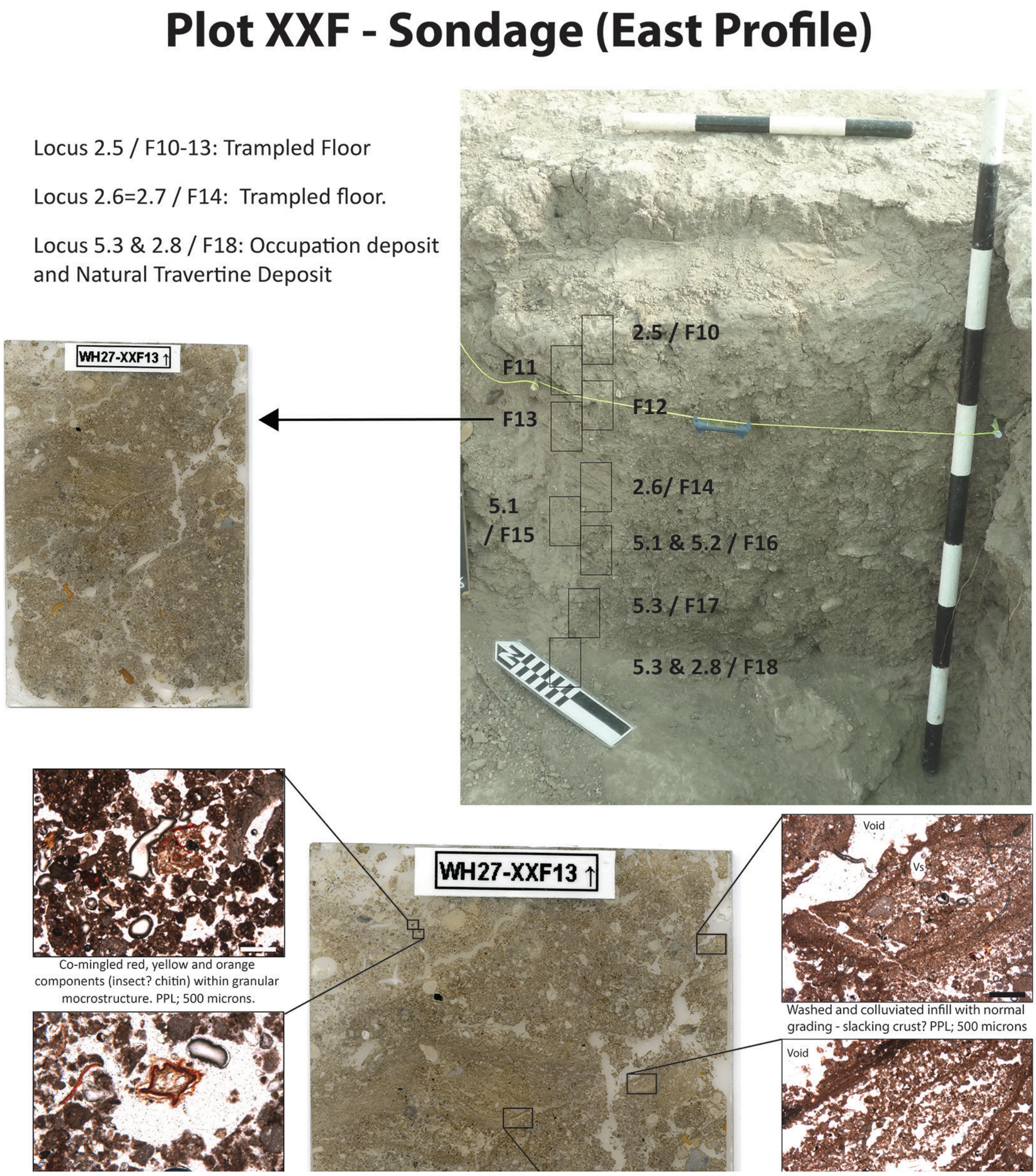


1. a) Eastern profile of Plot XXF sondage after the 1980s excavation (used with permission Edwards 2013b: 48 fig. 3.19), b) Stratigraphy of east profile of the Plot XXF – Sondage with the sampling location marked in red (redrawn from Edwards 2013b: 48), c) Used with permission Edwards 2013b: 53 fig. 3.30, and d) Eastern profile during geoarchaeological sampling of Blocks 8–10.

(Arpin *et al.* 2002) and were examined with both Olympus CX31 and Zeiss A1 Scope. The microscopes were set at magnifications between × 20–400 under Plane-Polarised Light (PPL), Crossed-Polarised Light (XPL), ultraviolet (UV), and Ordinary Incident Light (OIL). Micromorphological features were photographed using a mounted AutoCam MRc5 camera. Thin sections were described, ascribed microstratigraphic units (MSUs) and deposit types (DTs), and counted using established methods (Bullock *et al.* 1985; Courty *et al.* 1989; Stoops 2003; Goldberg and Macphail 2006).

Results

Even though a full profile of thin section samples was taken (samples XXF10 to XXF18), only those pertaining to the investigation of the floors identified during excavations will be reported upon here (samples XXF10 to XXF14 and XXF18). In the eastern profile, four trampled floor surfaces were identified on the macroscale



2. Location of samples from Floor 2.5, eastern profile of the Plot XXF Sondage, Wadī Ḥammih 27. Floral and meso-faunal turbation is presented within the microphotograms. A slacking crust infills a prominent channel void.

which were associated with Occupation Phases 2, 3, and 4 (Fig. 1).

Using sediment micromorphology, the trampled travertine surface (Floor 2.8, associated with the Lower Phase 3 occupation) was securely identified. The Phase 2 (Floor 2.5) and Phase 3 (Floor 2.6=2.7) were not securely identified on the microscale. Floor 2.3 was not relocated in thin section as Phase 1 occupation deposits were excavated away during the 1980s. Deposits within the eastern profile of Plot

XXF have undergone significant secondary mixing by occupation, reoccupation, and subsequent floralturbation and meso-faunalturbation as well as seasonal shrink swell processes. Significant transportation of sediment down through chamber and channel void systems is also observed and is concentrated within the top 470 millimetres of the eastern profile. The following results are initial results only and selected results are presented in Table 1.

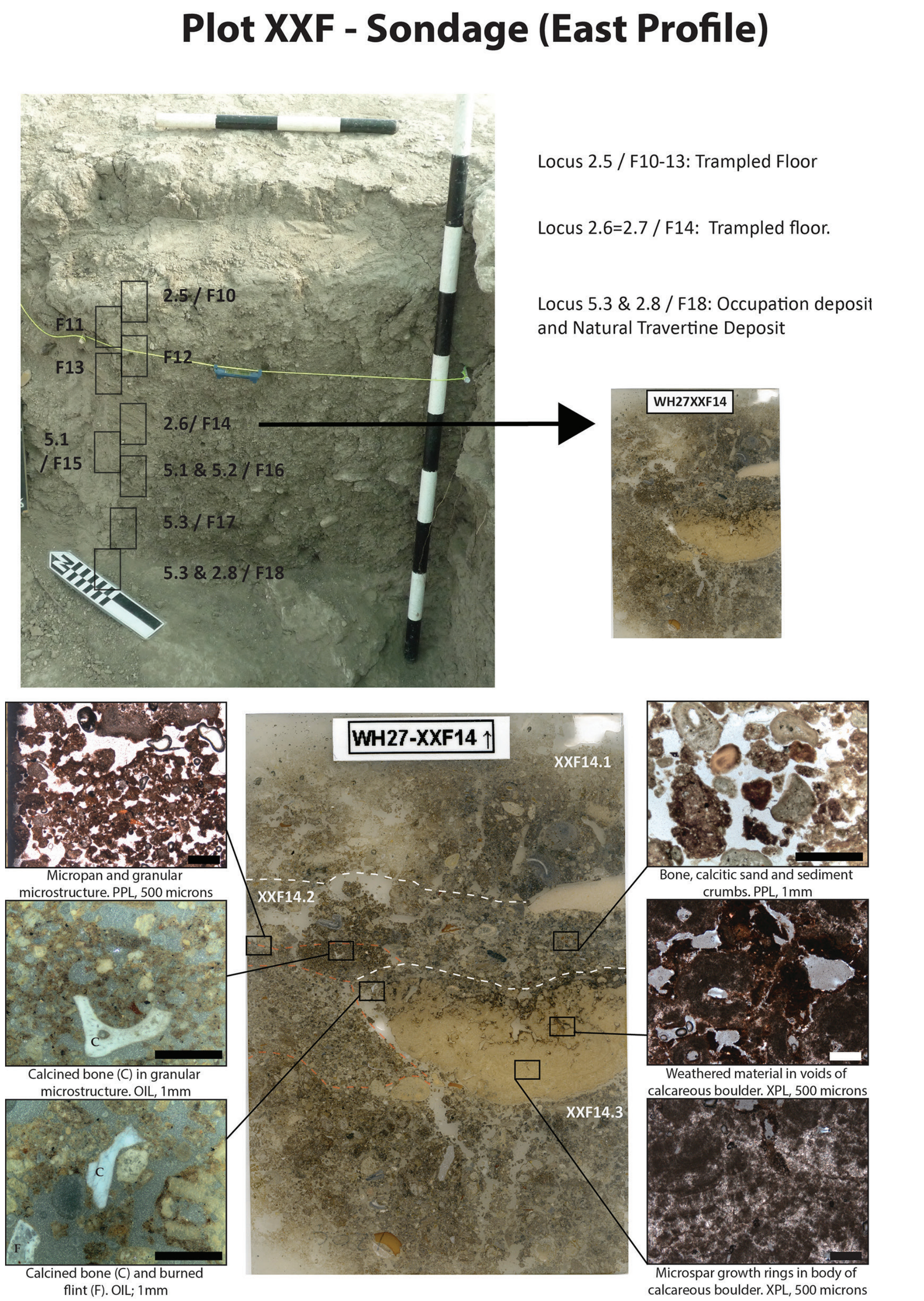
Plot XXF—Sondage, Eastern Profile, Floor 2.5 (Samples XXF10, XXF11, XXF12 and XXF13; MSUs XXF10.1, XXF10.2, XXF12.1, and XXF13.1)

Samples XXF10, XXF11, XXF12, and XXF13 were taken from Floor 2.5 (Fig. 2). These samples revealed complex microstratigraphy heavily altered by post depositional processes, including floralturbation, meso-faunalturbation, and seasonal shrink-swell processes, and water has transported silts down through the profile creating slacking crusts and coatings on void walls. Floor 2.5 is characterised by calcitic pebbles and sands as well as archaeological material embedded with calcitic silty clays. Archaeological material includes fragments of flint, shell, bone, charcoal, and fine igneous rock—basalt (exotic to the area and a fragment of a grindstone). Microstratigraphy within Floor 2.5 is comprised of four units (MSUs XXF10.1, XXF10.2, XXF12.1, and XXF13.1). Each microstratigraphic unit has a different microstructure; however, granular and crumb structures are present throughout. A thin, recent sheet wash deposit overlies the archaeological site and is comprised of redeposited calcitic sands (MSU XXF10.1).

A distinct pattern in artefact size is observed within the microstratigraphy of Floor 2.5. Micro-fragments of archaeological material are larger in the lowest microstratigraphic units (XXF12.1 and XXF13.1). Increased size of artefacts is indicative of more intense occupation. Archaeological material decreases in size moving upwards through MSU XXF11.1 and increase in size again in MSU XXF10.2. Due to plant rooting, meso-faunal burrowing and shrink/swell processes, archaeological material has mixed orientations and is mostly referred parallel with voids; very few flint and bone components are referred parallel with the underlying contact with Floor 2.6. A trampled surface was not securely identified within the microstratigraphy. Even though the microstratigraphy within Floor 2.5 has an embedded related distribution (is matrix supported); vertical patterns in size, variety, and frequency of archaeological components are observed; and some components are referred parallel with the underlying contact with Floor 2.6. Other important indicators of trampling—such as sub-horizontal fissures and dusty crusts—were absent. This is probably due to the significant post-depositional alteration to the deposit. Microstratigraphic evidence does not securely support the field identification of Floor 2.5.

Plot XXF—Sondage, Eastern Profile, Floor 2.6=2.7 (Sample XXF14; MSUs XXF14.1, XXF14.2, and XXF14.3)

Sample XXF14 was taken from Floor 2.6 (Fig. 3). The microstratigraphy within this sample illustrated moderate to significant post-depositional alterations including floralturbation and transported calcitic sandy sediments downward through the profile, infilling channel voids. Floor 2.6 is characterised by calcitic pebbles, a single boulder (using the Wentworth scale: between 4096 and 256 mm in length) and sands as well as archaeological material embedded with calcitic silty clays. Archaeological material includes burnt and unburnt fragments of flint, shell, bone (both burnt and calcined), and rare charcoal. Components are poorly to moderately



3. Location of sample XXF14 from Floor 2.6=2.7, eastern profile of the Plot XXF Sondage, Wadī Ḥammih 27. Post depositional alteration to Floor 2.6=2.7 includes micropans, granular structure within void infill. A weathered surface of the calcareous boulder is illustrated and internal growth rings within the component. Calcined bone and blackened calcareous components are present.

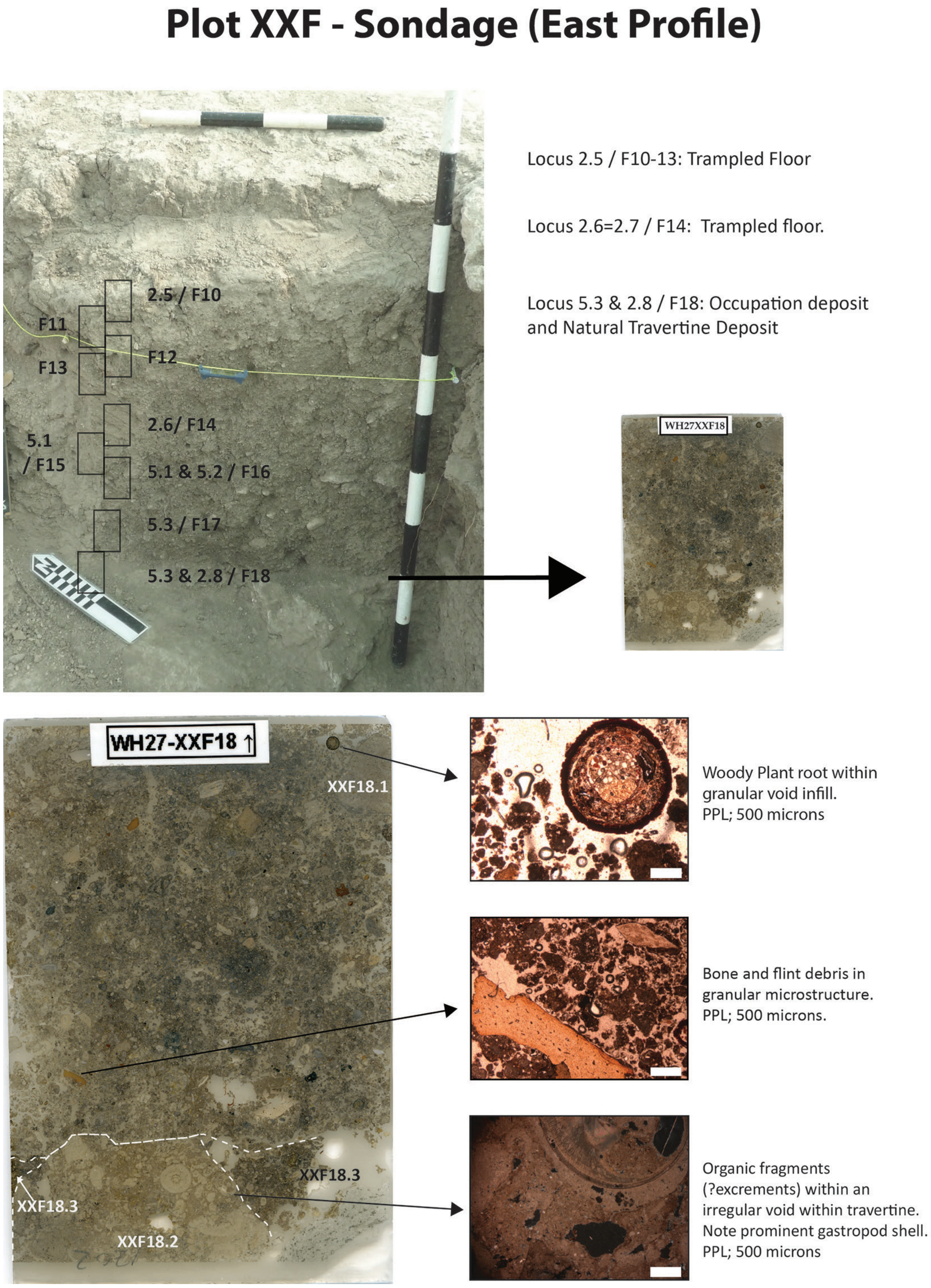
sorted within Floor 2.6. Microstratigraphy within Floor 2.6 is comprised of three units (MSUs XXF14.1, XXF14.2, and XXF14.3). Microstratigraphic units XXF14.1 and XXF14.2 are occupation deposits atop XXF14.3. The microstructure of the microstratigraphic units within Floor 2.6 are complex and composed of granular, crumb, and compound packing microstructures. The probable trampled surface of Floor 2.6 (MSU XXF14.3) is indicated by a prominent, horizontally bedded, limestone boulder. The upper surface of the boulder is weathered, and darker brown, compacted silty clay immediately overlies the boulder (MSU XXF14.2). This is, in turn, overlain by a horizontally oriented and bedded flint micro-fragment—the largest within this profile (within MSU XXF14.1).

Microstratigraphic unit XXF14.3—the bottom of Floor 2.6—was earmarked as a possible trampled floor based upon the presence of microscale characteristics including referred parallel bedding of large components and parallel bedding of these large components with the underlying contact with Locus 5.1 (MSU XXF15.1). Increased size and frequency of flint fragments within the overlying microstratigraphic unit (MSU XXF14.1) and the weathered upper surface of the limestone boulder were also taken into consideration. Floor 2.6 has a complex, open microstructure dominated by crumb and granular structures separated by compound packing voids. Stahlschmidt *et al.* (2017) used the open and aggregated microstructure at Baaz Rockshelter as a characteristic of trampling. The granular microstructure within Floor 2.6 is restricted to void infill. Sub-horizontal fissures (often used to identify trampling) are absent. Floor 2.6 has been subject to significant microscale post-depositional alteration. Hence, the more indicative characteristics of trampled surfaces (*i.e.*, crusting, organic residues trampled into the surface, and sub-horizontal fissures) are absent or microscale homogenization of Floor 2.6 has removed them. In this instance, micromorphology could not securely support the field identification of Floor 2.6.

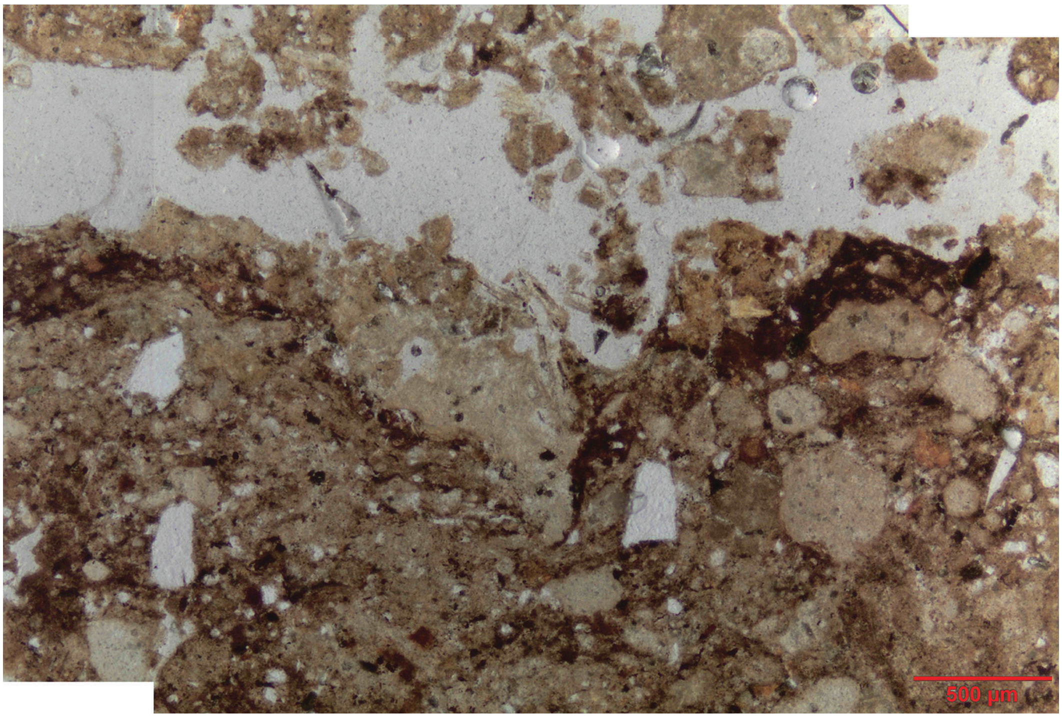
Plot XXF—Sondage, Eastern Profile, Floor 2.8 (Sample XXF18; MSUs XXF18.2, and XXF18.3)

Sample XXF18 was taken from Floor 2.8 (Fig. 4). The surface of the travertine within Floor 2.8 is undulating on both the macroscale and microscale. Undulations are filled with compacted Natufian grey clays, creating a level surface. The Natufian grey clay within these undulations was allotted microstratigraphic unit number XXF18.3. The travertine was assigned microstratigraphic unit number XXF18.2. These two microstratigraphic units are contiguous with one another at the bottom of the profile. Incipient iron hypo-coating on voids within the travertine (MSU XXF14.2) is present within millimetres of this trampled surface. Meso-faunal burrowing and excrements are observed close to the surface of the travertine (MSU XXF18.2). The structure of travertine within MSU XXF18.2 is a grain supported packstone comprised of calcitic granules and sand-sized components as well as gastropod shells all embedded within a micritic mud. Layered silt-sized flint and bone fragments and calcareous sand are embedded within compacted Natufian Grey Clay indicative of aeolian deposition. Sediment within Locus 5.3, immediately overlying Floor 2.8, peels away easily from the compacted surface visible in Sample XXF18 (Fig. 5). Microscopic black organic residues and thin dusty coatings are referred parallel with the surface of Floor 2.8 (within microstratigraphic unit XXF14.3).

Several microscale indicators of trampling are present within the surface of Floor 2.8. These include dusty crusts, referred parallel bedding of blackened organic



4. Location of sample XXF18 from Floor 2.8, eastern profile of the Plot XXF Sondage, Wadī Ḥammih 27. Natural Travertine rock and trampled occupation floor. Microstratigraphic units (MSU) are labelled on thin section XXF18.



5. Thin section sample XXF18, MSU XXF18.3. Detail of the trampled surface with blackened organic residues, dusty crusting and the upper deposit (Locus 5.3) lifted away from the compacted surface (PPL).

material, compaction—the overlying occupation deposit (Locus 5.3) peels away—and layered deposits infilling undulations (Fig. 5). Based upon the presence of these more telling characteristics of trampling, the identification of Floor 2.8 as a floor during excavation was corroborated by microscale evidence. During the 2014–2016 excavations, it became clear that the thin section samples taken from the eastern profile of the Plot XXF sondage are from outside the Phase 3 Structure 3 but inside Phase 2 Structure 1. The sediment samples did not have the same protection from weather and natural post-depositional processes.

Trampled Living Floors

Matthews *et al.* (1997) used criteria including embedded related distributions (matrix supported deposits), horizontal bedding and parallel distribution with the underlying deposit base to identify occupation deposits on floors in three Bronze Age tell sites in Southwest Asia. The majority of microstratigraphic units within the eastern profile of the Plot XXF sondage have embedded related distributions, weak to moderate parallel bedding with the base of deposits, and have linear distribution. Micro-artefacts are also present within most microstratigraphic units overlying the travertine (MSU XXF18.2). These structural criteria were applied here to identify MSU XXF10.2, XXF11.1, XXF12.1, XXF14.1, and XXF14.2 as occupation deposits. Components within these microstratigraphic units are unsorted and randomly distributed, resembling a gravity flow deposit. Karkanas and Goldberg

(2019) identified that occupation deposits and trampled living floors resemble these natural deposits. Trampling and human activity caused redistribution and parallel orientation of longer or elongated components—*i.e.*, the orientation and inclination of components were realigned by repetitive movement (Schiffer, 1985). Larger components (flint, bone, a calcareous boulder, and granules) within XXF14.1 and XXF14.3 have horizontal orientation and parallel bedding due to trampling (Rentzel *et al.* 2017).

Occupation surfaces should demonstrate characteristics of trampling and intensified accumulation of artefacts and other vestiges of human origin upon them (Karkanas and Goldberg 2019). Vertical patterns in variety, size, orientation, bedding, and frequency are evident in the eastern profile of the Plot XXF excavation trench. Intensified accumulations of microscale archaeological components were identified within Floor 2.5 (MSU XXF10.2, XXF11.1, XXF12.1) and Floor 2.6=2.7 (MSU XXF14.1). Microstratigraphic units (XXF10.2, XXF11.1, and XXF12.1) within Floor 2.5 have the relative highest variety (basalt, flint, bone, and shell), frequency and generally larger micro-artefacts. Microscopic archaeological material within Floor 2.5 (MSU XXF10.2, XXF11.1, and XXF12.1) are strongly referred parallel with voids and are rarely horizontally or sub-horizontally oriented, signifying post-depositional alteration. A more restricted variety (bone, shell, and flint) and smaller archaeological material is present within the bottom of trampled Floor 2.5 (MSU XXF13.1) and the middle of Floor 2.6=2.7 (MSU XXF14.2). The largest flint fragment within this profile is within trampled Floor 2.6 (MSU XXF14.3). Therefore, fragments of flint, bone, shell, and charcoal are larger, more frequent, horizontal to sub-horizontally oriented immediately overlying trampled occupation surfaces. They reduce in variety, size and frequency moving upwards, away from trampled surfaces.

Three trampled occupation floors (Floor 2.5, 2.6=2.7, and Floor 2.8) were identified during excavation in the 1980s and subsequent analysis (Edwards 2013a). Identifications were made based upon sediment compaction, sediment colour, architectural features resting upon surfaces, artefact clusters resting on surfaces, bedded artefacts parallel with the surface, increase in artefact diversity, and an increase in artefact frequency. These macroscale patterns were reflected on the microscale. Micromorphological investigation of samples from Floors 2.5, 2.6=2.7, and 2.8 securely identified one floor (Floor 2.8). A trampled surface within Floor 2.6=2.7 was suggested based upon parallel bedding of flint and other smaller burned micro-fragments with the base of the deposit and a calcareous boulder trampled into the surface (Fig. 3). The trampled surface within Floor 2.8 (MSU XXF18.2 and XXF18.3) is composed of localised, organic residues with referred parallel bedding with the base of the deposit (Fig. 5).

Trampled living floors in unprotected, natural environments are predisposed to post-depositional alteration, impeding identification. Therefore, identification is reliant upon patterning of lithics and other micro-artefacts or single hearth constructions and other features (Machado *et al.* 2013). Although there was architecture at Wādī Ḥammeh 27, the lower deposits within the eastern profile of Plot XXF were undoubtedly located outside Structure 3. Evidence of trampling within the profile includes compaction and horizontally or sub-horizontally oriented and bedded flint, bone and shell micro-fragments, and geogenic components. Sub-horizontal fissures, regularly used to identify trampling (Davidson *et al.* 1992; Gé *et al.* 1993), are absent. This is probably due to macroscale and microscale post-depositional alterations to the deposits. Trampled surfaces have been heavily bioturbated leaving parallel bedding of micro-artefacts, variety, size, and frequency as the main criteria for their identification within the east profile of Plot XXF.

During trampling experiments, Rentzel and Narten (2000), found effects of trampling on dry substrates is constrained to within a few millimetres underlying the activity surface—although in wet sediments—indications of trampling (including bedded artefacts and sub-horizontal fissures) can be observed to a depth of three centimetres. Additionally, compaction appears to be more pronounced in damp conditions (Karkanas and Goldberg 2019). Microstratigraphic units within the eastern profile of Plot XXF do not preserve sub-horizontal fissures due to post-depositional alteration and the friable nature of the sediment. However, the most obvious evidence for trampling during wet conditions—though heavily altered subsequent to deposition—is within Floor 2.6=2.7 (MSU XXF14.3). A calcareous boulder has probably been trampled up to 10mm into the surface and is underlying the largest, referred parallel bedded flint micro-fragment (within MSU XXF14.1). According to the findings of Rentzel and Narten (2000), in order for this pebble to have been trampled into the underlying deposit, the sediment must have been wet.

Suspected reworked, constructed trampled floors in addition to the original four identified within the east profile of Plot XXF by Edwards (2013a), and construction materials within the eastern and southern profile of Plot XXF are currently under investigation and will be reported at a later date.

Post-Depositional Processes

Post-depositional alterations to the deposits are very dominant and have impacted upon microstructure and the orientation of micro-artefacts. Coarse textural post-depositional alterations to the upper 470 mm of the eastern baulk of Plot XXF provide signals of a semi-arid environment. Colluvially and fluvially washed void infills were deposited via turbulent water under conditions where ground cover was absent (lacking vegetation; Courty *et al.* 1989). These coarse pedo-features disappear within Floor 2.6=2.7 (MSU XXF14.3) because turbulent water loses velocity as it moves downwards through the profile. The vertical location of these pedo-features implies a more recent series of infilling events. Further, currently vegetation is absent upon the ground surface overlying Wādī Ḥammeh 27 during summer months and at the beginning of the wet season. Meaning, coarse textural void infills were deposited since aridification of the area around the site. Furthermore, some of these infills contain yellow or reddish-brown plant root remains and stable meso-faunal excrements indicating more recent bioturbation.

Based upon the semi-arid climatic signal given by coarse textural post-depositional processes, recent floral turbation (yellow, red, pink colours) and dense pellets of micro-faunal excrements, at least some post-depositional alteration has occurred since the 1980s excavation. The profile has probably been altered, to at least some degree, from both above and within loose backfilled sediments. To avoid this situation, it is recommended that geoarchaeological testing takes place in tandem with initial excavations so additional samples can be taken in different locations and features within Natufian sites for a wider investigation of activities, activity areas, and occupation habits.

Conclusion

The application of archaeological micromorphology to sediments within the eastern baulk of Plot XXF revealed microscale signatures of Natufian activities and trampled occupation floors. Even though sediments from this profile are significantly altered by post-depositional processes, patterns in variety, size, frequency, bedding, and orientation of fragments of flint, shell, bone, charcoal, and basalt were utilised to identify Natufian activities, occupation deposits, and reworked, trampled surfaces. Based upon microscale evidence presented in this chapter, the activities undertaken by Natufian people at Wādī Ḥammeh 27 included flint knapping (early reduction sequence chips are present), heat treating flint, burning or cooking bone and shell, curation of adornments, and grinding resources with basalt mortars and pestles.

Several of the criteria for identifying trampled floors are present within features in the eastern profile of Plot XXF. These include weathered surfaces (Floor 2.6=2.7), parallel bedding, a pellet-shaped aggregate open microstructure and larger fragments of material culture, and geogenic components directly overlying features in Floor 2.6=2.7 (MSU XXF13.1 and XXF14.2; Fig. 3). *In situ* pressure breaks, sub-horizontal fissures, also used to identify trampling (Gé *et al.* 1993), are absent and compaction is restricted to sediment within aggregates. This could be due to post-depositional alterations overprinting these structures. Based on the paleoclimate at Wādī Ḥammeh 27, trampling of dry sediment possibly resulted in an open, pellet-shaped structure containing aggregates lacking sub-horizontal fissures. This microstructure is also indicative of bioturbated deposits and in concert with compaction could indicate meso-faunal burrowing rather than trampled surfaces. Meso-faunal galleries and floral channel voids (Figs. 2 and 4) are present throughout the eastern profile, especially within Floors 2.6=2.7 and Floor 2.8. Plant roots and meso-faunal burrowing have caused heavy bioturbation, generally leaving parallel bedding of micro-artefacts, variety, size, and frequency as the main criteria for identification of trampled floors. This evidence alone is not enough to identify trampled floors. A trampled floor was securely identified within the contiguous MSU's XXF18.2 and XXF18.3 at the base of the eastern profile of Plot XXF sand is consistent with the macroscale identification of Floor 2.8.

Micromorphological investigations of sediments from Wādī Ḥammeh 27 are ongoing and the results presented here are preliminary. Additional ancillary geo-archaeological analyses have also been undertaken in tandem with this investigation which will enable a clearer understanding of human activities and occupation behaviour at Wādī Ḥammeh 27.

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A New Overview of Late Neolithic Sites in Jordan

Introduction

The Late, or Pottery, Neolithic (*ca.* 6500–5100 BC) is a key period in the archaeology of Jordan. While much research is dedicated to the earliest developments in food production in the Pre-Pottery Neolithic, it was not until the Late Neolithic that agriculture was adopted as the main way of subsistence, at least in those areas of Jordan where rain-fed agriculture is possible (Gibbs and Banning 2013). In what are now steppe and desert areas, pastoralist groups (still also reliant on hunting and perhaps some agriculture) became evident (Rollefson *et al.* 2014), thus forming the basis for the famous distinction between 'desert and sown' in later periods.

The Late Neolithic is also of profound interest for studying the effects of changing climate on early farming societies. After a probably favourable Early Neolithic (because it was relatively wet), more arid conditions appear to have started around 6600 BC, with a 200-year-long cold and arid period superimposed on this from around 6250 BC (Alley *et al.* 1997; Rohling and Pälike 2005). While local climate conditions in Jordan at the time are not completely clear, it is likely that these hemisphere-wide-attested changes would have had an impact on vegetation and crop growing conditions. There was no wide-spread collapse at the time (Gibbs and Banning 2013; Flohr *et al.* 2016), but the question remains as to exactly how people adapted to or coped with the changes.

Notwithstanding the importance of the Late Neolithic to research on the final appearance of agricultural societies and their resilience to climate change, the period remains less well-known than many other periods. While this is partly caused by a research bias, the sites are also less visible: they are often small, covered by colluvium, or have eroded, and diagnostic artefacts can be rare or difficult to recognise (Banning

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2015). They are also covered by later occupation, as for example shown at Pella (Bourke *et al.* 1998, 2003).

There have been many surveys in Jordan over the years, and even though the Late Neolithic has rarely been their target, Neolithic material has been identified even if not widely reported. The research presented in this paper, as a first, essential step, brings together the existing information on Late Neolithic sites in Jordan. This will form the basis of more extensive research into this period, amongst other things examining location and the potential for using GIS modelling and remote sensing in the al-Karak area (see Banning *et al.* 2013; Hitchings *et al.* 2016 for its successful use in north Jordan).

The initial research was conducted as part of the Endangered Archaeology in the Middle East and North Africa (EAMENA) project (eamena.org), which uses remote sensing to document the archaeology and condition of archaeological sites in the MENA region in order to help mitigate threats. Because prehistoric sites are often not visible on the imagery, they can be overlooked and we cannot protect sites if we do not know where they are. This research therefore mapped the known Late Neolithic sites using publications in combination with remote sensing.

Methods

The present stage of the research reported here comprised a desk-based study in combination with site visits. The archaeological site databases MEGA-Jordan (MEGA-J, www.megajordan.org), Jordan Antiquities Database and Information System (JADIS, in use until 2002, then superseded by MEGA-J), the Digital Archaeological Atlas of the Holy Land (DAAHL, daahl.ucsd.edu/DAAHL), and the EAMENA database (database.eamena.org) were searched for Late Neolithic sites. As the search outputs also included sites that were generically Neolithic or Neolithic/Chalcolithic, the listed sites were carefully checked in the literature and only included on the final list if specific Late Neolithic evidence was reported. The second step was an extensive literature search for Late Neolithic sites, focusing on journals that include preliminary field reports, such as the *Annual of the Department of Antiquities of Jordan*, and checking survey gazetteers, excavation, and other project reports. For each site, characteristics were recorded, such as the site type, the evidence available for the Late Neolithic (and its sub-periods) at the site, the type of research conducted at the site, and the type of remains present.

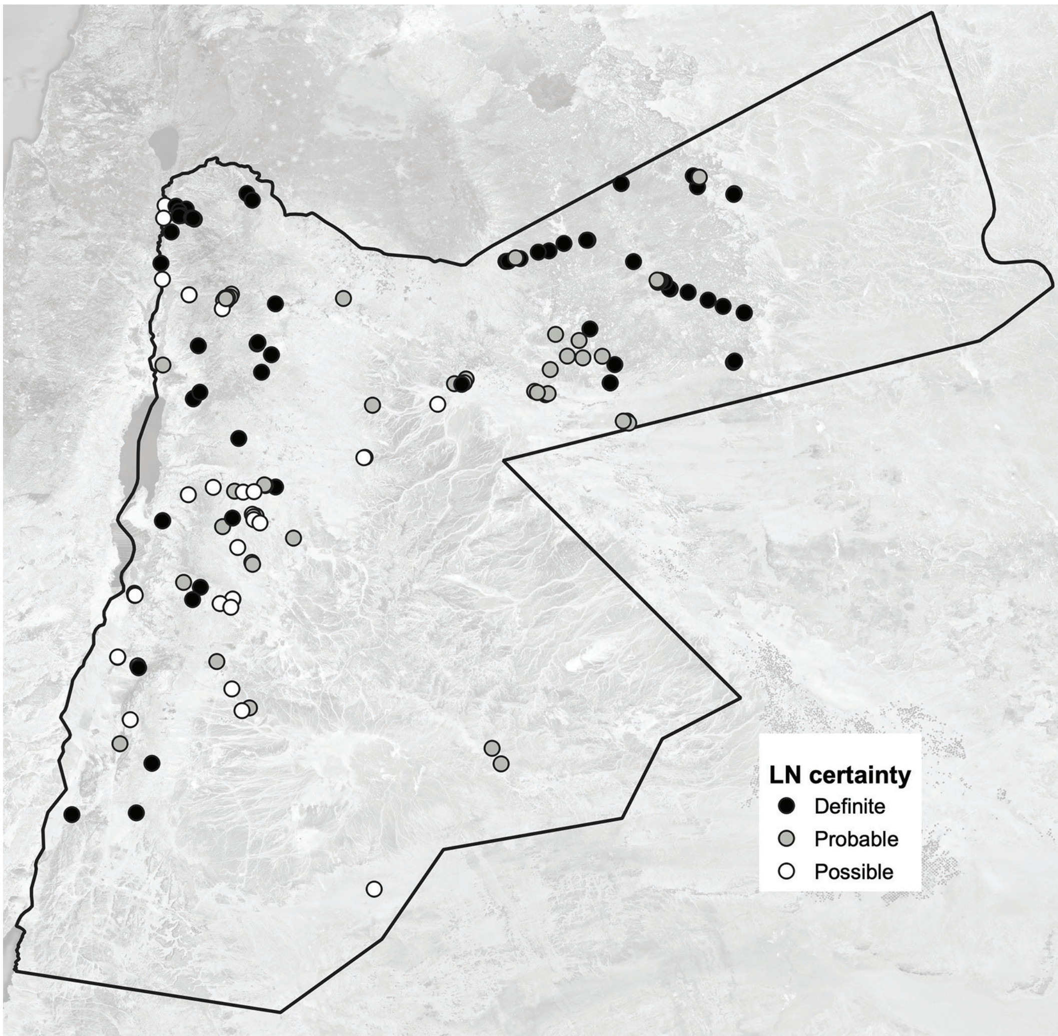
Because many of the sites had been recorded by surveys conducted prior to the use of handheld GPS, their locations were often unknown or very uncertain. As it is essential to have an exact location, both for the research into site location and GIS modelling, and to be able to protect the sites from development, one of the most time consuming aspects of this research was to check and correct site location. This was achieved by digitising survey maps, remote sensing analysis, finding the site on aerial/satellite imagery (if visible), or following the description in the survey reports and locating its topographic position on that basis. For a number of sites, the location was checked on the ground during site visits in 2018 (Flohr and Finlayson forthcoming) and 2019 (Flohr and Finlayson 2020). Field visits identified Late Neolithic material at a couple of archaeological sites previously not known to include a Late Neolithic component (Flohr and Finlayson 2020).

Finally, the sites were studied using remote sensing, and for a more limited number, by site visits, to look at the archaeology more closely and to assess the current condition of the site, including any disturbances and threats. The information on the archaeology, location, and condition was then entered in the EAMENA database

(database.eamena.org) where more information about each of the sites can be found.

Results: A New Map of Late Neolithic Sites in Jordan

The results are presented in Fig. 1, Fig. 2, and Table 1. To date (January 2020), *ca.* 168 Late Neolithic sites were found to have been reported for Jordan, 68 with good evidence (categorised as 'definite'), 59 with reasonable evidence ('probable'), and 41 with some evidence ('possible'). The list is unlikely to be complete, as some information is likely to still lie hidden in the copious literature concerning the archaeology of Jordan. The Eastern Desert sites published by Betts *et al.* (2013) have been included, but not yet studied in detail. In addition, it is to be expected that the list will grow considerably in coming years, as ongoing surveys in the Eastern Desert continue to be published, such as the Jebel Qurma Project

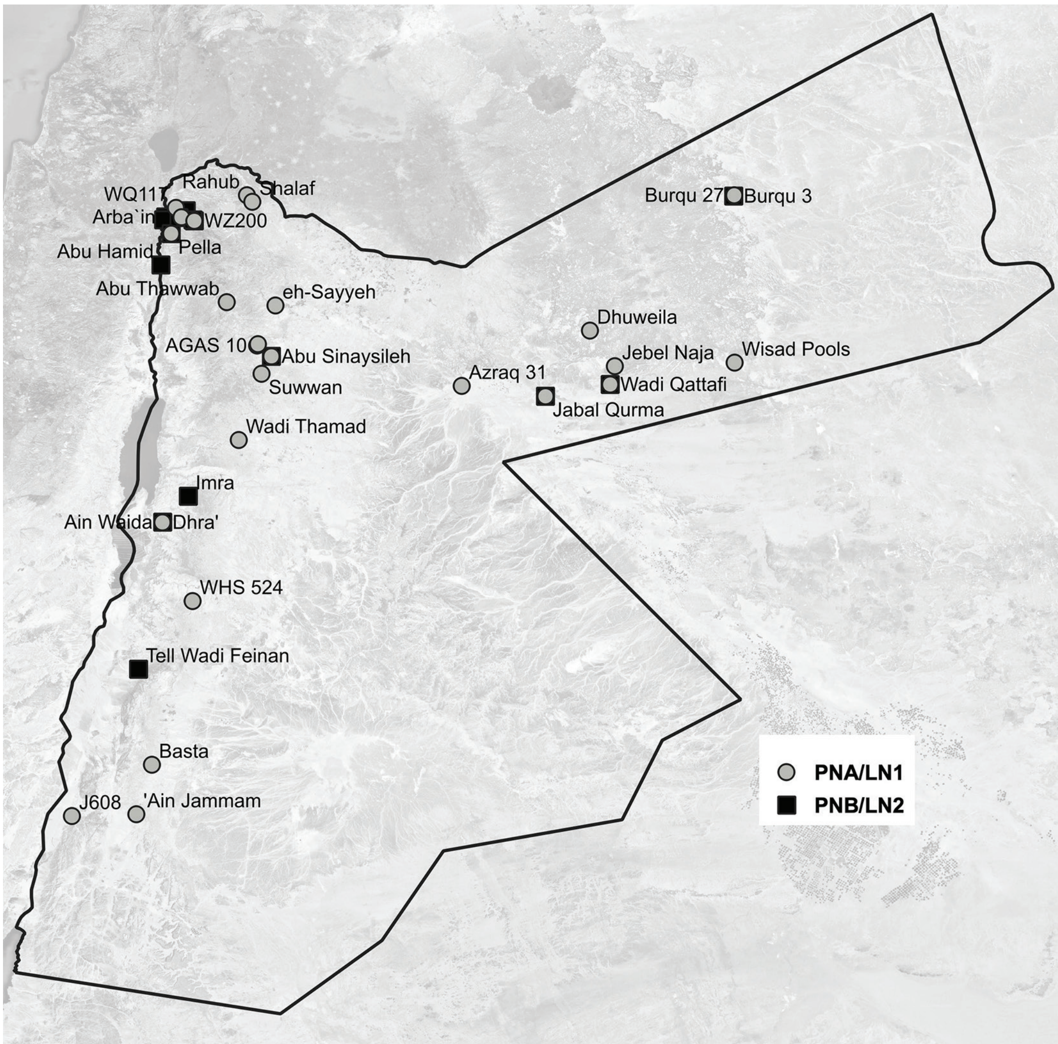


1. Late Neolithic sites in Jordan—black: definite, grey: probable, white: possible. Background: Google Earth satellite imagery.

(Akkermans *et al.* 2014) and the Western Harra Survey project (Chambrade and Smith 2018).

It should be noted that the records in the table are not always exactly comparable as 'sites', hence the use of '*ca.* 168 sites' above. In surveys, parts of sites are sometimes recorded separately and later appear to form part of one larger site or site complex, such as is the case for the Wādī ath-Thamad sites (presented as one record in Table 1; Foley and Foley 2008) and potentially for MN 329 and MN 423 (Mortensen *et al.* 2013). In other cases large areas such as Wisād Pools are reported as one record, but these can be vast and should perhaps be considered multiple 'sites'.

The sites in Table 1 and Fig. 1 are only



2. Late Neolithic sites sub-divided by 'PNA/LN1' (ca. 6500–5900 BC, Yarmoukian; grey circles) and 'PNB/LN2'(roughly 6th millenium BC, including Wādī Rabāḥ; black squares). Not all site names in the Wādī Ziqlāb and Wādī Quṣaybah could be shown.

Table 1 (pages 101–15). Late Neolithic (LN) sites reported in Jordan. Periodisation of cited source is normally adhered to, so that a mixture of PNA/Yarmoukian terminology, etc. is used. Excav. = Excavation, Unk. = Unknown, Negl. = Negligible. Periods: LP = Lower Palaelithic, MP = Middle Palaeolithic, UP = Upper Palaeolithic, EP = Epipalaeolithic, PPNA = Pre-Pottery Neolithic A, PPNB = Pre-Pottery Neolithic B, PPNC = Pre-Pottery Neolithic C, PNA = Pottery Neolithic A, PNB = Pottery Neolithic B, Ch. = Chalcolithic, BA = Bronze Age, EB = Early Bronze Age, MB = Middle Bronze Age, IA = Iron Age, Hell. = Hellenistic, Nab. = Nabataean, Rom. = Roman, ER = Early Roman, LR =Late Roman, Byz. = Byzantine, Isl. = Islamic, Um. = Umayyad, Ayy. = Ayyubid, Ott. = Ottoman. The periods given include possible occurrences.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Abu Hamid, تل ابو حامد	Abū Ḥāmid, تل أبو حامد	9541	0123204	Definite	Excav.	Ceramics, C_{14} dates. Wādī Rabāḥ, *ca.* 5200 BC and after.	Ch.	35.571338, 32.318369	High	Dollfus and Kafafi 1993; Lovell *et al.* 2007
Abu Snesleh/ Sinaysileh	Abū Sunaysilah	12782	0134443	Definite	Excav.	Ceramics and lithics in excavation. Yarmoukian and Wādī Rabāḥ.	Late Ch./EBI, MBII, Ayy.	36.033487, 31.936012	High	Kerner 2016; Lehmann *et al.* 1991
(Qa') Abu Tuleiha/ Tulayha West	(Qāʿ) Abū Ṭulayḥah/ West	3277	0135623	Probable	Excav.	Based on typological comparison of architecture plus one C_{14} date.	BA	35.941486, 30.459362	High	Fujii 2000, 2001, 2002a, 2003
AGAS 10		6991	0160453	Definite	Survey	Probably an extension of ʿAyn Ghazāl, but with only Yarmoukian.	BA (main)	35.973481, 31.981286	Medium	Simmons and Kafafi 1988

those that date, or might date, between 6500 and 5000 BC. While it could be argued that Late Neolithic characteristics can be found beyond that date at some sites (*e.g.*, Bourke 2007 citing Hennesy), the definition chosen here is one of a time period as much as that of specific characteristics—indeed the period shows a considerable diversity between the characteristics of sites. As such, Tulaylāt al-Ghasūl, for example, has been excluded from the table, as radiocarbon dates have shown the earliest 'Neolithic' layers to be dated to the first half of the 5th millennium BC. It is likely that with increased research more of the sites in the table will have to be discarded for the same reason; on the other hand, more might be found to be included when lower layers of multi-period sites are investigated. At the other end of the Late Neolithic, it is likely that the list contains sites prior to 6500 BC, as sites reported to be 'Early Late Neolithic' in the desert are partly contemporaneous with the PPNC (*ca.* 6800–6500 BC) in Jordan's wetter zones (see for example Betts *et al.* 2013). For this reason Jīlāt 25 (Garrard *et al.* 1994) was not included, but it is likely other sites

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
ʻAin Ghazal	ʻAyn Ghazāl	2710	0117592	Definite	Excav.	Excavated material culture. Yarmoukian.	PPNB, PPNC	35.976967, 31.987097	Definite	Kafafi 1990; Rollefson 1993
ʻAin Jammam	ʻAyn Jammām	4188	0122122	Definite	Excav.	Excavated material culture. Yarmoukian?/PNA.	PPNB	35.468340, 30.020534	High	Waheeb and Fino 1997; Rollefson 2005; Gebel 2008
ʻAin Waida	ʻAyn Wayḍah	9350	0134424	Definite	Excav.	Excavated material culture, C_{14} dates. Very late LN.	Ch.	35.578646, 31.242430	Definite	Kuijt and Chesson 2002
Arba'in, Tall el Arbaein, الاربعين	Arbaʻīn, Tall al-Arbaʻīn, تل الأربعين	2854	0160596	Possible	Survey	PNB ceramics, but could be Chalcolithic.	Ch.-modern	35.590910, 32.519196	High	Ibrahim *et al.* 1976; Kafafi 1993 after Kafafi 1982
Awja 1	al-ʻAwjā	x	0160583	Possible	Excav., cleaning	Dated by affinities with Abū Ṭulayḥah West.	None	36.462328, 29.710631	Medium	Fujii 2013
AWS-85		x	0160574	Probable	Survey	Lithics	PPNC	36.847477, 31.834541	Negl.	Rollefson *et al.* 2001
AWS-86		x	0160575	Probable	Survey	Lithics	None	36.840079, 31.819302	Negl.	Rollefson *et al.* 2001
AWS-unknown		x	x	Probable	Survey	No information, but in total 4 LN sites were reported for the survey.	Unknown	Unknown	Negl.	Rollefson *et al.* 2001
AWS-unknown		x	x	Probable	Survey	See above.	Unknown	Unknown	Negl.	Rollefson *et al.* 2001
Azraq 1, Ain el Assad	ʻAyn al-Asad	2954	0160753	Probable	Survey	Large lithic scatter; LN date not confirmed in excavation.	LP, MP	36.799096, 31.815032	Low	Garrard *et al.* 1975; Rollefson 1982
Azraq 31		x	0134447	Probable	Survey, Excav.	Lithics Early LN.	LPPNB	36.829366, 31.812347	Low	Garrard *et al.* 1986, 1988
Basta	Basṭah	9759	0134776	Definite	Excav.	PNA/Yarmoukian rubble layers/squatter occupation, including *in situ* finds.	PPNB (main), PPNC	35.53354, 30.22763	High	Gebel 2009
Burqu area	Burquʻ	2797	0134452	Definite	Survey, Excav.	8 sites reported to contain Late Neolithic material (1, 2, 3, 11, 17, 20, 27, 35).	Multi-period	General area	n/a	Betts *et al.* 2013

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
-Burqu 2	Burquʿ	2797	0134452	Probable	Survey	Lithics later in LN sequence.	‘later’	TBC	n/a	Betts *et al.* 2013
-Burqu 3	Burquʿ	2797	0134452	Definite	Excav.	Lithics, C_{14} date (5900 ±95 cal BC). Lithics indicate occ. also early in LN.	None	37.96721, 32.60644	Low	Betts *et al.* 2013
-Burqu 27	Burquʿ	2797	0134452	Definite	Excav.	Lithics, C_{14} dates (*ca.* 6300–6000 BC).	Ch.	37.96922, 32.60985	Low	Betts *et al.* 2013
DAS 75		x	x	Possible	Survey	Lithics	MP, Ch., EB	35.474353, 30.635383	Medium	Findlater 2003 after Finlayson and Baird 1995
Debab	Dhubāb	9690	x	Possible	Survey	Ceramics, but could be Chalcolithic.	Ch.	35.588600, 32.560700		Ibrahim *et al.* 1976; Kafafi 1993 after Kafafi 1982
Tulul edh-Dhabab:	Tulūl adh-Dhubāb	2709, 2751	0160586					35.68906, 32.18644	High	
-Tell Dhahab East	Tall adh-Dubāb	2751	x	Possible	Survey	LN presence reported	MP?, PPN?, EB, IA, Hell., R.			Gordon and Villiers 1983
-Tell Dhahab Extension West	Tall adh-Dubāb	x	x	Possible	Survey	LN presence reported	LP?, MP, PPN?, Ch.?, later			Gordon and Villiers 1983
Dhra’	adh-Dhirāʿ	9350	0119703	Definite	Excav.	Lithics and ceramics. Jericho IX.	PPNA	35.577504, 31.241374	Definite	Finlayson *et al.* 2003
Dhuweila	Ḍuwaylah	8192	0134442	Definite	Excav.	Lithics, C_{14} dates. 7th mill.	PPNB, EB	37.36564, 32.04375	Low	Betts 1998
Tell Fendi, تل فندي	Tall Findī	2729	0160109	Possible	Survey	PNB ceramics in survey, but not confirmed by excavation.	Ch./EBI, Byz. Ayy./Mam.	35.582475, 32.507191	High	Kareem 1989
FJP S111		x	0119222	Probable	Survey	Lithics	Ch.	35.399907, 30.309596	High	Fiema *et al.* 2008
Ghathyan, ‘Ain Ghathyan	Ghathyān, ‘Ayn Ghathyān	12542	0160119	Probable	Survey	Reported under Late Neolithic in survey report	Ch.	35.866192, 32.189531	Medium	Gordon and Knauf 1987

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Ghirqa, Ghirga	Gharqah	x	0160125	Probable	Survey	Lithics. Could be Early LN.	PPNB?	37.320270, 31.995679	High	Betts 1987; Rollefson *et al.* 2014
Ghrubba	Ghurubbah	4567	0134784	Probable	Survey (section)	Ceramics found in section	None	35.579559, 31.893034	Medium	Mellaart 1956, 1962
Gleb Rumman	Qalīb ar-Rummān	x	x	Possible	Survey	Possible LN based on ceramics	Rom.	South, Wadi Rumman	n/a	Jobling 1981
Hamad Survey sites:	Ḥamad	x	x	Probable	Survey	Several sites contained Late Neolithic material in the survey by Betts *et al.*	Multi-period	n/a (large region)	n/a	Betts *et al.* 2013
-89/1, Jebel ar-Rishat	Jabal ar-Rīshāt	x	x	Probable	Survey	Burin Neolithic site, truncation burins	None reported	TBC	n/a	Betts *et al.* 2013
-88/1005		x	x	Probable	Survey	Concave truncation burins	None reported	TBC	n/a	Betts *et al.* 2013
-88/1006		x	x	Probable	Survey	Concave truncation burins	None reported	TBC	n/a	Betts *et al.* 2013
-88/1009		x	x	Probable	Survey	LN lithics, knapping site	PPN	TBC	n/a	Betts *et al.* 2013
-88/1010		x	x	Probable	Survey	Concave truncation burins	None reported	TBC	n/a	Betts *et al.* 2013
-88/1011		x	x	Probable	Survey	Concave truncation burins	Unknown	TBC	n/a	Betts *et al.* 2013
-88/1013		x	x	Probable	Survey	Concave truncation burins	Unknown	TBC	n/a	Betts *et al.* 2013
-89/7, Tell al-Hibr 2	Tall al-Hibr	x	x	Possible	Survey	Lithics Early LN (PPNC) or LN	PPNC?	TBC	n/a	Betts *et al.* 2013
-89/8		x	x	Probable	Survey	Structures similar to al-Ghirga, lithics typical of burin Neolithic.	Unknown	TBC	n/a	Betts *et al.* 2013
Harra Transect Survey I-1	al-Ḥarrah	59933	0134437	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB	38.01178, 32.11120	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey I-3		59936	0134438	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB	38.01064, 32.11182	High	Müller-Neuhof in prep.; MEGA-J

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Harra Transect Survey II-1		59980	0134439	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB, Abb.	37.77641, 32.19725	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey II-13		59964	0134440	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB, Isl.	37.92270, 32.13823	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey II-3		59944	0134712	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB, Byz.	37.85998, 32.16442	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-2.2		60018	0134713	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB	37.54802, 32.32538	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-28		60006	0134714	Definite	Survey	Lithic(s) diagnostic of LN	Ch. and/or EB, 20th c.	37.70139, 32.21097	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-29		60008	0134715	Definite	Survey	Lithic(s) diagnostic of LN	Ch./EB, Byz., 20th c.	37.69776, 32.21276	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-37		60060	0134716	Definite	Survey	Lithic(s) diagnostic of LN	EP, PPNA, Ch./EB, Byz.	37.67775, 32.24020	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-42		60070	0134717	Definite	Survey	Lithic(s) diagnostic of LN	MP, UP, EP, Ch./EB, Byz., Isl.	37.66087, 32.24649	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-43		60071	0134441	Definite	Survey	Lithic(s) diagnostic of LN	MP, PPNB, Ch./EB	37.65945, 32.24690	High	Müller-Neuhof in prep.; MEGA-J

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Harra Transect Survey III-46		60078	0134718	Probable	Survey	Lithic(s) diagnostic of LN	Ch./EB, Byz., Isl.	37.65347, 32.24041	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-48		60082	0134719	Definite	Survey	Lithic(s) diagnostic of LN	EP, Ch./EB	37.64950, 32.23905	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey III-54		60096	0134720	Probable	Survey	Lithic(s) diagnostic of LN	Ch./EB, Byz.	37.64652, 32.24823	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey IV-11		60126	0134721	Definite	Survey	Lithic(s) diagnostic of LN	EP, PPNA, Ch./EB	37.35734, 32.41515	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey V-1		60146	0134723	Definite	Survey	Lithic(s) diagnostic of LN	EP, PPNA, Ch./EB, Byz., Isl.	37.35218, 32.41507	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey VIII-17		60184	0134724	Definite	Survey	Lithic(s) diagnostic of LN	PPNB, Byz.	37.19481, 32.37035	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey VIII-2		60174	0134725	Definite	Survey	Lithic(s) diagnostic of LN	EP, Ch./EB, LR, Byz., Abb., Ott.	37.01429, 32.32625	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey IX-3		60132	0134722	Definite	Survey	Lithic(s) diagnostic of LN	EP, Ch./EB	37.49638, 32.65164	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey XII-2		60304	0160457	Definite	Survey	Lithic(s) diagnostic of LN	Ch./EB	37.81561, 32.63850	High	Müller-Neuhof in prep.; MEGA-J
Harra Transect Survey XII-7		60314	0160571	Definite	Survey	Lithic(s) diagnostic of LN	Ch./EB, Byz.	37.79800, 32.68416	High	Müller-Neuhof in prep.; MEGA-J

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Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Harra Transect Survey XII-9		60318	0160572	Probable	Survey	Lithic(s) diagnostic of LN	Ch./EB, Byz.	37.82317, 32.67857	High	Müller-Neuhof in prep.; MEGA-J
Harrat al-Juhayra, JF-0202	Ḥarrat al-Juhayrah	x	0136371	Probable	Excav.	Dated by typology of structures.	None reported	35.80502. 30.65320	High	Fujii 2005
Haud el-Bayad, 'Ain Bahram	Ḥawḍ al-Abyaḍ, 'Ayn Bahrām	6606	0160121	Probable	Survey	Under Pottery Neolithic in survey report.	Ch., EB, Rom., Byz., Um.	35.86125, 32.17761	Negl.	Gordon and Knauf 1987; MEGA-J
Haud Umm el-Jihash II	Ḥawḍ Umm al-Jiḥāsh	11362	0160123	Probable	Survey	Under Pottery Neolithic in survey report.	EB, Rom., Byz., Um.	35.83988, 32.17351	Negl.	Gordon and Knauf 1987; MEGA-J
Imra', Amra', ASKP 015	Imri'	10212	0086284	Possible	Survey, visited	Late Neolithic or possibly Early Chalcolithic lithics.	EB-present	35.68591, 31.35075	Definite	Miller 1991; Flohr and Finlayson in prep.
Jabal Kapd Cairns	Jabal Qabid	x	x	Probable	Excav.	Haparsa point in two burial cairns.	Unknown	Unknown	n/a	Abu-Azizeh, 2014
Jabal Qurma area:	Jabal Qurmah			Definite	Survey	Many LN sites reported.	Multi-period	37.17990, 31.76907	n/a: general area	Betts *et al.* 2013; Akkermans *et al.* 2014
-QUR-1		60451	0160454	Probable	Survey	Burins, typology of structures.	Unknown	37.13439, 31.78304	High	Akkermans *et al.* 2014; MEGA-J
-QUR-6		60462	0160455	Probable	Survey	LN type lithics, and typology of structures.	Unknown	37.14573, 31.77812	High	Akkermans *et al.* 2014; MEGA-J
-QUR-21		8088	x	Probable	Survey	Grouped enclosure associated with LN lithics (*e.g.*, bifacial knife).	Unknown, PPN?	37.19074, 31.77348	High	Akkermans *et al.* 2014; MEGA-J
-QUR-64		x	x	Probable	Survey	*e.g.*, Nizzanim point, typology of structures.	Unknown	Unknown	n/a	Akkermans *et al.* 2014; MEGA-J

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
-QUR-146		x	x	Probable	Survey	*e.g.*, Haparsa point, typology of structures.	Unknown	Unknown	High	Akkermans *et al.* 2014; MEGA-J
Jabal Tharwa 1a, WS 12a	Jabal Tharwah	x	0119699	Possible	Survey	Close similarities with circular 'tent' foundations at 'Ayn Ghazāl.	none	37.52148, 31.65864	Medium	Wasse and Rollefson 2005
Jabal Tharwa 1b, WS12b	Jabal Tharwah	x	0119670	Definite	Survey	Lithics	PPN	37.52191, 31.65501	Medium	Wasse and Rollefson 2005
Jabal Tharwa 1d, WS12d	Jabal Tharwah	x	0119672	Possible	Survey	1 LN lithic (arrowhead), main occupation EP.	EP (main)	37.51868, 31.65215	Medium	Wasse and Rollefson 2005
Jabal Tharwa 1e, WS12e	Jabal Tharwah	x	0119673	Possible	Survey	1 LN lithic ("Yarmoukian-like" arrowhead), spot-find in rubble.	none	37.51590, 31.65173	Medium	Wasse and Rollefson 2005
Jabal Tharwa 1f, WS12f	Jabal Tharwah	x	0119674	Possible	Survey	Lithics "suggestive of … Late Neolithic…"	EP, PPNB, Ch., EB	37.51602, 31.65292	Medium	Wasse and Rollefson 2005
Jabal Tharwa 1g, WS12g, The Village	Jabal Tharwah	x	0119675	Probable	Survey	Lithics	Ch./EB	37.52803, 31.65008	Medium	Wasse and Rollefson 2005
Jabal Tharwa 2, WS13	Jabal Tharwah	x	0119676	Probable	Survey	2 LN lithics	EP, Ch./EB (main), LRom., Byz.	37.50508, 31.65850	Medium	Wasse and Rollefson 2005
Jebel Abu Thawwab	Jabal Abū Thawwāb	11351	0125096	Definite	Excav.	Excavated material culture (ceramics, lithics), Yarmoukian.	EBI	35.84647, 32.16276	High	Gillet and Gillet 1983; Kafafi 1985, 1988, 2001
Jebel Naja	Jabal Najāh	x	0134451	Definite	Excav.	Early/PNA, Lithics, C_{14} date (6290±100 cal BC).	area: LN-present	37.46987, 31.89489	Low	Betts *et al.* 2013
JF-0104, Wadi ar-Ruwayshid ash-Sharqi	Wādī ar-Ruwayshid ash-Sharqī	x	0135907	Possible	Survey	Based on typology of structures.	Ch. and/or EB	35.86802, 30.53871	High	Fujii 2002b

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
JF-9705, Wadi Abu Safah	Wādī Abū Safāh	x	0135906	Possible	Survey	Based on typology of structures.	Ch. and/or EB	35.91037, 30.44793	Negl.	Fujii 2002b
Jilat 23	Jīlāt	x	0134448	Probable	Survey, excav.	Concave truncation burins, LN type arrowheads.	None reported	36.42505, 31.50683	Low	Garrard *et al.* 1987, 1994
Jilat 24	Jīlāt	x	0134449	Probable	Survey, excav.	Lithics similar to Jīlāt 23.	None reported	36.42006, 31.50559	Low	Garrard *et al.* 1987, 1994
JKSH F15		64355	x	Probable	Unk.	Unknown (probably lithics, knapping site).	None reported	36.95642, 30.29038	High	MEGA-J after Abu-Azizeh & Tarawneh
JKSH F19		64358	x	Probable	Unk.	Unknown (probably lithics, knapping site).	None reported	36.99418, 30.22540	High	MEGA-J after Abu-Azizeh & Tarawneh
Karak Site Visits site 019	al-Karak	x	0154380	Probable	Visited	Lithics contained 3 concave truncated burins.	Not studied, but present	35.96909, 31.26230	Definite	Flohr and Finlayson in prep.
Karm II, 'Ain el-Karm	'Ayn al-Karm	6604	0160120	Probable	Survey	Mentioned under Pottery Neolithic in survey paper.	Ch., EBI, Byz, 20th C.	35.85016, 32.17516	Negl.	Gordon and Knauf 1987; MEGA-J
Kharaneh 2	al-Kharrānah	7681	0160595	Possible	Survey	1 diagnostic LN lithic	Unknown	36.45620, 31.72500	Negl.	Garrard *et al.* 1975
Kharaneh 7	al-Kharrānah	7680	0160594	Probable	Survey	"Diagnostic of Pottery Neolithic generally"	Unknown	36.45620, 31.72500	Negl.	Garrard *et al.* 1975
Khirbet Falah	Khirbat Falāḥ		x	Possible	Survey	Ceramics possibly LN	Ch., EB, Byz., Isl., 20th c.	35.57745, 32.25160	Low	Kafafi 1993 after Kafafi 1982
'LAS 27' (wrong identifica-tion)		5615	0133962	Possible	Visited	Lithics appear LN	present, but not studied	35.79002, 31.38160	Definite	Flohr and Finlayson forthcoming
LAS 27, LAS Field #825A		x	0136569	Definite	Survey, visited	26 LN lithics	LP/MP	36.05067, 31.38022	Definite	Clark *et al.* 2006
LAS 38, LAS Field #646		6873	0133963	Possible	Survey	2 LN lithics	Ch./EB, IA, ER/ Nab., LR/Byz, L.Isl.	36.00847, 31.38942	Low	Clark *et al.* 2006

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
LAS 41, LAS Field #647B		12755	0133964	Probable	Survey, visited	4 LN lithics. Not confirmed during site visit.	Multi-period, incl. Ch./EB	36.00374, 31.39192	High	Clark *et al.* 2006
LAS 59, LAS Field #686		6519	0133965	Probable	Survey	6 LN lithics	Multi-period, incl. Ch., EB	35.87935, 31.36563	High	Clark *et al.* 2006
LAS 78, LAS Field #231		6503	0133966	Possible	Survey	1 LN lithic	IA, ER/Nab., LR/Byz.	35.91541, 31.36159	Low	Clark *et al.* 2006
LAS 95, LAS Field #817		12763	0134414	Possible	Survey	2 LN lithics	Ch./EB	35.96049, 31.36346	Low	Clark *et al.* 2006
LAS 164, LAS Field #801		5555	0134415	Probable	Survey	6 LN lithics	EBIV, ER/Nab.	35.82930, 31.21731	Negl.	Clark *et al.* 2006
LAS 188, LAS Field #529		6490	0134416	Definite	Survey, visited	40 LN lithics reported	L/MP, U/EP	35.87065, 31.25311	Definite	Clark *et al.* 2006
LAS 236, LAS Field #643		6854	0134417	Possible	Survey	1 LN lithic reported	Ch./EB, ER/Nab.	35.95350, 31.26883	Low	Clark *et al.* 2006
LAS 250, LAS Field #644		6855	0134418, 0154382, 0154383	Probable	Survey, visited	9 LN lithics reported. Not confirmed during site visit.	MP, UP, Ch./EB, ER/Nab.	35.95821, 31.25883	Definite	Clark *et al.* 2006
LAS 259, LAS Field #645		6856	0134419	Possible	Survey	2 LN lithics reported	Multi-period, incl. Ch./EB	35.95979, 31.24652	Medium	Clark *et al.* 2006
LAS 284, LAS Field #622		12727	0134420	Possible	Survey	2 LN lithics	M/UP, Ch./EB, L.Isl.	35.98538, 31.23265	Low	Clark *et al.* 2006
LAS 327, LAS Field #28		3312	0134421	Probable	Survey	4 LN lithics	M/UP, Ch./EB, EB, ER/Nab.	36.12584, 31.16934	Low	Clark *et al.* 2006

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
LAS 532, LAS Field #828		12688	0136807	Possible	Survey, visited	1 LN lithic reported. Not confirmed during site visit.	Multi-period, main IA-Byz./Um.	35.95145, 31.06770	Definite	Clark *et al.* 2006
LAS 533, LAS Field #831		6803	0136808	Probable	Survey	3 LN lithics reported.	IA, ER/Nab., L.Isl,	35.95466, 31.05976	High	Clark *et al.* 2006
Mahfour al-Ruweishid	Maḥfūr ar-Ruwayshid	8384	x	Possible	Excav.	Lithics, C_{14} date (5016±104 BC) – Chalc.?	Present	TBC	n/a	Betts *et al.* 2013
MN 329		x	0133882	Definite	Survey, visited	LN ceramics and lithics. Flakes observed on site visit.	PPNA?	35.70838, 31.75387	Definite	Mortensen *et al.* 2013
MN 423		x	0133883	Definite	Survey, visited	LN ceramics and lithics	Unknown	35.70701, 31.75137	Medium	Mortensen *et al.* 2013
MN 526		x	0133884	Definite	Survey, visited	LN ceramics and lithics	Rom/Byz.	35.73411, 31.77935	Medium	Mortensen *et al.* 2013
Pella, Tabaqat Fahl, طبقة فحل	Ṭabaqat Faḥl	2705	0138858	Definite	Excav.	LN ceramics, lithics, and deposits in lowest layers	Multi-period	35.61421, 32.44938	Definite	Bourke *et al.* 1998, 2003
Qa' Megalla	Qāʿ Majallah	x	x	Probable	Survey	Area containing sites with concave truncation burins	PPNB	37.19966, 31.87403	general area	Betts *et al.* 2013
Qa' Naja West	Qāʿ Najah	x	x	Probable	Survey	Area containing sites with LN lithics	TBC	37.33620, 31.92288	general area	Betts *et al.* 2013
Qa' Naja East	Qāʿ Najah	x	x	Probable	Survey	Area containing sites with LN lithics	TBC	37.41726, 31.92962	general area	Betts *et al.* 2013
Rahub, 'Ain Rahub, Tell Rahoob	Rāhūb, ʿAyn Rāhūb, Tall Rāhūb	part of 2833	0122115	Definite	Excav.	LN material incl. ceramics (Yarmoukian), but might not be in situ	EP (Natufian)	35.93107, 32.61011	High	Muheisen *et al.* 1988; Kafafi 1989
Rumman (North)	Rummān	11382	0160124	Probable	Survey	Mentioned under Pottery Neolithic in survey report.	Multi-period, incl. Ch., EB	35.83339, 32.16009	Low	Gordon and Knauf 1987; MEGA-J
Ruweishid as-Satih, RS91	Ruwayshid as-Saṭḥ	x	x	Probable	Survey	Lithics comparable to Jabal Najāh.	Unknown	TBC, E Desert	n/a	Betts *et al.* 2013

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Salihi	aṣ-Ṣāliḥī	11363	x	Possible	Survey	Ceramics possibly LN.	Ch., EB, Hell, R., Byz., Isl.	35.82788, 32.12825	Negl.	Kafafi 1993 after Kafafi 1982
eh-Sayyeh	Ḥusayyah	7174	0134423	Definite	Survey, Excav.	Ceramics, lithics. Main: PPNC-Yarmoukian.	PPNB, PPNC, Ch./EB	36.05021, 32.14889	High	Bartl and Kafafi 2015
SGNAS 21		8561	0134446	Possible	Survey	2 LN sherds, + undiagn. Neolithic lithics.	EB, Nab.	35.39066, 30.67085	Low	MacDonald 1992
SGNAS 29		8560	0134588	Possible	Survey, Visited	1 LN sherd	Ch., Ch./EB	35.39027, 30.67226	High	MacDonald 1992
SGNAS 75+76, Feifa	Fīfā	8774	0134444	Definite	Survey, Excav.	46 LN sherds. LN occupational layers found in excavation.	LN/Ch., Ch. Ch./EB	35.46046, 30.93867	High	Schaub 1991; MacDonald 1992
SGNAS 92		4075	0134445	Probable	Survey, visited	4 LN sherds. Could not be confirmed during 2018 visit: either wrong location or site was destroyed.	LN/Ch., Ch.	35.46166, 30.92959	Low	MacDonald 1992; see Flohr and Finlayson forthcoming
SGNAS 95		8763	0160456	Possible	Survey	1 LN sherd	Ch./EB	35.46375, 30.93048	Negl.	MacDonald 1992
esh-Shalaf, الشلاف	ash-Shalāf	60329	0122109	Definite	Excav.	Ceramics and lithics, Yarmoukian.	Rom.	35.95335, 32.58245	Medium	Bienert *et al.* 1999; Bienert and Vieweger 1999; 2000
SHUBS 100		x	0119657	Definite	Excav.	Cairn with 5 LN points.	None	37.25699, 32.40128	Definite	Richter 2014 (Shubayqa Survey)
Suwwan, Tell Abu Al-Suwwan	Tall Abū aṣ-Ṣuwwān	2938	0160452	Definite	Excav.	Ceramics and lithics. Yarmoukian.	PPNB	35.99210, 31.86310	High	al-Nahar 2010
Tell Wadi Feinan	Tall Wādī Fīnān	x	0122093	Definite	Excav.	Ceramic, lithics, C_{14} dates. Late in the Late Neolithic.	Later field system	35.47774, 30.62717	Definite	Najjar *et al.* 1990
Um Guwe'ah	Umm Quwaʿah	x	x	Probable	Survey	Late LN based on ceramics analysed by C. Bennett.	Ch., Rom.	South, Wadi Rumman	n/a	Jobling 1981
Um Uqser	Umm Quṣayr	x	x	Probable	Survey	Based on ceramics analysed by C. Bennett.	Rom.	Wadi Rum	n/a	Jobling 1981

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Umm el-Basatin 1	Umm al-Basātīn	5818	0160122	Probable	Survey	Mentioned under Pottery Neolithic in survey report.	Ch., unknown	35.84319, 32.17080	Negl.	Gordon and Knauf 1987
Uweinid 9	ʿUwaynid	7897	x	Possible	Survey	1x LN Byblos point-like.	PPN?	36.7290, 31.7289	Negl.	Garrard *et al.* 1975
Wadi al-ʿAjib 35	Wādī al-ʿAjīb	x	0133865	Probable	Survey	Lithics	Pal.?, EP, PPNB, Rom.	36.33480, 32.17134	Low	Betts 1985
Wadi Nukheila Site J608	Wādī Nukhaylah	x	0160447	Definite	Excav.	C_{14} date (6294±92 cal BC, charcoal), LN projectile points, flakes.	None	35.19885, 30.01308	Low	Henry *et al.* 2001
Wadi Qattafi Mesa-4	Wādī Qaṭṭāfī	2958	0134453	Definite	Excav.	LN lithics (Yarmuk, Haparsa points) and C_{14} date (PNB).	Multi-period?	37.45053, 31.81840	High	Rowan *et al.* 2017
Wadi Qattafi Mesa-7	Wādī Qaṭṭāfī	x	0160592	Definite	Excav.	Lithics, C_{14} date (PNA).	Multi-period?	37.45053, 31.81840	High	Rowan *et al.* 2017
Wadi Rajil VIII-4	Wādī Rājil	60206	0160589	Definite	Survey	LN diagnostic lithic(s)	EP, Ch., BA, Byz., 20th c.	37.02466, 32.32716	High	Müller-Neuhof in prep.; MEGA-J
Wadi Rajil VIII-7	Wādī Rājil	60204	0160590	Probable	Survey	LN diagnostic lithic(s)	Ch., EB	37.05476, 32.34122	High	Müller-Neuhof in prep.; MEGA-J
Wadi Rajil VIII-14	Wādī Rājil	60190	0160577	Definite	Survey	LN diagnostic lithic(s)	None	37.14979, 32.36501	High	Müller-Neuhof in prep.; MEGA-J
Wadi Rajil VIII-37	Wādī Rājil	60245	0160587	Definite	Survey	LN diagnostic lithic(s)	EP, PPNA, Ch. EB, LR, Byz., 20th c.	37.07331, 32.33782	High	Müller-Neuhof in prep.; MEGA-J
Wadi Selahib	Wādī Salāḥib	x	x	Probable	Survey	Area with burin Neolithic sites and PPNB-LN knapping sites	PPNB	37.27148, 31.93039	general area	Betts *et al.* 2013
Wadi Shu'eib, Tell	Tall Wādī Shuʿayb	5144	0134454	Definite	Excav.	PNA ceramics (Yarmoukian and Jericho IX), LN lithics	PPNB, PPNC	35.72772, 31.97349	Definite	Simmons *et al.* 2001

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
Wadi Thamad Neolithic site(s), Umm Meshrat	Wādī ath-Thamad, Umm Mashraṭ	x	0135621, 0134425-28	Definite	Survey, Excav.	Large area of Neolithic occupation with 'sites' WT-40, WT-95, WT-96, WT-97, WT-104, WT-105. PNA lithics and ceramics	EP	35.89630, 31.58613	Definite	Cropper *et al.* 2003; Foley and Foley 2008
Western Harra Project Site 2772	al-Ḥarrah	x	0160444	Possible	Survey	Burin site typical of LN	Unknown	37.22199, 32.02122	Low	Chambrade and Smith 2019
WHNBS 469		12129	0160157	Possible	Survey	Possibly LN in Wādī al-Ḥasā North Bank Survey	PPN?, Ch.?	35.87210, 30.91390	Low	Clark *et al.* 1994; MEGA-J
WHNBS 471		6373	0160158	Possible	Survey	Possibly LN in Wādī al-Ḥasā North Bank Survey	PPN?, Ch.?	35.87120, 30.91460	Low	Clark *et al.* 1994; MEGA-J
WHS 149, Khirbet Hammam	Khirbat Ḥamām	10036	0122272	Probable	Survey, Excav., Visit	8 LN sherds in survey, no evidence in excavation, but may be in other part of site	PPNB, Nab.	35.66608, 30.98416	Definite	MacDonald 1988; Peterson 2003, 2007
WHS 307, Ras al-Siq	Ras as-Sīq	5511	0122431	Definite	Survey, Visit	Large concentration of mainly LN sherds.	Nab., Rom., Byz.	35.73626, 30.96361	Definite	MacDonald 1988
WHS 524, Khirbet Darih II	Khirbat aḍ-Ḍarīḥ	9994	0122649	Definite	Survey, Excav., Visit	Large concentration of LN sherds, PNA.	None	35.703504, 30.911724	Definite	Bossut *et al.* 1988; MacDonald 1988; Bossut and Kafafi 2005
WHS 857		5495	0122985	Possible	Survey	Small number of LN sherds.	EB	35.81879, 30.89551	Low	MacDonald 1988
WHS 870		6106	0122998	Possible	Survey	Small number of LN sherds.	Pal., Rom., Isl.	35.86378, 30.88009	Low	MacDonald 1988
Wisad 1	Wisād	2953	0119677	Definite	Survey	LN projectile points and bifacial knife fragments.	None	37.96551, 31.90395	Medium	Wasse and Rollefson 2005
Wisad Pools	Wisād	2953	0119678	Definite	Excav.	W-66 and W-80: Yarmoukian C_{14} dates, lithics.	Multi-period	37.97091, 31.90973	High	Rollefson *et al.* 2013; Rowan *et al.* 2017

Table 1. Late Neolithic (LN) sites reported in Jordan.

Name(s)	Alternative name(s)	MEGA-Jordan	EAMENA	LN certainty	Type of research	Evidence for LN	Other periods	Lat., long.	Location certainty	References
WQ117, Wadi Quseiba 117	Wādī Quṣaybah	64164	0134430	Definite	Excav.	Ceramics, lithics. Yarmoukian.	None	35.63406, 32.55720	Medium	Banning *et al.* 2015; Hitchings *et al.* 2016
WQ335, Wadi Quseiba 335, Jawafat Shaban	Wādī Quṣaybah, Jawwāfat Sha'bān	64168	0134429	Definite	Excav.	Ceramics, flakes. Wādī Rabāḥ (PNB).	None	35.67708, 32.54503	High	Banning *et al.* 2015; Hitchings *et al.* 2016
WSWP Bayda 36	al-Bayḍā	4326	0134781	Possible	Survey, visit?	No dating evidence in initial survey, but in DAAHL LN is reported.	Nab., Isl.	35.44285, 30.41002	Low	DAAHL; 'Amr and al-Momani, 2001
WT4, Menakh	Manākh	2653	0134435	Definite	Survey	Small amount of LN artefacts.	EP	35.64745, 32.53656	High	Kadowaki *et al.* 2008
WZ120, Tell Rakan I	Tall Rākān	2652	0134431	Definite	Excav.	Lithics, ceramics. Yarmoukian.	LPPNB, Ch., EB	35.65703, 32.51798	High	Banning and Najjar 1999; Banning and Gibbs 2010
WZ135, al-Basatin, WZ140	al-Basātīn	2649, 10589	0134432	Definite	Excav.	Lithics, ceramics, C_{14} dates. PNB.	EB	35.64702, 32.51676	High	Banning *et al.* 2005; Kadowaki *et al.* 2008
WZ148, Uyyun al Hamman	'Uyūn al-Ḥammān	2650	0134434	Probable	Survey, Excav.?	One possible LN burial with probable LN sherds on top.	EP (main)	35.70456, 32.50724	Medium	Kadowaki *et al.* 2008
WZ200, Tabaqat al-Buma	Ṭabqat al-Būmah	2651	0125088	Definite	Excav.	PNA/Yarmoukian grave, domestic occupation probably *ca.* 5900–5000 BC.	EP	35.71093, 32.50287	High	Banning *et al.* 1996, 2011; Kadowaki *et al.* 2008
WZ307		x	0134436	Probable	Survey	Shown on map of LN sites, no further info found.	Unknown	35.69862, 32.50880	Low	Banning and Gibbs 2010
WZ310, 'Aqaba, WZ312	al-'Aqabah	2924	0134433	Definite	Excav., Survey	Ceramics, lithics. PNB. WZ312 is secondary redeposition of WZ310.	Ch., EB	35.70550, 32.50660	High	Banning *et al.* 1996; Kadowaki *et al.* 2008; Banning and Gibbs 2010

of this period have found their way into the table and need to be separated out in future. Of course, even the Late Neolithic as reported here is an almost 1500-year-long period, and currently the sub-periods of many of the sites are unknown (but see Fig. 2). In any case, the research shows that a substantial number of Late Neolithic sites are already known. While the number may lag behind that of many of the later periods, it confirms that there was no 'collapse' or decline during this period anywhere in Jordan.

Preliminary Conclusions about Site Location

Of the sites/site groups included here, about half are in current desert areas. This most likely reflects the excellent preservation there, although it may also reflect wetter climate conditions in the past. Many, if not most, Neolithic people would have lived and farmed in the zones that currently have higher rainfall and are still farmed and lived in, exposing the sites to more frequent damage and destruction (Flohr and Finlayson forthcoming). In the east-west *wadi* areas, geomorphological processes of colluviation and heavy water erosion are also much more active, covering or eroding many Late Neolithic sites (Banning 2015).

Unsurprisingly, the Late Neolithic sites, at least those with some domestic and/or agricultural/pastoral function, are located close to water sources including perennial or seasonal watercourses and springs (sites with funerary/memorial/ritual functions are not so closely associated with water). Otherwise there is considerable variation in site location, presumably depending on site function. In the Wādī Ziqlāb and Wādī Quṣaybah, it was noted that Late Neolithic sites were often present near *wadi* confluences (Hitchings *et al.* 2016). This is also the case for a number of other sites in the agricultural zone outside this area, such as al-Ḥusayyah, abu Sunaysilah, ʿAyn Ghazāl, Wādī Shuʿayb, and Tall Wādā Faynān, WHS 149 (if indeed LN). The reason for this, presumably, was that these areas tend to be naturally wet and fertile. Along these lines we can see other sites that are not near *wadi* confluences but are placed where good agricultural areas are present, at least nowadays, such as WHS 307, WHS 524, WT-4 (on an alluvial fan), MN 329, MN 423, MN 526, and the Wādī ath-Thamad Neolithic site(s). However, there are also Late Neolithic settlement sites for which it is not directly obvious why the site was located where it was.

Next Steps

This list of Late Neolithic sites is only a starting point, and I invite comments from colleagues: do they know of additional Late Neolithic sites? Or perhaps that some of the sites have now been shown not to be Late Neolithic?

This still preliminary—but even so, substantial—list of sites now allows more formal GIS analyses than the quick observations discussed above. The intention is to define patterns to create a GIS model to find more Late Neolithic sites. This has been achieved in the Wādī Ziqlāb, where such a model is used to find areas where sites could have been preserved, also taking into account Neolithic agency in deciding where to live (Banning *et al.* 2013; Hitchings *et al.* 2016).

It is not possible to use a single model for all of Jordan, or for all site types combined: different landscapes are used in different ways and by different groups. In addition, more targeted field surveys are needed to investigate regional settlement patterns (Gibbs and Banning 2013). Therefore, the next step for my research is to focus on the al-Karak Plateau. This area is located on the interface of different environmental zones, and survey work will examine areas in each of the environmental zones, specifically targeting areas that are more likely to contain Late Neolithic occupation.

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Late Neolithic Settlement Patterns in Wādī az-Zarqa (6th and 5th Millennia BC)

Introduction

The az-Zarqa River (Wādī/Sel az-Zarqa) is the second largest tributary of the Jordan River, after the Yarmouk River. It rises in Ras Al ʿAyn springs/Amman and flows through a deep and broad *wadi*, measuring 70 km in length and ranging between 7 to 10 km in width, into the Jordan River. The *wadi* represents a passageway that connects the Jordan Valley in the west with the al-Badiya regions in the east. Archaeological sites were established on the banks of the *wadi* as early as the Palaeolithic (1 mya) to modern times (Kafafi *et al.* 2000; Palumbo *et al.* 2002).

This paper aims to present information about the Late Neolithic settlement patterns (*ca.* 5500–4500 BC), by studying the diversity of the type of settlements (village, camp, and station) side-by-side with the archaeological data excavated at major Late Neolithic sites (Fig. 1).

The main sources of information for the subject under study are derived from surveys (ʿAyn Ghazal Survey 1987, the Wādī az-Zarqa/Wādī ad-Ḍulayl Survey 1993, and Jabal abu Thawwab Survey 1985) and excavations (ʿAyn Ghazal, eh-Sayyeh/al-Ḥusayyah, Khurīsan, Abu aṣ-Ṣuwwān, and Jabal abu Thawwāb) conducted in the Wādī az-Zarqa basin.

The above-mentioned archaeological surveys and excavations indicated that the *wadi* was heavily occupied during the Neolithic period (*ca.* 10,500–6,500 BP), and that the area was very rich in flora and fauna during that period. For example, the Neolithic site Khuraysān, which was established around 10,500 years ago, represents the earliest farming community to be established in the *wadi* (Ibanez *et al.* 2015). The Pre-Pottery Neolithic A (PPNA) settlements in the *wadi* were followed by large settlements such as ʿAyn Ghazal (Rolleson *et al.* 1992) and Abu aṣ-Ṣuwwān (Al Nahar and Kafafi 2015).

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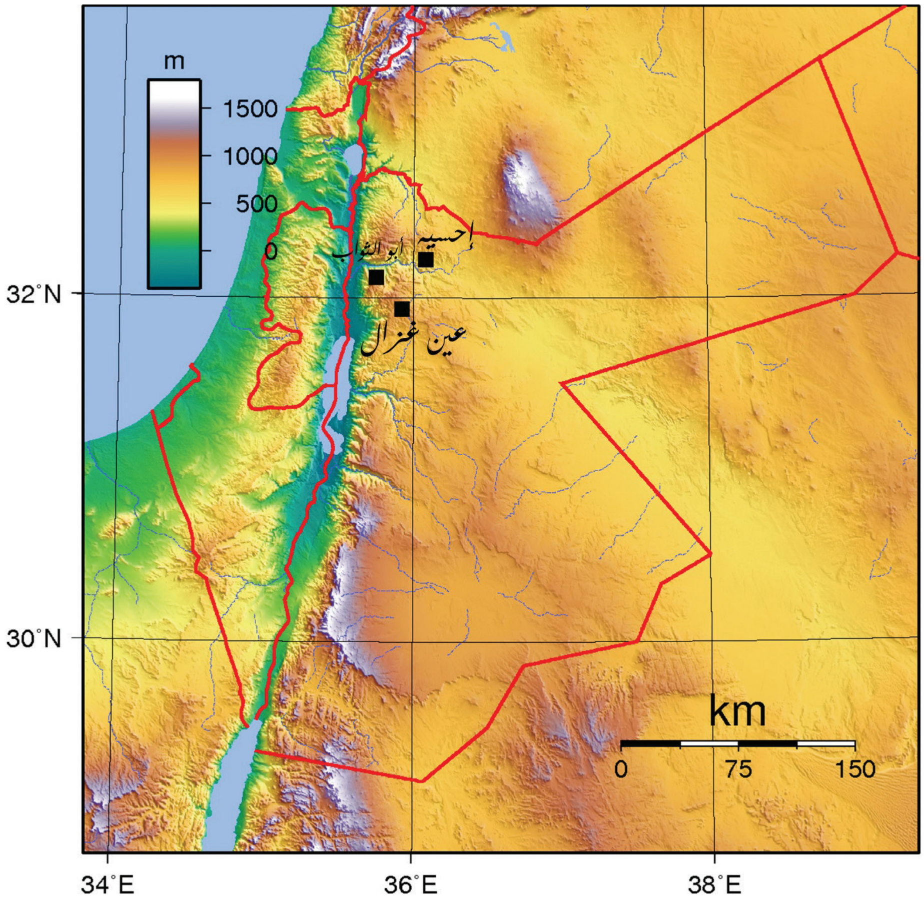


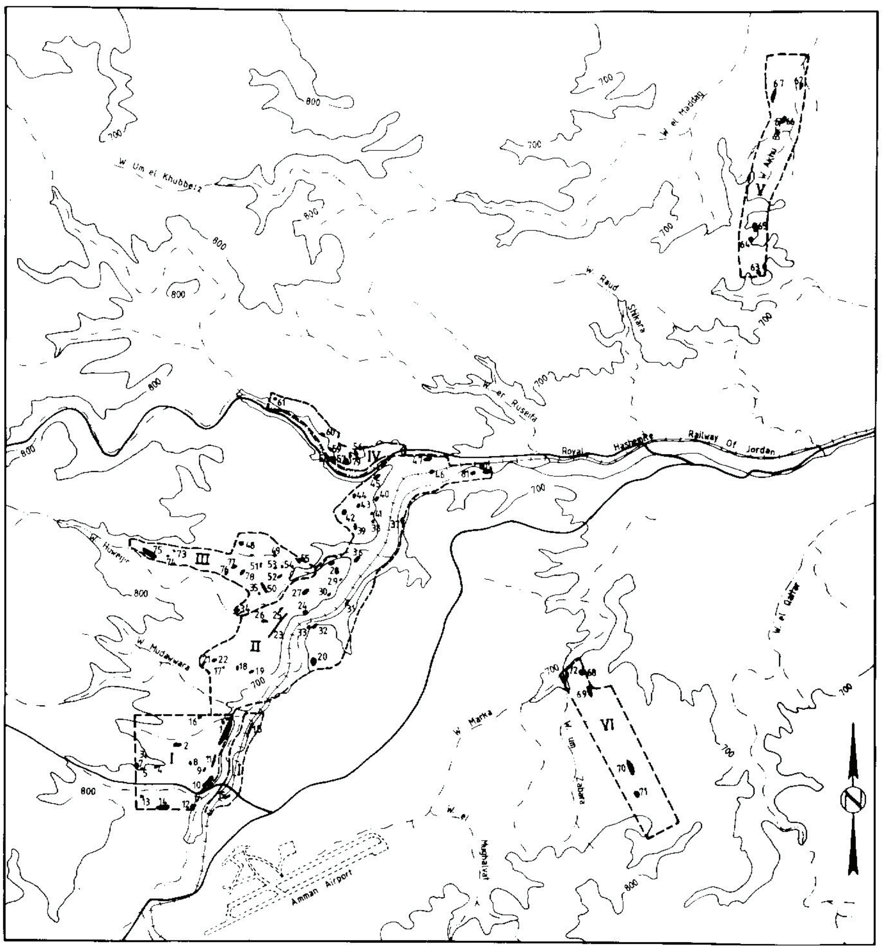
1. A map showing major Late Neolithic sites.

Late Neolithic Pastoral Sites

During the 1930s, Nelson Glueck (Glueck 1951; 1951a) conducted an intensive survey in Jordan and parts of Palestine, including the Wādī az-Zarqa. This survey was followed by some others during the second half of the 20th century, with several others in Wādī az-Zarqa (*cf.* above), which discovered that this Jordanian geographical zone (Wādī az-Zarqa) was inhabited as early as the Palaeolithic period. Flint tools and a mammoth tusk belonging to this period were collected and excavated at several sites such as the as-Sukhna. Moreover, during the Neolithic period, this region witnessed the presence of the first settled communities in very large sites such as Khuraysān (PPNA and Early Pre-Pottery Neolithic B), ʿAyn Ghazal and Abu aṣ-Ṣuwwān (PPNB). These large Pre-Pottery Neolithic villages were affected by a climatic change in around 6000 BC (uncalibrated date), which led to the abandonment of many Early Neolithic villages (*i.e.*, Pre-Pottery Neolithic), except a few of them such as the sites of ʿAyn Ghazal and Abu aṣ-Ṣuwwān. Those two sites displayed continuation of occupation but were far smaller than previous settlements at the sites. As a result of this natural change, it seems that some of the farming communities changed their subsistence strategies to pastoralism, such as at the site of eh-Sayyeh/al-Ḥusayyah (Bartl and Kafafi 2016) and the burin sites in the area located to the east of ʿAyn Ghazal. Moreover, new, smaller settlements were established very close to permanent water resources, such as the site of Abu Thawwab (Kafafi 2001) where people practiced farming, pastoralism, and hunting. A brief study of the results of the archaeological fieldworks conducted in Wādī az-Zarqa, and related to the Late Neolithic settlement patterns, is presented below.

ʿAyn Ghazal is a major Neolithic settlement located in the northern part of Amman. In 1987, an archaeological survey was conducted in the site's vicinity with the aim of documenting whether the site was surrounded by smaller Neolithic settlements and to examine the range of human occupation in the region of ʿAyn Ghazal (Fig. 2). As a result of the survey, 12 Neolithic settlements were identified. Three settlements are located in the immediate vicinity, just south of ʿAyn Ghazal, and might be considered as an extension to the PPN village (Simmons and Kafafi 1988, 1989), while the rest are situated a moderate distance from it. One of the three sites belongs to the Yarmoukian Period.

Several burin sites were reported in

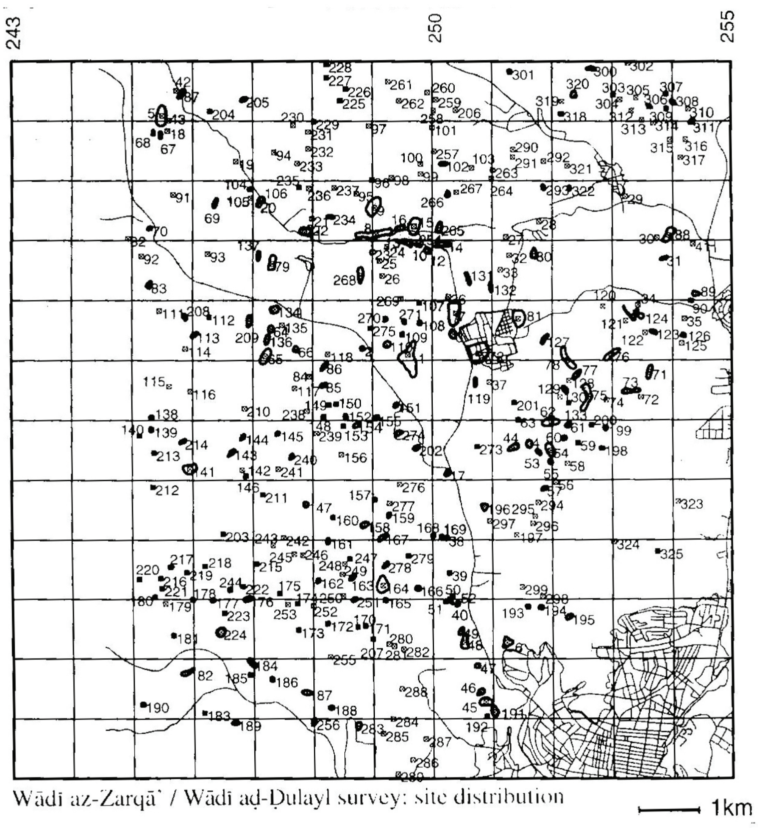


2. Map produced from the 1987 ʿAyn Ghazal survey.

areas located a moderate distance from ʿAyn Ghazal, such as Wādī Marka (AGAS 70). Most of the recorded burin sites are surface scatters. Two sites, however, contained *rujum* that might be associated with the Neolithic occupations. They resemble the burin sites found in the Black Desert by Alison Betts in the 1980s. Many scholars feel that they date either to the Late Pre-Pottery Neolithic or to the Pottery Neolithic (Betts 1986, 1988, 1998; Betts and Helms 1986).

The surveyors of the ʿAyn Ghazal survey had expected to find smaller Neolithic villages, farmsteads, or pastoral sites, but that was not the case, unless some of the chronologically ambiguous lithic scatters and *rujum* or structure sites are Neolithic. It now appears that ʿAyn Ghazal did, in fact, operate as a relatively independent settlement and that major support sites were not part of its settlement system. It is, however, possible that some Neolithic settlements may be buried under relatively recent deposition. The tendency for such sites to be located near major *wadi* systems may have rendered them nearly invisible to conventional archaeological survey (Simmons and Kafafi 1989). On the basis of the survey data, however, it is tentatively concluded that there are no major Neolithic sites located in the areas that were investigated.

In 1996, a survey project was conducted by the Rome La Sapienza University/Italy and Yarmouk University covering the area which extends between the city az-Zarqa and the village Quneyyeh (Fig. 3). In this survey 294 sites were recorded, and only

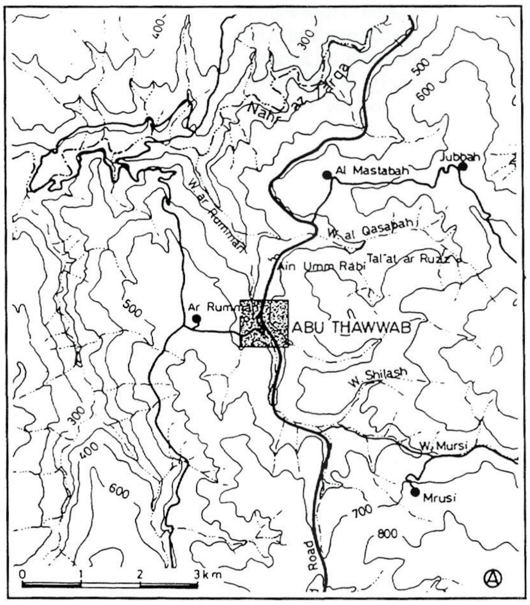


3. Map resulting from the Wādī az-Zarqa/Wādī edh-Dhulail survey.

one site (Site 9) namely Wada'a/eh-Sayyeh/al-Ḥusayyah has been identified as Neolithic (Palumbo *et al.* 1996: 380–4). Moreover, located 4 km downstream of Wādī az-Zarqa from the town as-Sukhna, the site Khuraysān, which was first registered by Hanbury-Tenison in 1978, has been revisited and recently excavated by a Spanish team. However, this survey proved that neither Late Neolithic farmsteads, stations, camps, nor villages were recorded in addition to eh-Sayyeh/al-Ḥusayyah.

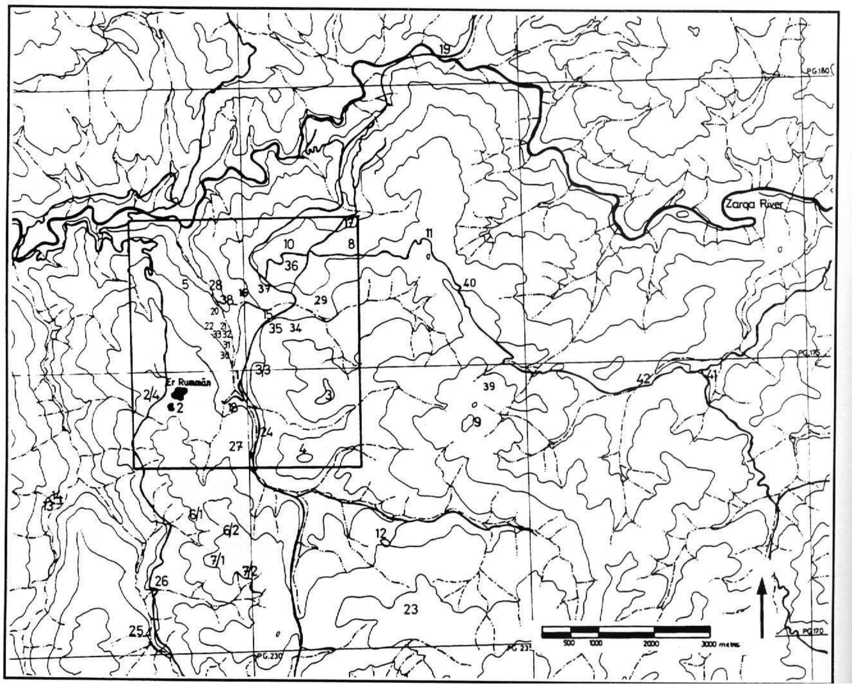
The site eh-Sayyeh/al-Ḥusayyah was first sounded in 1997 (Caneva *et al.* 1999) and continued to be excavated in 2013, 2014, and 2015 (Bartl and Kafafi forthcoming). The results of the excavations indicated that the site was first established during the Late Pre-Pottery Neolithic B (PPNB) and continued in the Pre-Pottery Neolithic C (PPNC), Late Neolithic (Yarmoukian), and the Chalcolithic periods. Despite the fact the excavations yielded Late Neolithic architectural remains, there were very few from the Pottery Neolithic, leading the excavators to conclude that it belonged more to a pastoral community rather than a settled village. Moreover, the site is located halfway between the mega Neolithic sites 'Ayn Ghazal and Abu aṣ-Ṣuwwān, and no other Late Neolithic site has already been recorded in the distances extending between the sites. This deduction reinforces the belief that Late PPNB farming settlements were either abandoned or reduced to small villages and that portions of the farming community changed their subsistence strategy to pastoralism. This position might be supported by the large number of burin sites recorded in the regions located in the vicinity of Wādī az-Zarqa.

In 1985, within the framework of the Jabal abu Thawwab project, a team consisting of six members visited 42 sites ranging in date from the Middle Palaeolithic to the modern era (Figs. 4–5). The aim of this survey was to gain a deeper understanding of the site in the context of the larger area surrounding it. Out of the 42 visited sites, and in addition to Abu Thawwab, eight were assigned to the Late Neolithic and were identified as villages (Kafafi 2001: 9–10). Four identified as villages are as follows: Jabal Abu Thawwab (Site 1), 'Ayn el-Karm II (Site #15/2), 'Ayn el-Gathyan (Site #17), and 'Ayn Safsafeh (Site # 24). Four others produced pottery sherds related to the Yarmoukian Period: 'Ayn Ras al Ma (Site #2), as-Salihī (site #2/1), Haud el-Bayad (Site #29), and Umm el-Basatīn I (Site #31).



4. Map resulting from the Jabal Abu Thawwab survey.

This survey determined that there was a concentration of settlement and farming activities during the period ranging from 5600 to 5000 BC (uncalibrated date). In addition, most of these sites were constructed on slopes very close to perennial springs or overlooking *wadis*. The largest of them is the Late Neolithic village Jabal Abu Thawwab, which appears to be the center of all these smaller sites. It seems that the Late



5. Map resulting from the Jabal Abu Thawwab survey.

Neolithic settlement patterns in this region are completely different from those in the Upper Wādī az-Zarqa where we have a central site (Abu Thawwab), surrounded by small either farmsteads or seasonal camps constructed in places where perennial water is available.

Sixth-Millennium BC Villages

The excavated archaeological material in Wādī az-Zarqa belonging to the 6th millennium BC was assigned to two different periods: the Pre-Pottery Neolithic C (*ca.* 6000–5600 BC) and the Yarmoukian (*ca.* 5600–5000 BC). The archaeological material attributed to each of the two periods is discussed below.

*The PPNC Settlements (*ca. *6000–5600 BC)*

The two sites (ʻAyn Ghazal and eh-Sayyeh/al-Ḥusayyah) identified as PPNC settlements are different in nature. ʻAyn Ghazal is considered to be one of the most important PPNB villages excavated in Wādī az-Zarqa due to the large area of the settlement, the richness of excavated architecture and other objects (especially art objects), and the continuation of living at the site from the 7th to the 6th millennia BC, in other words, from the Pre-Pottery to the Pottery cultures (Rollefson *et al.* 1992).

Around *ca.* 6500 BC the farming villages in the Jordan Valley and Palestine were abandoned, and the inhabitants of this part of the southern Levant found themselves obliged to immigrate to the eastern side of the Jordan River (Kafafi 2001a). The immigrants were absorbed into communities at sites such as ʻAyn Ghazal and other Late PPNB Neolithic villages where both the social and economic spheres of daily life were suitable. It seems that during this period (Late PPNB), several immigrant families built houses in the eastern side of ʻAyn Ghazal, a little bit far away from those of the original inhabitants in the southern and northern sides of the site. Unfortunately, the exposed areas in the East Field at ʻAyn Ghazal across the River Zarqa were too limited to gain a clear understanding of the nature of settlement during the 7th and 6th millennia BC.

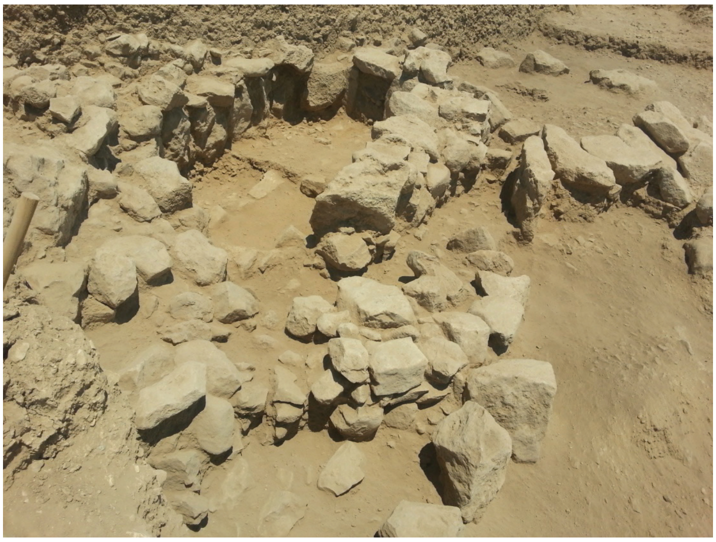
It has been argued (Rollefson and Kafafi 2000) that shortly after the beginning of the 6th millennium (*ca.* 5900 BC) the socio-cultural changes of ʻAyn Ghazal witnessed a major alteration that is reflected in the architectural types found at the site. This also might be due to a natural catastrophe that affected the way of life not only in Wādī az-Zarqa but also all over the southern Levant. This natural catastrophe enforced a major change of the lifestyle during the first half of the 6th millennium, which is identified as the PPNC. At the site, two types of domestic buildings dating to the PPNC were recorded and studied, and both indicated the return to a nuclear family arrangement. The first type is characterized by a small single-room house with a walled courtyard. The second type was the 'corridor building' (Fig. 6), a semi-subterranean storage feature/foundation probably belonging to families who lived only for a short period of the year at ʻAyn Ghazal. It has been suggested that during this period, in the fall/winter until the end of the harvest in May/June, these families would have stayed in the steppe and Badia regions with their herds, returning to ʻAyn Ghazal in Wādī az-Zarqa when the water and vegetation in the eastern side of Jordan had disappeared (Rollefson and Koehler-Rollefson 1993).

One more settlement has been excavated in Wādī az-Zarqa, namely the site eh-Sayyeh/al-Ḥusayyah, which is located very close to the confluence of both Wādī-az-Zarqa with Wādī edh-Dhulail (Kafafi *et al.* 1997; Caneva *et al.* 2001). The site was first registered during the survey conducted in 1993 by Gaetano Palumbo, and then sounded in 1997 by a Jordanian-Italian team (Caneva *et al.* 1999: 10–2; 2001: 102–5), and excavated in 2013, 2014, and 2015 by a Jordanian-German expedition (Bartl and Kafafi forthcoming). The site measures approximately 10 ha in area, and the archaeological excavations yielded architecture, flint tools, and pottery sherds dated to a period ranging from the Late PPNB to the Chalcolithic period without any interruption of settlement (Fig. 7).

6. PPNC corridor buildings at ʻAyn Ghazal.

As a result of the archaeological survey and excavations at eh-Sayyeh/al-Ḥusayyah, it has been deduced that the eastern side of the site did not produce any architectural remains; in the meantime, several constructions were encountered in the western part of the site. An elliptical feature was uncovered in the 2015 season which might be used either as a grave or a storage facility (Fig. 8). The same type and building plan was also uncovered

7. A general view of eh-Sayyeh/al-Ḥusayyah.



8. An elliptical structure at eh-Sayyeh/al-Ḥusayyah.

9. Sixth-millennium BC structures at eh-Sayyeh/al-Ḥusayyah.

in the western part of the site, but it was accompanied by other constructed rooms, perhaps built later than this elliptical feature. In the Badia, the same kind of feature has also been discovered. Thus, it is possible that such an installation might have served as storage for semi-nomadic populations who lived in the region during the first half of the 6th millennium and used to stay at the site for only part of the year.

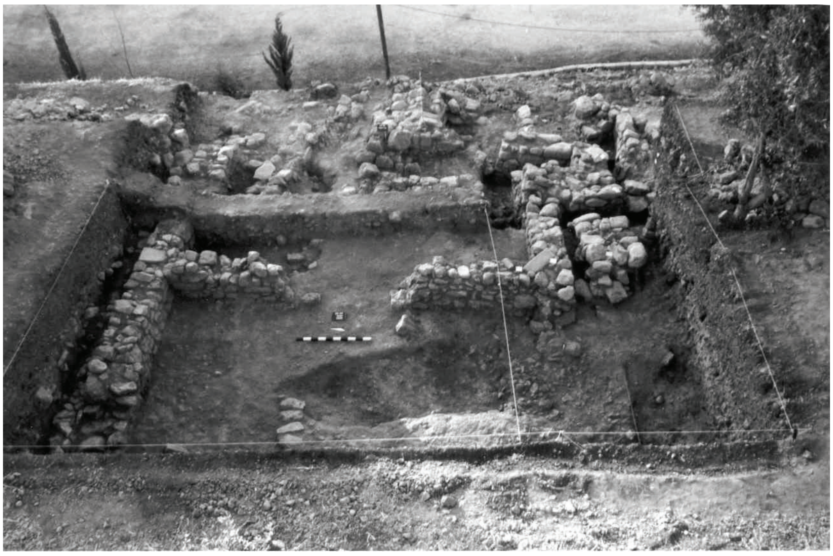
In addition to the elliptical feature, several rectangular rooms were likewise uncovered in the same area of the elliptical building, but built on top of it (Fig. 9). In these excavated rooms, only a few Yarmoukian pottery sherds were found along with more flint tools dating to the 6th millennium BC. This is an indication that the people who lived at the site during this period of time were semi-nomadic.

Regarding settlement patterns during the first half of the 6th millennium BC, one could conclude that no permanent villages existed in the valley, but transhumance was practiced and populations stayed in this region for several months of the year.

Yarmoukian Settlements Patterns (ca. *5600–5000 BC*)

The results of excavations at several sites situated in Wādī az-Zarqa and belonging to the second half of the 6th millennium BC demonstrate that there was a shift in settlement patterns after the PPNC. At sites like ʿAyn Ghazal, Tall Abu aṣ-Ṣuwwān, Jabal Abu Thawwab, and Tall Ḥimma, all located in the basin of Wādī az-Zarqa, villages and farmsteads were founded in this region of Jordan. People settled in permanent villages (*e.g.*, ʿAyn Ghazal and Jabal abu Thawwab), but they were small in area compared with the Pre-Pottery Neolithic villages. The excavations of Tall Abu aṣ-Ṣuwwān and Tall Ḥimma did not produce any major constructions, but storage pits were excavated at all Yarmoukian sites.

At ʿAyn Ghazal, the uncovered Yarmoukian structures consist of both rectangular (Fig. 10) and curvilinear (Fig. 11) floor plans. The investigated buildings appear to have been used as regular dwellings for nuclear families, except one built during the last occupation of the Neolithic period (end of Yarmoukian) that



10. An excavated Yarmoukian house.

11. Sixth-millennium BC buildings at ʿAyn Ghazal.

was circular in plan and constructed only of one row of small stones, probably indicating that it was built as a barn. In addition, there was also an apsidal one (Fig. 12) that had a small courtyard and might have served a public purpose, such as a space for ritual.

The earliest phases of the Yarmoukian at ʿAyn Ghazal suggest that the PPNC partial separation of the population into permanent settled farming communities was evidently concluded. In addition, the Yarmoukian presence once again suggests that the pastoral type of dwellings was no longer a part of the ʿAyn Ghazal community and a clear indication of a nuclear family structure was made very clear by the isolated courtyard houses (Kafafi and Rollefson 1995: 15–6).

With the beginning of the Yarmoukian period around 5600 BC, the size of the site continued to be reduced, and there was no evidence of domestic use either in the East or in the North Fields of the site. Furthermore, the Yarmoukian houses were built far away from each other. During the last phase of the Yarmoukian period, the end of the 6th millennium BC, the last farmers living at ʿAyn Ghazal were struggling to make their living at the site.

One more Yarmoukian settlement located in the Wādī az-Zarqa basin is the site Jabal Abu Thawwab, situated on the eastern bank of Wādī ar-Rummān, which empties into the Wādī az-Zarqa from its southern side. The site was first settled during the Yarmoukian Period (*ca.* 5600–4500 BC), followed by a gap of occupation,

12. An apsidal house at ʿAyn Ghazal.

then reoccupied during the Early Bronze Age I (*ca*. 3900–3100 BC).

The archaeological excavations conducted at the site during the 1980s revealed several rectilinear and curvilinear structures related to the Pottery Neolithic period. Moreover, many storage pits were also found at the site. The site is medium in size and measures around 300 m x 200 m. Furthermore, the Yarmoukian architecture, flint tools, and pottery assemblages suggest that the site served as a permanent, medium-sized Yarmouk village.

Two other Yarmoukian sites should also be mentioned here: the Tall Abu aṣ-Ṣuwwān and Tall Ḥimma. There is little Yarmoukian material at Tall Abu aṣ-Ṣuwwān and it does not give the impression that it functioned as a village. The excavator published only an assemblage of pottery sherds and flint tools, but no complete house plans or any other Yarmoukian structure. Nevertheless, storage pits were found at the site. This might indicate that the site served as a farmstead, a farming community, or a station for transhumance groups. At Tall Ḥimma, the test trenches excavated in 1996 by Evelyn van der Steen yielded a small amount of Yarmoukian pottery sherds, which do not shed light on the nature of the settlement during the Yarmoukian period.

Conclusions

To conclude, the results of the archaeological fieldwork conducted in the Wādī az-Zarqa basin indicated the following:

1. The Wādī az-Zarqa Basin witnessed two types of settlements during the 6th and 5th millennia BC:
   a. Permanent settlements and villages where the inhabitants relied on farming, pastoralism, and hunting.
   b. Camps or small permanent settlements built by pastoralists and semi-nomads practicing transhumance.
2. There was continuous contact between the human groups who lived in the villages and farmsteads in the Wādī az-Zarqa Basin and others who lived in far distant regions, especially in the Badia. This is supported by the similarity of the type of storage in the two regions.
3. The 6th- and the 5th-millennium settlements were founded very close to the perennial water sources and on the slopes of the mountains overlooking either the Wādī az-Zarqa or its tributaries.

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Chalcolithic Ceramic Spoons from Ḥarrat al-Juḥayra 1 and 2, Southern Jordan

Abstract

Ceramic spoons are one of the most common pottery groups in the Chalcolithic period of the southern Levant. They have been unearthed from ordinary dwellings and are considered to be one of the tools of daily use. Recently, ceramic spoons were unearthed from ritual features in Tel Tulaylāt al-Ghassūl and Ḥarrat al-Juḥayra 1 and 2. Therefore, it is possible that ceramic spoons had a ritual function. The purpose of this paper is to clarify the functions of Chalcolithic ceramic spoons in the southern Levant. For that reason, this paper provides a data collection of Chalcolithic ceramic spoons and classifies them morphologically into three types: Type 1, 2, and 3. The paper concludes that Type 1, which has a short handle, was used for ritual activities.

Introduction

This paper explores the function of Chalcolithic ceramic spoons in the southern Levant. Various pottery groups of the Chalcolithic period in the southern Levant have been discussed by scholars (Amiran 1969; Gonen 1992; Garfinkel 1999). Although opinions on them vary, ceramic spoons have always been considered to be one of the common tools in the Chalcolithic southern Levant. For example, R. Amiran (1969: 25) argued that the ceramic spoons are particular to the Ghassulian, but she did not discuss their functions. R. Gonen (1992: 55) suggested that ceramic spoons were kitchen tools and used for mixing food. Y. Garfinkel (1999: 25, 259), who classified Neolithic and Chalcolithic pottery in the southern Levant, suggested that ceramic spoons existed in the both periods. Furthermore, it is important to note that stone spoons also have been unearthed from the Neolithic and Chalcolithic periods in the southern Levant (Garfinkel and Miller 2002: fig. 127; Ibrahim 2016: pl. 38-1).

As stated above, the functions of the

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Chalcolithic ceramic spoons in the southern Levant have not been considered carefully. However, two recent archaeological discoveries revealed that ceramic spoons are connected to ritual sites. A miniature ceramic spoon and small cup were unearthed from an infant burial feature in Area Q at Tulaylāt al-Ghassūl (Bourke *et al.* 2000; Lovell 2017). Also, Ḥarrat al-Juḥayra 1 revealed two complete ceramic spoons and a small cup in a ritual feature (Fujii *et al.* forthcoming). These two findings raise the possibility that Chalcolithic ceramic spoons were used for ritual activities.

Research Methods: Classification for the Ceramic Spoons in the Southern Levant

This paper explores the morphological classification of ceramic spoons in order to clarify their functions. Garfinkel has already provided a data collection of the Chalcolithic ceramic spoons in his monograph on Neolithic pottery (1999: fig. 161). For the purposes of this paper, Table 1 combines recent archaeological findings with those recorded in Garfinkel's monograph, while Figure 1 is a distribution map. In Garfinkel's data set (1999: 259), ceramic spoons were only recovered from the Late Chalcolithic period. More recent discoveries have yielded ceramic spoons dating to the Late Neolithic period in the southern Levant. Therefore, ceramic spoons must have been used in the Early and Middle Chalcolithic periods, even though they have not been observed in either the Early or the Middle Chalcolithic periods.

This paper classified the Chalcolithic ceramic spoons into three types: Type 1,

Table 1. Chalcolithic ceramic spoons from the southern Levant. L.= Length, W.= Width.
(Continued.)

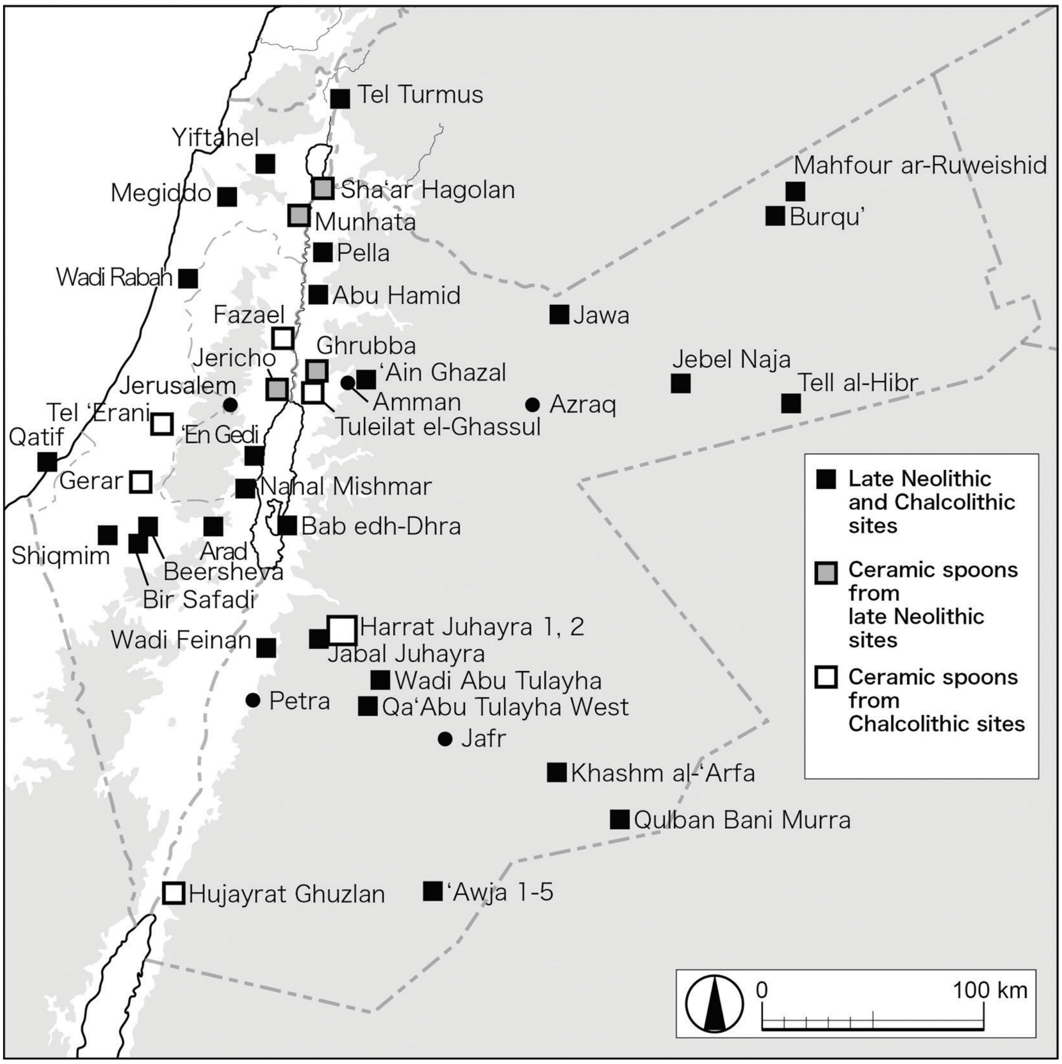
No.	Site	Context	Type	L.	W.	L. of Handle	Bibiliography
1	Ḥarrat al-Juḥayra 1	F123, Area-1 loc.116	Type 1	9.3	5.6	2.5	Fujii *et al.* forthcoming
2	Ḥarrat al-Juḥayra 1	F123, Area-1 loc.118	Type 1	9.2	5.5	2.5	Fujii *et al.* forthcoming
3	Ḥarrat al-Juḥayra 2	F256, loc. 102	Type 1				Fujii *et al.* forthcoming
4	Ḥarrat al-Juḥayra 2	F256, loc. 102	Unknown				Fujii *et al.* forthcoming
5	Ḥarrat al-Juḥayra 2	F264. loc. 105	Type 1	10.5		2.5	Fujii *et al.* forthcoming
6	Ḥarrat al-Juḥayra 2	F264. loc. 102	Unknown				Fujii *et al.* forthcoming
7	Ḥarrat al-Juḥayra 2	F264-2. loc. 527	Type 2				Fujii *et al.* forthcoming
8	Tulaylāt al-Ghassūl	RN30035, QI 2.4	Unknown	3.1	1.2	0.9	Bourke 2000: fig. 22:13
9	Tulaylāt al-Ghassūl		Type 2	10.6	5.2	4.3	Lee 1973: 101, no. i
10	Tulaylāt al-Ghassūl		Type 1	11.5	6.2	2.5	Lee 1973: 101, no. c

Table 1, *continued*. Chalcolithic ceramic spoons from the southern Levant. L.= Length, W.= Width.

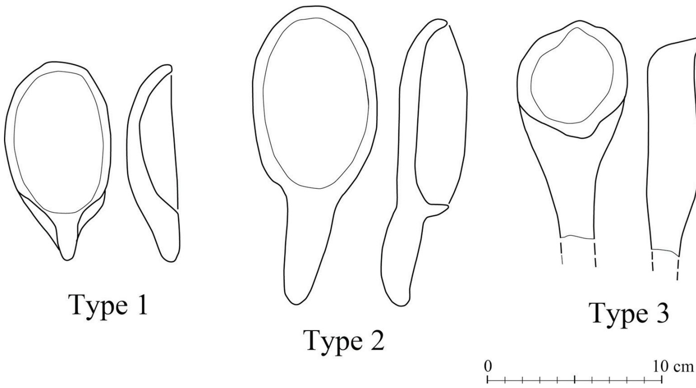
11	Tulaylāt al-Ghassūl		Type 2	17.2	7.1	6.8	Lee 1973: 101, no. d
12	Tulaylāt al-Ghassūl		Type 2	19.8	9.8	7.5	Amiran 1969: pl. 19
13	Tulaylāt al-Ghassūl		Type 1				Mallon *et al.* 1934: pl. 44: 55
14	Tulaylāt al-Ghassūl		Type 1				Mallon *et al.* 1934: pl. 44: 56
15	Tulaylāt al-Ghassūl		Type 2				Mallon *et al.* 1934: pl. 44: 57
16	Tulaylāt al-Ghassūl		Type 2				Mallon *et al.* 1934: pl. 44: 58
17	Tulaylāt al-Ghassūl		Type 2				Mallon *et al.* 1934: pl. 44: 64
18	Tulaylāt al-Ghassūl		Type 2				North 1961: pl. IX,8685
19	Tulaylāt al-Ghassūl	Bag 128, Sanctuary A	Unknown		4.8		Seaton 2008: pl. 127.e
20	Grar	Area B, F49, 1089	Unknown				Gilead and Goren 1995: fig. 4.18.7
21	Grar	Area E, Z101, 2681	Type 2				Gilead and Goren 1995: fig. 4.18.8
22	Fazael		Unknown				Porath 1985: fig. 5:8
23	Fazael		Unknown				Porath 1985: 8
24	Fazael		Unknown				Porath 1985: 8
25	Tall ʿErani	Gath D57-587	Type 2				Brandl 1989: fig. 4:9
26	Tall ʿErani	Gath D60-165/10	Type 3				Brandl 1989: fig. 4:8
27	Tall Ḥujayrāt al-Ghuzlān	HG10/0666	Type 3				Kimscha 2013: fig. 34

Type 2, and Type 3 (Fig. 2). Type 1 has an oval-shaped bowl in plan and a very small handle. Type 2 also has an oval-shaped bowl, but a long handle. Finally, Type 3 has a small round-shaped bowl and a long handle.

Type 1 has been unearthed from Tulaylāt al-Ghassūl and Ḥarrat al-Juḥayra 1 in ritual contexts. Since the handle of Type 1 is approximately 2.5 cm in length, it is not large enough to pick up easily. It would be hard to use Type 1 as a mixing instrument, as Gonen (1992: 35) assumed. Type 2 has the same shaped bowl as Type 1, but the handle of Type 2 is longer than that of Type 1. Most handles are curved vertically. Since the handle of Type 2 ranges from 4.5 to 7.5 cm in length, Type 2 is more suitable for stirring or mixing than Type 1. Type 3 was found at Tall Ḥujayrāt al-Ghuzlān (Table 1:27), and the specimen was reported as a crucible (Kimscha 2013: fig. 34). It was



1. Late Neolithic and Chalcolithic sites in the southern Levant.



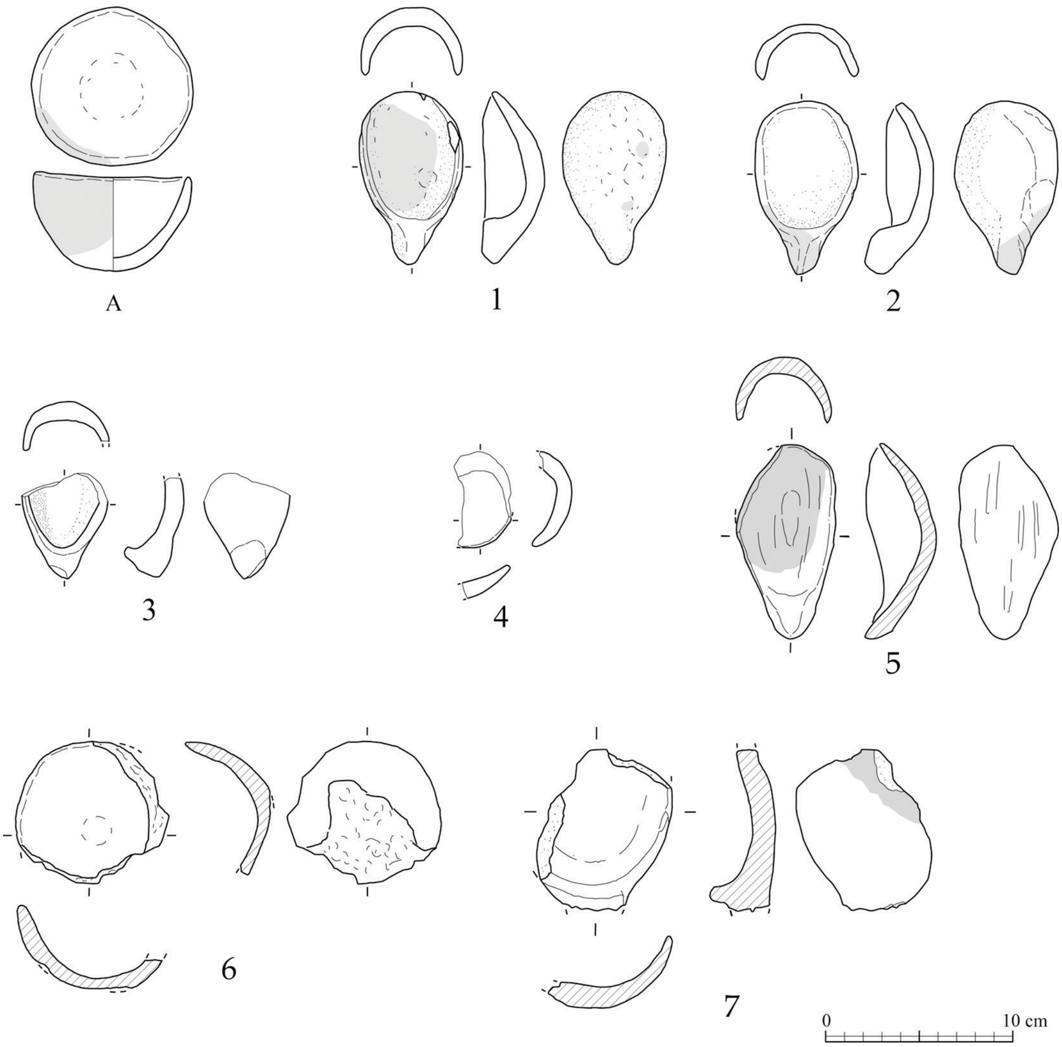
2. Type 1, 2, and 3 ceramic spoons in the Chalcolithic period.

difficult to identify it as a ceramic spoon, but a similarly shaped specimen was uncovered from Tall ʼErani (Table 1:26), so Type 3 was established as an independent type.

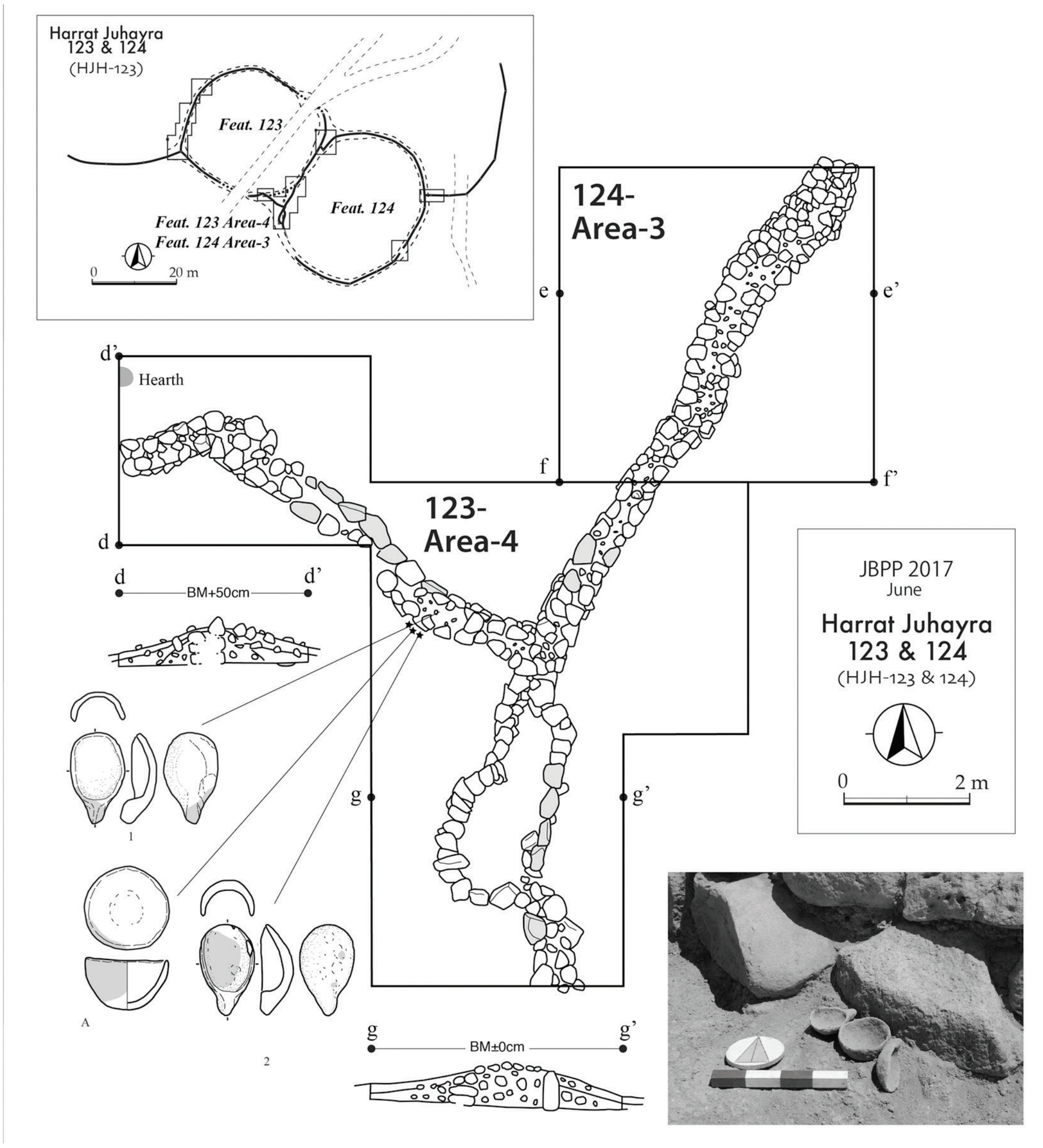
The Chalcolithic Ceramic Spoons in the Southern Levant

Ḥarrat al-Juḥayra 1

Ḥarrat al-Juḥayra 1 is a Chalcolithic burial ground in the eastern foothills of Jabal Juḥayra, an isolated volcanic hill behind Jurf ad-Dārwish in south Jordan. The site is an extensive composite site including tails and enclosures (Fujii *et al.* forthcoming). Two Type 1 ceramic spoons accompanied by a small cup were unearthed from tailed enclosures HJH-123 and HJH-124 (Fujii *et al.* forthcoming: fig. 13:1–3; Table 1:1, 2, Figs. 3:1, 2, A). They were found *in situ* on the construction level in the connecting part between HJH-123 and HJH-124 (Fig. 4). HJH-123 and HJH-124 are typical enclosures. These kinds of features in the Chalcolithic period have been considered



3. Chalcolithic ceramic spoons from Ḥarrat al-Juḥayra 1 and 2.



4. The Chalcolithic spoons and small cup from HJH-123 (Fujii et al. forthcoming: fig. 11).

to be ritual features, so the spoons and the small cup are also considered to be used for ritual activities. HJH-123 and HJH-124 will be discussed in the official excavation report in detail (Fujii *et al.* forthcoming). C-14 data collected from the construction level of HJH-123 revealed a date of 4252–4051 cal BC (95.4%; HJH-1, F-123, Area-4, loc. 114. hrf; IAAA-172623).

Ḥarrat al-Juḥayra 2

Ḥarrat al-Juḥayra 2 is located adjacent to the southwest of Ḥarrat al-Juḥayra 1. Several dwellings and a few enclosures are found at this site. Five ceramic spoons were unearthed from the dwellings (Table 1:3–7; Figs. 3:3–7); two of them are Type 1 and one of them is Type 2. HJH-264, which yielded one Type 1 ceramic spoon, has a ^{14}C date at the lowest level. The date ranges from 4200 to 4000 cal BC [HJH-2, F-264/2, loc. 528.chr; IAAA-181108; 4229–4199 cal BC (14.9%), 4172–4089 cal BC (36.3%), 4084–4034 cal BC (29.1%), 4025–3992 cal BC (15.0%)].

Tulaylāt al-Ghassūl

More than 11 ceramic spoons dating to the Chalcolithic period were unearthed at Tulaylāt al-Ghassūl (Table 1:8–19). Three of them can be classified as Type 1, seven can be defined as Type 2, and others are of unknown type. It is noteworthy that a small ceramic spoon was recently found from Area Q, Tulaylāt al-Ghassūl (Table 1:8). The small ceramic spoon was found in association with a small cup from the infant burial feature (Lovell 2017). J.L. Lovell, however, maintains that the function of the ceramic spoon is not significant in this context, and what matters more is that the spoon and cup are miniature objects.

Grar

Two Type 2 ceramic spoons were recovered from Grar (Table 1:20, 21), and one of these has incised decorations.

Fazael

One Type 2 ceramic spoon was illustrated in the excavation report and two ceramic spoons were found from there (Table 1:22–24). The details concerning the two spoons that were not drawn are unclear.

Tall ʼErani

Two ceramic spoons were uncovered at Tall ʼErani, one of which is Type 2 and the other is Type 3 (Table 1:25, 26). Type 3 ceramic spoons were only found at Tall ʼErani and Tall Hujayrāt al-Ghuzlān.

Tall Hujayrāt al-Ghuzlān

Although the only one Type 3 ceramic spoon was found at Tall Hujayrāt al-Ghuzlān, it was recorded as a crucible (Table 1:27).

Discussion

Although this paper discusses the morphological classification of Chalcolithic spoons, the idea is still regarded as a working hypothesis, primarily because the existence of Type 3 is not confirmed. Type 3 is defined as those ceramic spoons with a round-shaped bowl. However, only two Type 3 ceramic spoons have been discovered, and one of them was recorded as a crucible.

On the other hand, there is stronger evidence for the classification of Types 1 and 2. The main criterion of the classification is the length of the handle. Type 1 is defined as a ceramic spoon with a very short handle compared to Type 2. Types 1 and 2 both have oval-shaped bowls. Although Type 1 and 2 ceramic spoons were reported in the first excavation report of Tulaylāt al-Ghassūl (Mallon *et al.* 1934: pl. 44), researchers have not paid attention to their morphological differences so far.

Type 1 ceramic spoons were intentionally produced with a shortened bowl, and the handle is too short to stir or mix something. Type 1 ceramic spoons could be used to carefully move a small amount of food. There is a possibility that Type 1 ceramic spoons were used for feeding infants foods such as milk, soup, and cream.

The data collection of the Chalcolithic ceramic spoons reveals that the number of Type 1 spoons is almost the same as that of Type 2. Type 1 ceramic spoons were only found at Ḥarrat al-Juḥayra 1 and 2 and Tulaylāt al-Ghassūl. On the contrary, several Chalcolithic sites yielded Type 2 ceramic spoons. Because of this, it is likely that Type 2 was more popular that Type 1. The longer handle of Type 2 ceramic spoons is more suitable for stirring or mixing something, so it is possible that Type 2 was a daily tool similar to modern spoons.

Two ceramic spoons recovered from the ritual feature in Ḥarrat al-Juḥayra 1 shed light on another possible function. The two ceramic spoons were found *in situ* on the construction level near the wall of HJH-123 (enclosure). They are associated with the ritual feature, HJH-123, and considered to be used for a ritual activity. The two ceramic spoons are not classified Type 2, which is interpreted as a daily tool, but Type 1.

This paper argues that Type 1 ceramic spoons had a ritual function. A Type 1 ceramic spoon was also discovered in a dwelling (HJH-264; Fig. 3:5). It is a possibility that Type 1 ceramic spoons served both ritual and daily life purposes. HJH-264, however, is a peculiarly shaped dwelling that accompanied a round structure, providing further support for the possibility that this Type 1 ceramic spoon also had a ritual function.

Furthermore, Tulaylāt al-Ghassūl recently yielded a small ceramic spoon associated with a small cup in an infant burial feature (Table 1:8). Burials are ritual contexts, and the fact that this spoon's shape bears Type 1 characteristics supports the hypothesis of this paper. Moreover, it is important to note that small Type 1 spoons have been associated with small cups at Tulaylāt al-Ghassūl as well as HJH-123, Ḥarrat al-Juḥayra 1.

Conclusion

This paper provides a data collection of Chalcolithic ceramic spoons and their morphological classifications. Also, this paper suggests that Type 1 ceramic spoons served a ritual function. Although the Chalcolithic ceramic spoons have been considered to be one of the most common artifacts of the period, there has been little discussion about their functions. Additionally, this paper raises the possibility that Type 1 ceramic spoons were not only used ritually, but also to feed infants. Finally, this paper ends with the suggestion that if ceramic spoons were indeed used to feed infants, they represented improved sanitary conditions and could have contributed to lower infant mortality in the Chalcolithic period.

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Settlement/Cemetery Complex at Ḥarrat al-Juḥayra 2: An Exotic Middle Chalcolithic Culture in the al-Jafr Basin, Southern Jordan

Introduction

Since the reconnaissance survey in 1995, our research project in the al-Jafr Basin in southern Jordan has consistently addressed the issue of the formation process of nomadic society at the arid margin of the southern Levant. The results of the field research series focusing on this issue were synthesized in "Jafr Chronology" (Fujii 2013), which has enabled us to outline the socio-cultural sequence during the key five millennia spanning from the Pre-Pottery Neolithic (hereafter PPNB) when sheep and goats were first introduced until the Early Bronze Age (EBA) when full-scale nomadic society is supposed to have been established. However, available datasets are still patchy and far from sufficient to trace the long-term sequence rigorously. Among others, the Chalcolithic period is deficient in specific research data, which leads to the vulnerability of our study.

Our recent surveys and excavations at the Ḥarrat al-Juḥayra sites have drastically changed this situation. The highlight of the investigations is the finding of a Middle Chalcolithic settlement and cemetery complex at Ḥarrat al-Juḥayra 2, which have shed new light on the post-Neolithic cultural landscape in the basin. Since the research outcomes are due to be reported elsewhere in detail (Fujii *et al.* in preparation a, b; forthcoming a, b), this paper reviews the overall picture of the complex and discusses its general characteristics and archaeological implications.

Site and Site-Setting

Ḥarrat al-Juḥayra is a local topographic term referring to a tongue-shaped lava plateau that extends from the eastern foot of Jabal al-Juḥayra to the west bank of Wādī Burma, a southern tributary of Wādī al-Ḥasā (Fig. 1). This small-scale volcanic tableland with a total area of *ca.* 15 km² and a relative height of *ca.* 20–30 m has a few topographic

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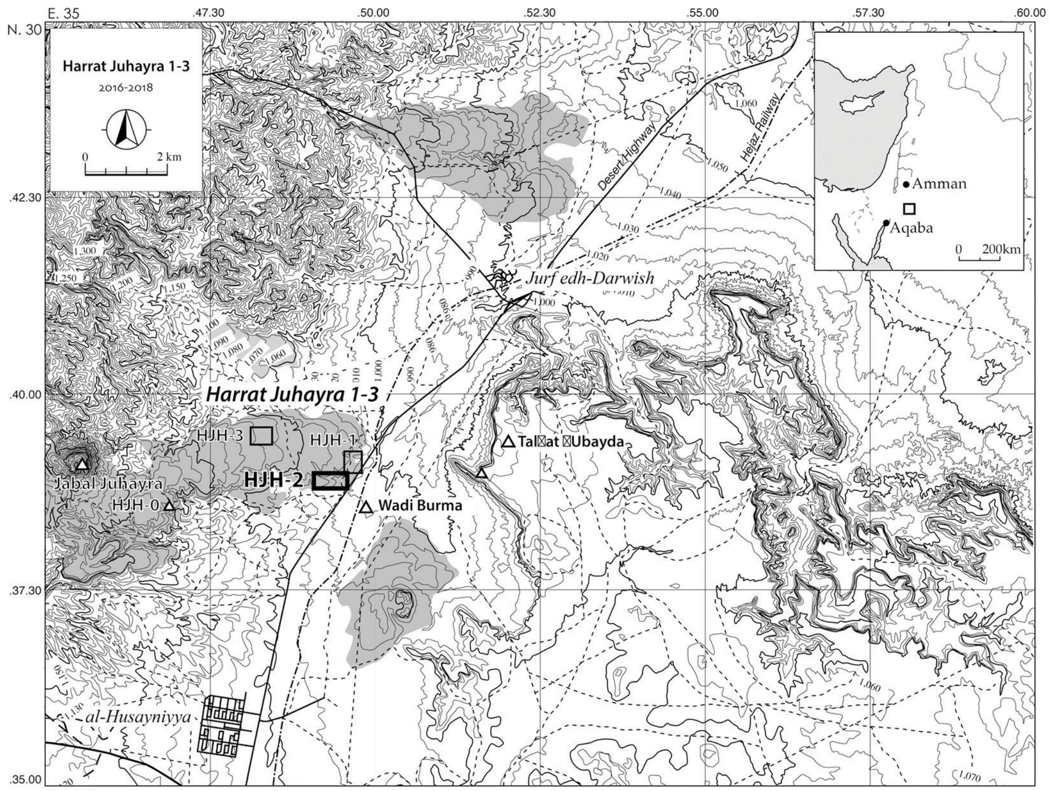
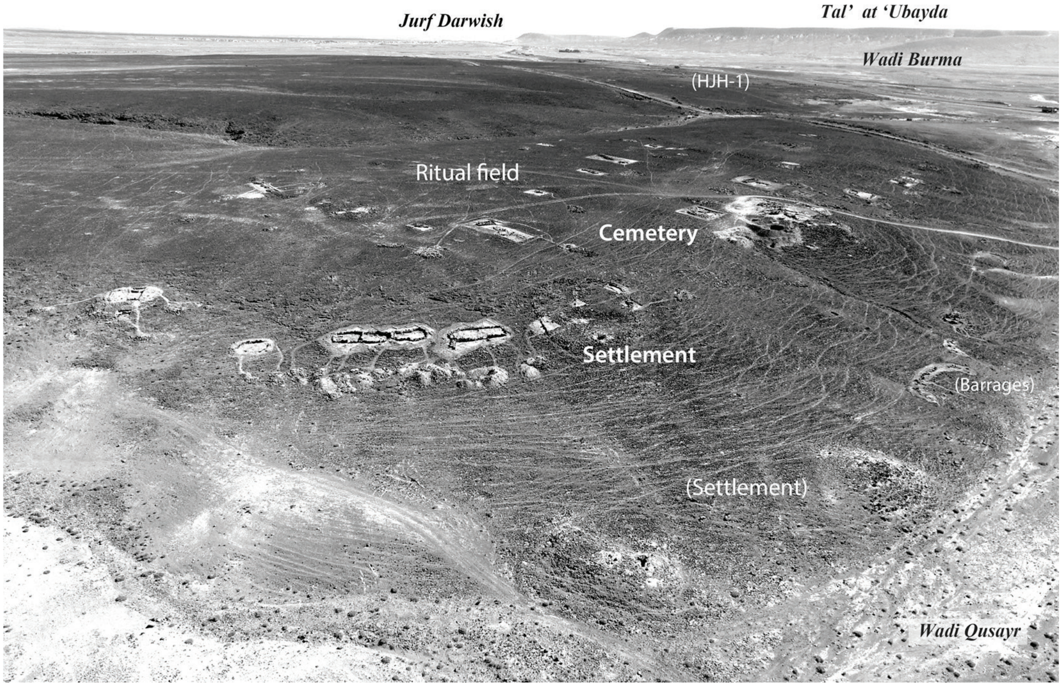
advantages for human habitation. To begin with, it has an annual average precipitation of *ca*. 100 mm (Jordan National Geographic Center 1984: 114) and forms a transitional eco-zone between the desert to the east and the sown to the west. Second, it is combined with Tal'at 'Ubayda, a limestone table mountain on the opposite bank of Wādī Burma, and as a whole, creates a bottleneck at an important point for local traffic. It is precisely for this reason that the Hijaz Railway and the Desert Highway are forced to run side-by-side immediately beside the site. The bottleneck must have produced the same effect in prehistoric times. In addition, the volcanic plateau serves as a convenient windbreak against the northwesterly predominant wind in this region (Fujii 2014). These advantages explain the reason why modern local nomads preferably pitch their tents in this area, especially at the southern skirts of the plateau.

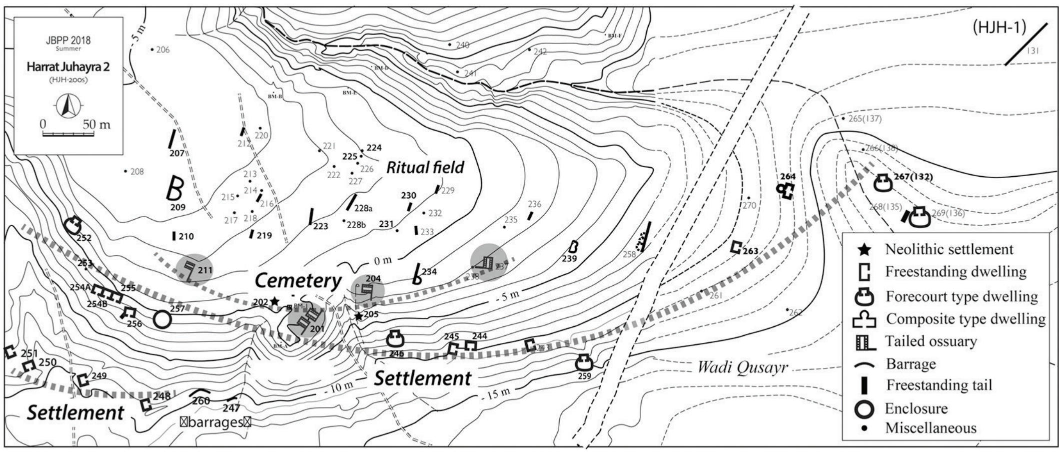
Our investigation in this area started with a general survey in December 2001 (Fujii 2002a). Since then, we have repeated a survey and an intermittent excavation in an effort to understand the occupational history of this key area. The investigated sites include a Late Natufian settlement of Wādī al-Quṣayr 139 (Fujii 2005a: 42–4, but see also Neerly and Delage 2004), a Pre-Pottery Neolithic A (PPNA) encampment of Ḥarrat al-Juḥayra 205 (Fujii *et al.* in press), an Early PPNB settlement of Ḥarrat al-Juḥayra 202 (Fujii *et al.* in press), a Late PPNB rockshelter settlement of Jabal al-Juḥayra (Fujii *et al.* 2018, in press), a Late Neolithic (LN) pseudo-settlement of Ḥarrat al-Juḥayra or rebadged Ḥarrat al-Juḥayra 0 (Fujii 2005b), Late Chalcolithic to EBA



1. HJH 1–3: Site locations.



2. HJH-2: Aerial view (looking NE).



3. HJH-2: Structure/feature distribution map.

burial grounds of Wādī Burma and Tal'at 'Ubayda (Fujii 2004, 2005a), and an EBA tabular scraper lost property site of Wādī al-Quṣayr 173 (Fujii 2011). The site density of this area is outstanding in the whole of southern Jordan as well as the al-Jafr Basin, corroborating anew its topographic advantages.

Ḥarrat al-Juḥayra 2, or HJH-2 for short, is among three Chalcolithic sites (*i.e.*, HJH

1–3) registered during the 2002 summer season survey (Fujii and Abe 2008: table 1). The site occupies the southeastern corner of the tongue-shaped plateau, overlooking the narrow drainage basin of Wādī al-Quṣayr, a side stream of Wādī Burma. While the other two contemporary sites are simple open sanctuaries composed only of ritual features, HJH-2 contains a settlement and cemetery complex in addition to an extensive ritual field, and as a whole, forms a huge composite site with a total area of *ca.* 25 ha (Figs. 2–3). The excavation at this site began in June 2016 and is still in progress. The following review and discussion are based on research outcomes as of September 2018 and are subject to minor revision depending on future investigation.

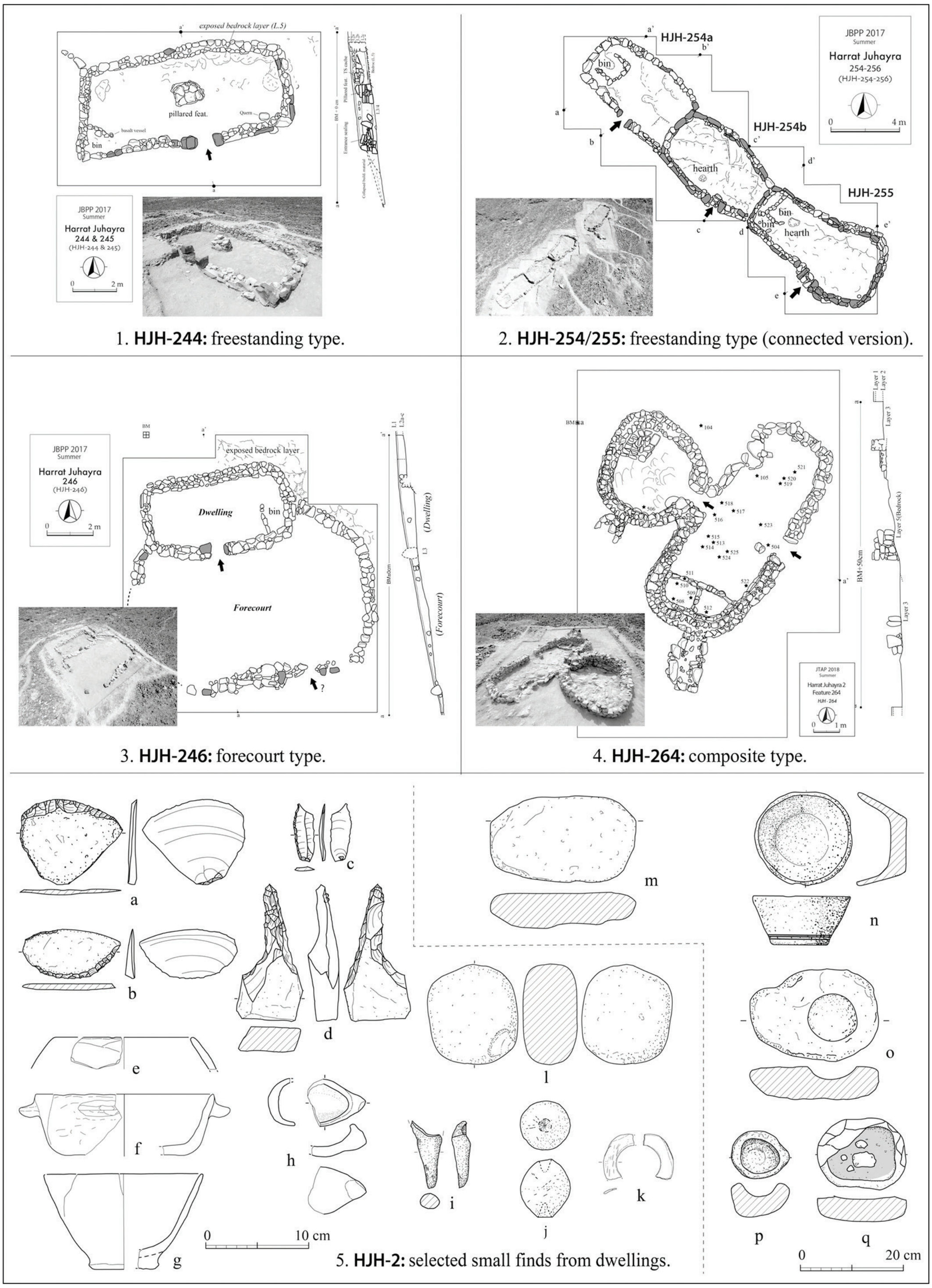
Settlement

The settlement, the main body of the composite site, consists of two dozen horizontally long dwellings, or broadhouses. They are aligned at intervals either in a single row (in the eastern and central parts) or two rows (at the western edge) along the southern slope of the volcanic plateau, constituting a linear settlement *ca*. 800 m in total length. Understandably, they are constructed with undressed basalt cobbles/ boulders that are ubiquitous on the plateau. Although not clay-mortared, they adopt a rubble-core, double-walling technique uncommon to desert fringe sites, and in this sense, they can be said to be rather substantial structures. In terms of typology, they fall into the following four major types.

The most common is the freestanding type, which is best exemplified by HJH-244 (*i.e*., Ḥarrat al-Juḥayra 2, Feature No. 44; the same applies hereafter) located in the middle of the linear settlement (Fig. 4:1). Although slightly skewed in general plan, this structure is a typical broadhouse equipped with a narrow entrance nearly in the middle of the long front wall facing to the south, measuring 9.8 m by 4.7 m in external size and up to 0.9 m in preserved wall height. The entrance is 0.8 m wide and framed with a pair of upright basalt boulders. As for indoor small features, a slab-lined, quadrant bin *ca*. 1 m^2 in floor area is incorporated into the southwestern corner of the horizontally long room. In addition, a tower-like stone concentration *ca*. 1.5 m in diameter and *ca*. 1 m high stands on the central floor, which was probably used as a stone pillar or a pillar base for supporting a roof. This type of broadhouse is distributed throughout the settlement, and relevant examples total 12 including HJH-262, -256, -249, and -251. It is a standard architectural style in the Chalcolithic southern Levant (*e.g*., Porath 1992).

The connected type is literally a connected version of the freestanding-type broadhouse. Structures of this type are rather exceptional and limited to three examples (*i.e*., HJH-254a, -254b, and -255) near the western edge of the settlement (Fig. 4:2). They are connected in a lateral direction to form an elongated complex, or a chain-building, ca. 20 m in total length. Similar complexes are ubiquitous throughout Chalcolithic settlements in the Golan Heights (*e.g*., Epstein 1998: fig. 7, 112, Site Plan 2; Kafafi 2010).

Next, the forecourt type broadhouse is represented by HJH-246 *ca*. 70 m west of HJH-244 mentioned above (Fig. 4:3). Structures of this type attach a slightly angular forecourt *ca*. 30–50 m^2 in floor area to a standard broadhouse. Here again, a narrow entrance framed with a pair of upright basalt boulders and a small slab-lined bin are incorporated into the middle of the front wall and the southeastern floor, respectively. Since few artifacts were found there, the attached forecourt probably doubled as a corral for keeping livestock. This type of broadhouse is also rather exceptional, and only one similar example has been confirmed at HJH-252 at the western edge of the settlement. In a broader



4. HJH-2: Settlement: Four types of broadhouses and selected small finds.

context, Faza'el in the Upper Jordan Valley has a few parallels (Porath 1985).

The composite type refers to an Ω-shaped complex that connects a standard broadhouse and a trapezoidal structure through a very narrow passageway *ca*. 0.5 m wide and *ca*. 1 m long (Fig. 4:4). This type of structure is so far limited to HJH-264 near the eastern edge of the settlement. The broadhouse functions as a front room and contains a pair of square, slab-lined bins and a few hearths along its southern sidewall and near the northern corner of the floor, respectively. In addition, a tail-like, external feature is attached to its southern sidewall. Meanwhile, the trapezoidal rear room contains a square, slab-lined, slab-paved, and altar-like platform at its rear right corner. Here again, although poorly preserved, a tail-like feature is attached to the southern sidewall. Seeing that traces of everyday life, such as hearths and small finds, are found in the front room, the rear room might possibly have some symbolic implication. The combination of a broadhouse and a (semi-)round symbolic feature can also be seen at contemporary open sanctuaries such as ʿAyn Jadī (Ussishikin 1980: fig. 4) and Tuleilat el-Ghassul (Bourke *et al.* 2000: fig. 6; Bourke 2008: fig. 5.9), suggesting, together with the other types of broadhouses, a close relationship with the Ghassulian cultural sphere.

The settlement also includes two small barrages (HJH-247 and -260) and a few miscellaneous structures (*e.g.*, HJH-253). What attracted our attention were the barrages, which were equally constructed across a shallow gully that flows down a gentle slope in the western half of the site (see Fig. 6:1). It is most unlikely, however, that they were used as normal storage dams. This is because, first, they are not only small in size (*ca*. 7–22 m long and *ca*. 0.5 m in maximum wall height) but also have gaps throughout the walls, and second, because they makes a slight curve toward the upper stream, not in a downward direction. These observations strongly suggest that they were gravity-type water-spraying barrages for conducting the gully stream to sloping cultivated lands on both its banks. Although no ^{14}C dates are available, they share the same stratigraphy with neighboring broadhouses, suggesting that they were combined with the settlement to form a well-organized agricultural infrastructure.

Small finds are homogenous in content at the broadhouses, and no remarkable rank differentiation within the settlement has been attested. The flint assemblages equally center on small, horizontally long tabular scrapers, also called fan-scrapers (Fig. 4:5a–b), and robust drills made on cortical flakes (Fig. 4:5d), and occasionally include sickle blades with silica sheen (Fig. 4:5c) and flint hammer-stones. Meanwhile, the pottery assemblages are dominated by cooking pots, casseroles, and shallow bowls (Fig. 4:5e–f). Of interest is the existence of a base fragment probably of a cornet (Fig. 4:5i), a V-shaped bowl (Fig. 4:5g), and a spoon-shaped miniature vessel with a knob handle (Fig. 4:5h), all of which have parallel examples in the Ghassulian pottery repertoire (*e.g.*, Adachi and Fujii in this volume; Amiran 1969: 22–3; Garfinkel 1999: 153–296; Bourke 2008: 131–4; Rowan and Golden 2009: 33–7). The third most common category is basalt/scoria products, which include a V-shaped bowl decorated with two incised lines near the base (Fig. 4:5n), a spoon-shaped vessel with a knob handle (Fig. 4:5p), a rectangular pallet with rounded corners (Fig. 4:5q), and standard grinding implements (Fig. 4:5l–m). The former two are stone versions of similar pottery types, and again, highlight a close relationship with the Ghassulian cultural sphere. In addition, limestone mace-heads were also commonly found (Fig. 4:5j), but adornments were limited to a few shell bracelets only (Fig. 4:5k). No prestige goods, such as copper products, were included.

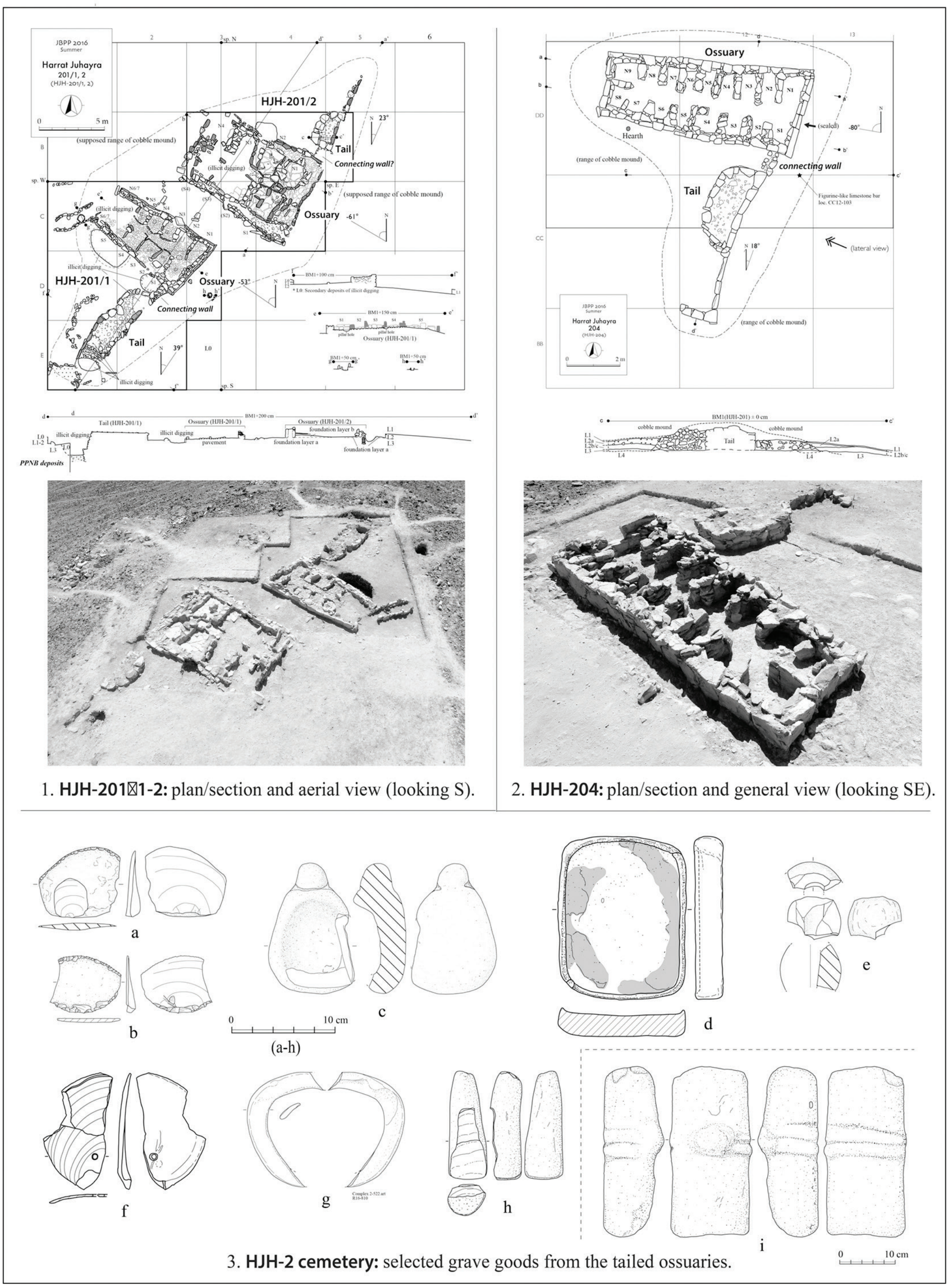
Although faunal and floral remains have yet to be analyzed, the absence of hunting weapons and the predominance of fan-scrapers demonstrate that hunting was entirely replaced by livestock herding. Likewise, the frequency of grinding implements and sickle blades, coupled with the existence of the water-spraying barrages, indicates that the villagers were engaged in cereal cultivation as well. Both perspectives would explain the reason why the stable settlement life, uncommon in the arid margin, was established at HJH-2. Noteworthy in this respect is the ubiquity of fan-scrapers, which probably suggests that sheep/goat shearing became popular. Furthermore, although no churns have so far been attested at HJH-2, the close contact with the Ghassulian culture implies the possibility that milk processing was also introduced. Assuming that the subsistence strategy at the HJH-2 settlement put emphasis on the production of such secondary products, its sudden appearance could be said to usher in the era of full-scale livestock farming in the al-Jafr Basin.

Cemetery

Some sixty stone-built structures/features are dotted on the flat hilltop behind the settlement, forming an extensive burial/ritual field *ca*. 15 ha in total area. However, what constitutes the cemetery in the strict sense of the word is limited to five tailed ossuaries (*i.e.*, ossuaries with a tail-like attachment feature) that are aligned at intervals along the southern edge of the hilltop. The others are devoid of interments and grave goods and, therefore, can be regarded as mere ritual features. We excavated four of the five registered examples and confirmed that they constitute an intermittent cemetery *ca*. 300 m in total length.

The tailed ossuaries have a L-shaped plan that connects a large trapezoidal structure and a d- or q-shaped, tail-like feature at a right angle, measuring *ca*. 12–15 m wide and *ca*. 8–10 m deep (FIG. 5:1–2). As with the broadhouses, a rubble-core, dry-walling technique uncommon to desert fringe sites is applied to their construction. The excavations recovered a substantial amount of human skeletal remains and grave goods, which corroborates that they were used as mortuary facilities.

The trapezoidal structures, the key components of the L-shaped complexes, measure *ca*. 3–6.5 m wide, *ca*. 5–9 m deep, and up to *ca*. 0.8 m in preserved wall height. The excavation at an undisturbed example (*i.e.*, HJH-204) indicates that they were constructed as low-walled, unroofed structures from the beginning, and together with the attachment features, entirely covered with a low cobble mound at the final stage. Every example incorporates a narrow entrance into the middle of the gable-side wall facing to the east or the southeast, namely, the base of a trapezoidal plan. The layout of indoor space is also homogeneous in every example, and 8–17 small, square to rectangular burial chambers are almost symmetrically arranged on both sides of a narrow corridor stretching from the entrance. These chambers yielded a substantial amount of human skeletal remains, but grave goods were unexpectedly scarce, being limited to fan-scrapers (FIG. 5:3a–b), a scoria spoon (FIG. 5:3c), a basalt rectangular pallet (FIG. 5:3d), limestone mace-heads (FIG. 5:5e), shell pendants/bracelets (FIG. 5:3f–g), and a basalt pestle (FIG. 5:5h). In addition, a limestone figurine *ca*. 30 cm high was found immediately beside the trapezoidal structure of HJH-204, under the cobble mound (FIG. 5:5i). This unique artifact is decorated with a headband-like bas relief and a small, nose-like protrusion, both of which are reminiscent of a basalt torso from Qulbān Beni-Murra, a Late Chalcolithic open sanctuary recently investigated near



1. **HJH-201/1-2:** plan/section and aerial view (looking S).

2. **HJH-204:** plan/section and general view (looking SE).

3. **HJH-2 cemetery:** selected grave goods from the tailed ossuaries.

5. HJH-2: Cemetery: Tailed ossuaries and selected grave goods.

1. HJH-260/247: barrages (looking N).

2. HJH-210: single-unit tail (looking NW).

3. HJH-230: double-unit tail (looking NW).

3. HJH-207: multi-unit tail (looking NW).

6. HJH-2: Barrages and Freestanding Tails.

the border with Saudi Arabia (Gebel 2016: fig. 21). In view of the overall similarity of small finds and the synchronism of the ^{14}C dates mentioned below, it is indisputable that the cemetery belonged to the adjacent settlement. Incidentally, some of the human bones bear osteological evidence for kneeling facets (Sakaue *et al.* 2017), which demonstrates anew that cereal cultivation was among the major subsistence activities at the settlement.

The d/q-shaped tail-like features, or the d/q tails for short, have a length of *ca*. 6–16 m, depending on the number of incorporated units. They are attached to one edge of the base of the trapezoidal ossuary, facing, as with the entrance, to the east or the southeast. In terms of typology, they are composed of a straight front wall built with upright basalt boulders and a curvilinear rear wall constructed with horizontally piled smaller stones, and the semi-circular space sandwiched between the two is infilled with basalt/scoria rubble and silty sands. Neither human skeletal remains nor grave goods are included in the space.

Incidentally, research evidence suggests that the d/q tail was gradually separated from the main body of the ossuary complex and changed into the freestanding tail, the main components of the ritual field behind the cemetery (Fig. 6:2–4; Fujii *et al.* in preparation b). It is needless to say that no interments are included in these symbolic features. The change in site from the settlement/cemetery complex to the simple ritual field centering on the freestanding tails probably mirrors the shift in lifestyle from sedentary farming to pastoral nomadism.

Discussion

The above review has reaffirmed that the composite site of HJH-2 includes a full-fledged settlement/cemetery complex quite unusual as a desert fringe site. The question is its date, origin, subsistence, and social structure. The following discussion deals with these basic issues, and on this basis, approaches a few more comprehensive issues, such as the cultural sequence of the Jafr Chalcolithic and its archaeological implications in local and broader contexts.

Date, Origin, Subsistence, and Social Structure

Nearly two dozen ^{14}C dates from various loci of the settlement/cemetery complex equally converge on a relatively narrow time range around *ca.* 4300–4100 cal BC (Fujii *et al.* in preparation a: table 1), suggesting that it was a short-lived architectural entity that operated for only a few centuries during the Middle Chalcolithic (c.f. Lovell 2001; Anfinset *et al.* 2011: table 8.1). As noted above, the contents of small finds accord well with this radiometric dating.

Where, then, did it originate? A key to approaching this issue is the fact that the complex appeared at the northwestern corner of the basin suddenly and as a completed form from the beginning. No contemporary settlements, to say nothing of its proto-type, have so far been attested in the basin. Both facts strongly suggest that the complex was an exotic cultural entity derived from the west. What existed in the west at this time were the Ghassulian in the Upper Jordan Valley and the Timnian on the Negev Highlands, but there is little doubt that the stable settlement life at HJH-2 derived from the former. Thus, it is conceivable that the eastward expansion or infiltration of the Early to Middle Ghassulian culture or the yet-to-be-specified Ghassulian-related Chalcolithic culture in the Lower Jordan Valley led to the appearance of the HJH-2 complex. The unique architectural landscape and small finds can be understood in this context. The only enigma is the origin of the tailed ossuary, another landmark of the complex, which needs further study.

Next, the subsistence strategy of the complex is clear, and ample evidence suggests that, even though for just a short period, a well-balanced mixed economy centering on cereal cultivation and livestock herding sustained the stable settlement life at HJH-2. However, this is nothing but a basic framework, and the details must await future faunal/floral analysis.

A key in discussing the last issue (*i.e.*, the social structure of the complex) is the homogeneity of the architectural landscape. As described above, the two dozen broadhouses share a similar scale and plan. Aside from the rare attachment of a forecourt and a trapezoidal rear room, there is no remarkable hierarchy among them. Likewise, the excavated small finds are quite homogenous throughout the whole settlement, and no prestige goods, such as copper products, are included at any broadhouse (another potential prestige good could be the maceheads, but they are equally made of ubiquitous material such as limestone and basalt, and at the same time, occur evenly throughout the settlement). The homogeneity in the settlement also applies to the cemetery. The four excavated tailed ossuaries share similar size and plan, and no special treatment is added to any interment. Grave goods are also homogeneous, and there is no rank differentiation among buried dead bodies. These observations strongly suggest that the settlement/cemetery complex at HJH-2 formed an egalitarian society before a chiefdom system.

Cultural Sequence of the Jafr Chalcolithic

The findings of the HJH-2 settlement/cemetery complex have shed new light on the Chalcolithic cultural landscape in the al-Jafr Basin, which has traditionally been poorly understood due to the lack of basic information about it. It is our new proposal that the Jafr Chalcolithic falls into the following three phases on the basis of the research outcomes from the HJH-2 complex.

The first phase, or the Early Chalcolithic in the basin (*ca*. 4600–4300 cal BC), is a stage immediately before the appearance of the HJH-2 complex, and its existence can be perceived through the pseudo-wall burial cairns at Qāʿ Abu Tulayha, an isolated sanctuary in the northwestern part of the basin (Fujii 2002b). Thus, this phase can be defined as a period when small-scale, high-mobility population groups following the PPNB pastoral transhumants and the LN initial nomads were sparsely dotted across the basin (Fujii 2013).

Research evidence from this site suggests that in the dry heartland of the basin, the nomadic society represented by the pseudo-wall burial cairn continued further into the Middle Chalcolithic (*ca*. 4300–4000 cal BC). This is when the HJH-2 complex suddenly appeared at its northwestern corner. To date, no clear evidence for friction between the two groups has been attested. It would follow that the Jafr Middle Chalcolithic witnessed the establishment of a dimorphic society where the farming community and the traditional nomads coexisted peacefully and kept their own territories, although it can also be argued that the isolation of the farming community and the low population density in the basin made this possible.

Meanwhile, the Late Chalcolithic (*ca*. 4000–3700/3600 cal BC) is marked by the collapse of the dimorphic society and the subsequent return to nomadic society. As noted above, the settlement/cemetery complex at HJH-2 did not last long and soon changed into the simple ritual field centering on the freestanding tails. This fact probably means that the exotic farming culture swiftly acculturated under the arid environment and was absorbed into the traditional nomadic society. In fact, in contrast to the tailed ossuaries seen only at the HJH-2 Middle Chalcolithic cemetery, the freestanding tail was widespread in the basin and beyond, suggesting that the short-lived dimorphic society had collapsed and the nomadic society was reassembled during the Late Chalcolithic (Fujii *et al.* in preparation b). However, it was not a simple return to the traditional lifestyle, because there is a possibility that the expansion of the Late Chalcolithic culture was associated with the secondary products, such as wool and milk, supposedly introduced through the HJH-2 complex. In this sense, the Jafr Late Chalcolithic potentially ushers in a new era of dryland adaptation. The existence of a variety of water-use facilities at Qulbān Bani-Murra also highlights the rise of advanced nomadism in this phase (Gebel 2016).

To summarize, it is tentatively concluded that the Jafr Chalcolithic started with the traditional nomadic society inherited from the preceding pastoral transhumants or nomads, witnessed the infiltration and swift acculturation of the exotic farming community, and eventually shifted to the advanced pastoral nomadism likely based on the production of secondary products. This advanced nomadism is thought to have paved the way to the full-fledged nomadic society in the EBA.

Archaeological Implications of the Jafr Chalcolithic

The HJH-2 settlement/cemetery complex has a few significant archaeological implications. To begin with, in a local context, it fills an information gap left in the Jafr Chronology and contributes to its refinement (Table 1). The updated chronology suggests that the pastoral nomadization in the al-Jafr Basin began

Table 1. Updated Jafr chronology (as of December 2019).

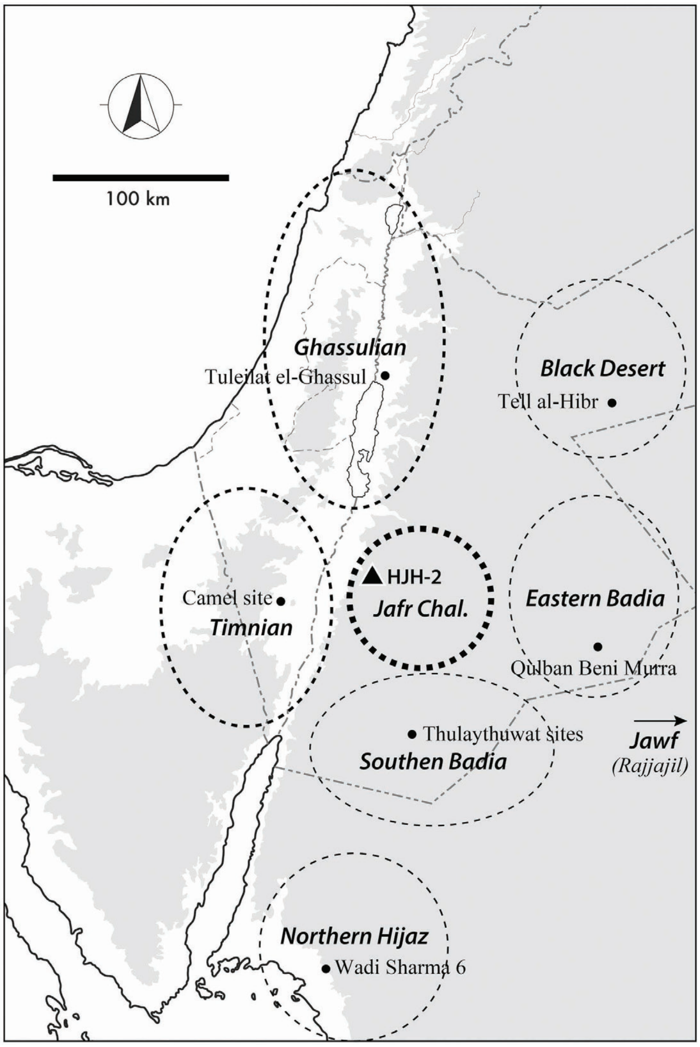
	Settlement/Encampment	Barrage/Cistern	Cemetery/Sanctuary
Late Natufian	Wadi Qusayr 139		
PPNA	Harrat Juhayra 205		
PPNB (Early)	Harrat Juhayra 202		
PPNB (Middle)	WAT*: Complex 00-III? — Wadi Ghuwayr 17 —	WAT: Barrages 1-3, Str. M Wadi Ghuwayr 17: St. 101 Wadi Ghuwayr 106 Wadi Nadiya 1: Barrages 1-2	
PPNB (Late)	Jabal Juhayra: Layer 3 — WAT: Complex IV?-IX —	J. Juhayra: Barrage & cisterns — WAT: Barrages 1-3 Wadi Nadiya 2: Barrages 1-3	(J. Juhayra: slab-lined features)
(PPNC/FPPNB) LN	Hashm ‘Arfa — ? — Jabal Juhayra: Layer 2	Eastern Jafr cistern-type barrages	HJH*-0 QAT*: NE Complex Jabal Juhayra: Layer 2 ‘Awja 1-2, 4-5
4600 (Early) 4300			QAT: SW Complex
Chalcolithic (Middle)	**HJH-2: settlement** —	**HJH-2: 247–260?** —	**HJH-2: cemetery** HJH 1-3: ritual field
4000 (Late) 3800			‘Awja 3 Wadi Burma
EBA			Tal’ at ‘Ubayda Wadi Ghuwayr 1-3

WAT*: Wadi Abu Tulayha; QAT*: Qa’ Abu Tulayha; HJH*: Harrat Juhayra

——— : Settlement/barrage/cemetery complex.

with the Middle to Late PPNB outpost complexes (such as Wādī Abū Ṭulayḥa, Wādī Ghuwayr 17, and Jabal al-Juḥayra), through the LN encampments (attested at Khashm ʿArfa and Jabal al-Juḥayra Layer 2), shifted to the advanced nomadism (triggered by the appearance and acculturation of the Middle Chalcolithic settlement/cemetery complex at HJH-2), and eventually crystallized in the EBA full-fledged nomadic society (represented by large-scale cairn fields of Talʿat ʿUbayda and Wādī Ghuwayr 1–3). What is important here is that the HJH-2 complex potentially made the turning point in the long-term sequence in the sense that it introduced technological innovation to the traditional nomadic society. This perspective is expected to provide fresh insight into the formation process of nomadic society in southern Jordan.

In a broader context, the HJH-2 com-



7. Middle to Late Chalcolithic cultural entities in and around the southern Levant.

plex bridges the Ghassulian and the Timnian to the west and the Jordanian Badia Chalcolithic entities to the east, and by so doing, contributes to a better understanding of the post-Neolithic cultural landscape throughout the southern Levant (Fig. 7). It is highly suggestive that a Middle Chalcolithic dimorphic society existed to the east of the boundary zone between the Ghassulian and the Timnian. This new perspective, coupled with the old and new research outcomes from the Jordanian Badia (*e.g.*, Abu-Azizeh 2013; Abu-Azizeh *et al.* 2014; Betts 2013; Müller-Neuhof 2013; Gebel 2016; Müller-Neuhof and Abu-Azizeh 2016) and northern Hijaz (Fujii 2018, in press), requires a fundamental paradigm shift from the dichotomy between the sedentary Ghassulian and the nomadic Timnian to a pluralistic model incorporating the Jafr dimorphic Chalcolithic and beyond.

Concluding Remarks

The excavations at the HJH-2 settlement/cemetery complex have highlighted the sudden appearance of an exotic Middle Chalcolithic culture at the northwestern corner of the al-Jafr Basin and its rapid acculturation in a new environment. Of significance is the challenging perspective that the acculturation to the traditional nomadic society led to the spread of the advanced nomadism based on the production of secondary products. This new perspective potentially provides valuable insights into the formation process of full-scale nomadic society in southern Jordan, but there still remain many questions to be discussed, including the precise origin of the unique complex itself and the details of the secondary products. We would like to address these questions through future investigation.

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Khirbat al-Batrāwī 2015–2019: The Four-Lines Defensive System and the Entrance Hall of the "Palace of the Copper Axes"

Introduction

The site of Khirbat al-Batrāwī, the previously unknown city of the 3rd millennium BC discovered in 2004, has been systematically explored by the Expedition to Palestine and Jordan of Sapienza University of Rome since 2005 (Nigro 2006a, 2006b, 2007, 2008, 2009, 2010a, 2010b, 2012a; 2012b, 2011; 2013a; 2013b; 2014a; 2016a; 2016b; 2017a; Nigro and Sala 2009; 2010; 2011; Nigro *et al*. 2008). Archaeological investigations and restoration works were carried out under the aegis of the Department of Antiquities of the Hashemite Kingdom of Jordan, with the support of the Italian Ministry of Foreign Affairs and International Cooperation and the Italian Ministry of University and Scientific Research.

The present paper focuses on the discoveries of the 11th–15th seasons (2015–2019), which were devoted to the exploration of 1.) the northern slope of the site where the westernmost stretch of the impressive fortification system was completely brought to light, and 2.) the "Palace of the Copper Axes", with the extension of the public building towards the west with a monumental Entrance Hall.

Khirbat al-Batrāwī: An Early Bronze Age City at the Centre of the Ancient Routes across Jordan, Syria, Egypt, and Mesopotamia

Al-Batrāwī (32° 05'12.74" N, 36° 04'16.41" E) is located in the Upper Wādī az-Zarqā' Valley, the easternmost affluent of the Jordan (Fig. 1). At the beginning of the 3rd millennium BC, a major fortified city was founded on the top of the steep rocky hill dominating a ford through the upper course of the river, giving access to a shortcut and connecting the az-Zarqā' and the Jordan Valleys (Nigro 2006a: 16–22, 2006b: 233–5, fig. 1; 2011; 2012c: 610). Upper Wādī az-Zarqā' Valley offered

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1. View of the rocky hill of Khirbat al-Batrāwī with the impressive northern defensive system, seen from the north.

a relatively wide cultivable land, with the possibility for intensive cultivation along the riverbanks, while the surrounding western hills were suitable for the cultivation of olive trees, lentils, and chickpeas (Nigro 2006a: 5–8, 2012c: 612; 2017a).

Al-Batrāwī was founded as the outcome of a synoecistic process that characterized the early urban phenomenon in the southern Levant.[1] The population formerly living along the river, and nomads living in the nearby steppe, were attracted to the new city and settled a series of small unfortified villages which became the production centres at the base of the economy of the newly formed city (Douglas 2006; Nigro 2009; 2010b; 2012c: 611–2; 2013b: 191–2).

The EB II–III (3000–2300 BC) city was in a strategic position, at the same time, for the exploitation of cultivable land, water resources, and a long-distance trade network connecting the site of al-Batrāwī with the main urban civilisations of the 3rd millennium BC. The discoveries in the "Palace of the Copper Axes" revealed the central role played by the fortified city of al-Batrāwī at the junction of the east-west route which crosses the Syro-Arabic Desert to Mesopotamia and the Arabian Peninsula and the south-north main route, later on named 'King's' Highway', running upon the Jordanian Highlands from the Sinai, the Gulf of al-ʿAqabah, and Wādī ʿArabah (Nigro 2012c: 611; 2014b). This overland track allowed a direct connection with pharaonic Egypt, whose mining activities in the Sinai took place in the same period. Contact with Egypt played an important role in the life of the city of al-Batrāwī, as finds from the palace testify (Nigro 2010a; 2012d; 2014c;

[1] On the urbanisation process and urban status of the southern Levantine 'cities', see: Falconer 1994; Philip 2001, 2003; Prag 2001; Rast 2001; Greenberg 2002; Chesson and Philip 2003; Harrison and Savage 2003; Savage *et al.* 2007; Genz 2010; Kafafi 2011; Chesson and Goodale 2014; Paz and Greenberg 2016.

2. Map of the Eastern Mediterranean illustrating supply points of gemstones, copper and other precious materials, and trade routes involving the city of al-Batrāwī during the 3rd millennium BC.

2015; Sala 2014a; Fig. 2).

The EB II–III Quadruple Fortification Lines (Area B North)

The excavation of a crucial stretch of the defensive perimeter of al-Batrāwī, at the middle of the northern side of the hill (Fig. 3), uncovered a massive and complex system organized on multiple lines of interrelated walls built in order to strengthen the westernmost spur of the site, which overlooked the underlying valley and the path approaching the city (Nigro 2006a: 153–223; 2006b: 240–6; 2007: 349–51; 2008: 65–125; 2010a: 241; 2010b: 438–9; 2012b, 41–52 plan II; 2013a: 495 fig. 7; 2016b: 136–9; Nigro and Sala 2009: 374–7).

At al-Batrāwī, multiple fortifications were built, destroyed, refurbished, and strengthened throughout the whole EB II–III periods. The fortifications represent a cycle of destruction and reconstruction, illustrating the main historical-archaeological periods of the site, which neatly epitomise the early urbanisation of the southern Levant (Nigro 2008: 66–76; 2012b: 14–30).

The EB II–III Main Inner Wall, Northern Bastion T.830 and Gate L.860

Among the main goals of the last five seasons of excavations at Khirbat al-Batrāwī was the complete understanding of the northern fortifications, with a special focus on the investigation of the Main Inner City-Wall (MIW) in the stretch where the huge Northern Bastion T.830 flanks it for more than 20 m (Fig. 4).

The main city-wall was erected in the EB II encircling the entire *khirbah*; it consisted of a mudbrick superstructure built upon a solid foundation of monolithic blocks and

3. General view of the northern multiple fortifications of Area B North at the end of the 14th season (2018) of excavations and restorations, seen from the north-east.

4. View of Northern Bastion T.830 and Gate L.860 inside it, seen from the east (after the restoration of the outer wall of the Bastion).

boulders (Nigro 2006a: 26–36; 2007: 349–52; 2008: 83–8; 2009: 663–4; 2012b: 32–7). At the end of the period, the structure was damaged by a violent earthquake (Nigro 2007: 357–8; 2008: 87, 245–68 fig. 3.37; 2009: 666–7; 2010b: 437; Gallo 2014: 150 fig. 4), following which the city-wall was reinstated and the defensive system reinforced in the EB III with the progressive addition of external fortifications.

During this second major period, a massive defensive work, Northern Bastion T.830 (Nigro 2016b: 138), was added to the Main Inner City-Wall due to a huge breach in this structure, possibly caused by an earthquake. The Northern Bastion reinforced this segment of the fortifications by letting the massive tower abut from the line of the MIW. The Northern Bastion was, thus, erected by setting its foundations into the bedrock and using large roughly cut limestone boulders in the lowest courses. The Bastion was excavated to the west after a careful restoration of its northern and eastern walls. It is characterised by a distinguished building technique with a perimeter wall made of big roughly cut limestone boulders 1.05 m long/0.52 m high (2×1 cubits) on the lowest two courses, many of which still preserve the original yellowish clay mortar and plaster. The size of blocks in the wall gradually reduces in the upper courses and they are carefully set and fastened by stone wedges and chops. It was 1.65–2.2 m wide, and it is preserved up to a height of 2.5 m for a length of more than 25 m. Inside the bastion, a huge rectangular room was filled up with big stones leaning against the northern face of the Main Inner Wall. Excavations within this blind room during the 2016 season exposed the northern outer face of the MIW where a

5. View of Gate L.860 inside the Northern Bastion T.830 and in the background Gate L.160, seen from the north-west.

6. The external fortification lines with Exterior Wall W.827 (on the left), Outer Wall W.155 (in the centre), and Northern Bastion T.830 (on the right), seen from the west.

blocked gateway was recognised.

Gate L.860 was originally opened through the MIW in the EB II, some 25 m west of Gate L.160 (Nigro 2008: 83–9, 245–68 fig. 3.37). It was 3 m wide, which is about double the width of Gate L.160 (Fig. 5). The eastern and western jambs were reinforced by squared limestone blocks laid as headers and stretchers in the MIW. Its width made it impossible to roof the passageway with a sole capstone, and it thus suggests that a wooden ceiling or a mudbrick vault was used. When the Gate fell out of use, apparently after the earthquake which hit the city towards the end of the EB II, it was carefully closed by a massive wall (W.867) that incorporated big limestone boulders, like Gate L.160, possibly to strengthen the MIW.

A street along the city-wall was excavated for a length of 14 m, from the "Palace of the Copper Axes" westwards. The floor gently slopes from the west to the east and represents the paving of the EB IIIB street running inside the MIW (Nigro 2012b: 188). Recent discoveries in the Palace, namely its extension towards the west, suggest that Gate L.860 was directly connected to it, and its forerunner is to be investigated in front of the gate itself.

External Fortifications on the Northern Slope of the Khirbah

The foundation of Northern Bastion T.830 was supported by an external wall, Outer Wall W.155 (Nigro 2007: 349–51; 2008: 92–9; 2010b: 438–9; 2012b: 38–40; 2016b: 138–9), with a corridor 1 m wide separating the two structures. The Outer Wall was built at the same time as the Northern Bastion, and in its western stretch where Bastion T.830 meets the Outer Wall there is an outer battering face made of large boulders to support the weight of the massive structure above (Fig. 6).

Another narrow corridor (L.862) separated the Outer Wall and the latest fourth defensive line of fortification, called Exterior Wall W.827, which runs parallel to the Outer Wall. Even if the outer face of the Exterior Wall proved to have been partly overlaid and cut by the foot of the EB IVB Embankment (Fig. 7), the inner southern face of the same wall clearly indicated that this structure, with a varying width from 2 m to 3.50 m, turned up southwards to end against the abutting face of the Outer Wall, forming a single impenetrable defensive line (Nigro 2012b: 46–51). The tower on the north-western corner of the city was the place where all the four fortification lines joined.

The Story of the City of al-Batrāwī as Reflected by its Complex Multiple Defensive System

The multiple city walls of al-Batrāwī represents a unique summary of the city's history, from its foundation at the end of the 4th millennium BC to its first destruction due to a tremendous earthquake towards 2800 BC, the reconstruction during EB IIIA followed by another destruction, and then the final fire which destroyed the city

7. View of the northern face of Exterior Wall W.827 with the EB IVB Embankment which concealed the EB III collapsed walls, seen from the north-east.

around 2300 BC (Nigro 2017b: 164–5).

The four fortification lines were progressively built on terraces. The top and earliest structure was the Main Inner City-Wall of the al-Batrāwī (Batrawy) II period (EB II, 3000–2800 BC), which also hosted the main gate (L.860) and a postern 25 m to the east (L.160). When this massive structure collapsed due to a strong earthquake, the whole fortification system had to be re-planned and reconstructed. This happened during the al-Batrāwī IIIa period (EB IIIA, 2800–2500 BC), when both gates were blocked by walls and another entrance was opened to the east. The MIW was reconstructed by raising its stone basement, inserting wooden chains, and rebuilding the mudbrick superstructure. At the same time, the northern slope of the hill was reinforced by two battering walls, Outer Wall W.155 and Scarp Wall W.165. The Northern Bastion T.830 was built on top of the Outer Wall, which appositely deviated its line to sustain the huge structure. Further on, in the al-Batrāwī IIIb period (EB IIIB, 2500–2300BC), the fourth and last fortification line was added to the system at its bottom, including Transversal Wall W.177 and

8. View of Exterior Wall W.827 and Outer Wall W.155 with its outer battering face and the two corridors, L.858 (between Bastion T.830 and Outer Wall) and L.862 (between Outer Wall and Exterior Wall), seen from the south-east.

Exterior Wall W.827, which created a rhomboidal courtyard to the east in front of the Outer Wall (blind room L.824), and then progressively turned up to end against the Outer Wall itself at the north-western corner of the city (Fig. 8).

The four lines of massive walls built on four sloping terraces bridged a height of about 6 m and an overall width of about 16 m. Strata in between these structures and encapsulated materials provided a clear sequence of major constructive phases during the life of the ancient city (Nigro 2008: 13–30 figs. 2.6–2.19).

The "Palace of the Copper Axes" and Entrance Hall L.1100 (Area B South)

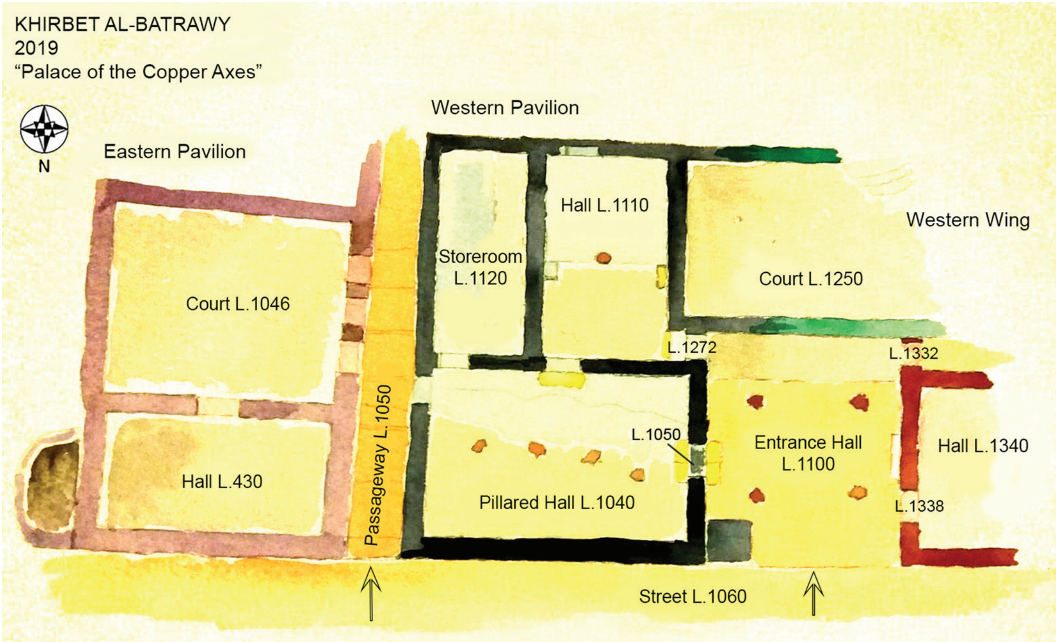
Excavations in Area B South brought to light a large building, which has been investigated since 2010 and interpreted on the basis of the architecture and meaningful finds as a public building, now known as the "Palace of the Copper Axes" (Fiaccavento 2013; 2014; Medeghini *et al.* 2016; Nigro 2012a: 705 fig. 6; 2012b: 176–82; 2012d; 2014c; 2015).

The palace was erected upon a series of terraces on the northern slope of the site, descending from the acropolis. The lowest terrace hosted two almost symmetrical pavilions subdivided by a central passage (L.1050), which have been carefully explored during four seasons (2010–2013) of excavations and restorations (Nigro 2013b: 198–204 figs. 13, 15–22; 2016b: 139–49; 2017b: 162–4).

The exploration of the palace was resumed in the 2018–2019 seasons and revealed the prosecution of the structure towards west, with a monumental Entrance Hall and another room to the west, belonging to a further wing of the palace, whose extension is evidently much greater (Fig. 9). The overall plan of the building proved to be organized according to a symmetrical rule, with the central main entrance, and two wings, the eastern one almost fully excavated and previously subdivided into an Eastern and a Western Pavilion (Fig. 10).

Entrance Hall L.1100

9. General view of the "Palace of the Copper Axes" with Entrance Hall L.1100 and the western wing at the end of the 2019 season of excavations and restorations, seen from the south.



10. Reconstructed plan of the “Palace of the Copper Axes” with the Entrance Hall in the middle of two symmetrical wings (drawing by Lorenzo Nigro).

Entrance Hall L.1100 had a roughly square plan, measured about 60 m^2 (7.20× 8.20 m), and represented the monumental entrance to the palace.[2] Entrance Hall L.1100 had a floor (L.1330) consisting of a thick and compact layer of yellowish clay mixed with lime. The hall was delimited to the east by walls W.1103+W.1133 of Pillared Hall L.1040, to the south by wall W.1245 of Court L.1250 and Porch L.1292, to the west by walls W.1323 and W.1333 of Hall L.1340, while to the north the Entrance Hall directly opened onto the peri-pomerial street running inside the Main Inner City-Wall. Four limestone pillar bases were set into it: the NE pillar base (B.1285) was at a regular distance of about 1.12 m from Wall W.1107, in front of door L.1150; the SE pillar base (B.1329) was at a distance of 2.25 m from Wall W.1133, in front of door L.1272; the NW pillar base (B.1331) was at a distance of 1.58 m from Wall W.1333, in front of door L.1338; finally, the SW pillar base (B.1339) was at a distance of 3.89 m from Wall W.1323, in front of door L.1332 (Fig. 11).

Finds from Entrance Hall L.1100

Like the other portions of the palace, Entrance Hall L.1100 suffered a violent fire (Nigro 2017b: 164), which provoked the sudden collapse of its ceilings supported by wooden beams (Gallo 2014: 158–60). A roughly 1 m thick layer of destruction has been carefully excavated within it, distinguishing on top a layer of collapse (F.1324), mainly incorporating fragments of yellowish-clay plaster, charcoals, ashes, broken mudbricks, stones, and several

[2] Before reaching the structures of the Entrance Hall, another portion of the EB IV village was brought to light, displaying two major occupational phases (Nigro 2012b: 146 table 3.1) directly built upon the thick destruction layer and collapsed remains of the latest phase of utilisation of the palace (EB IIIB, 2500–2300 BC).

11. General view of the Western Wing and Entrance Hall L.1100 of the "Palace of the Copper Axes" at the end of the 15th season (2019) of excavations and restorations, seen from the north-west.

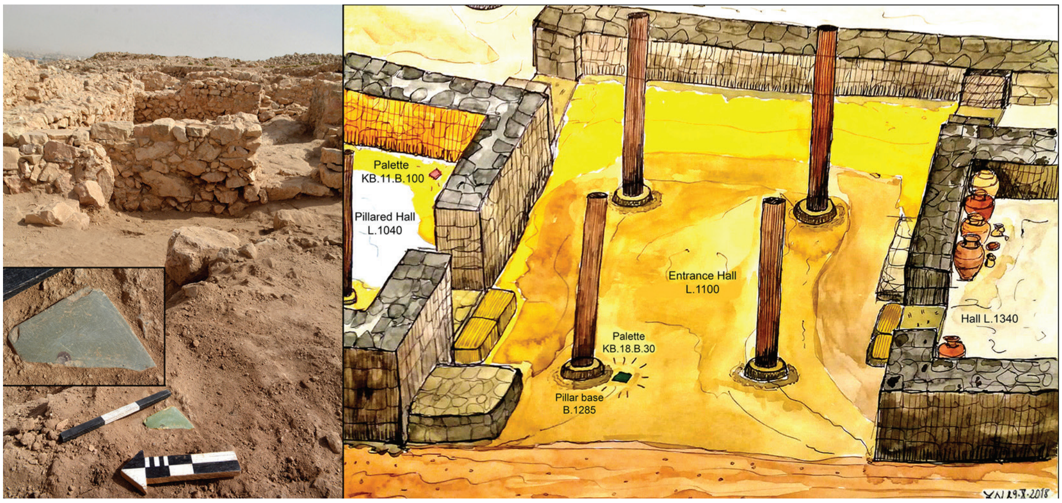
items apparently fallen down from an upper storey or roofing. A lower layer of destruction (F.1327) was a mixed filling with charcoals, ashes, broken and burnt mudbricks, mortar, plaster, and other fragments of combusted and broken building materials. Two *pithoi* (KB.18.B.1324/1 and KB.18.B.1324/3) were found leaning against the NE-SW oriented Wall W.1323.[3] The bottom of *pithos* KB.18.B.1324/1 was found against the eastern side of the wall and it contained the burnt epiphysis of a bovine humerus and a quartzite pear-shaped pestle (KB.18.B.32). In the middle of the hall, three vessels were uncovered: an *amphoriskos* (KB.18.B.1324/24) was found upside down, a small jar (KB.18.B.1324/25) with rope-like decoration and pushed-up ledge handles, and the upper part of a broken bottle (KB.18.B.1324/26; Sala 2014b: 267 fig. 12).[4]

Other implements found in the palace are fine flint tools, pottery stoppers or tokens, fine bone tools, a carefully polished bone awl (KB.18.B.28), and a sort of bone stylus (KB.18.B.25). A basalt donut or ring (KB.18.B.33), interpreted as the lower part of a potter's wheel (Fiaccavento 2013) or connected with a marble mortar (KB.18.B.24) re-employed in the earliest EB IVB phase, was also found.

However, the most remarkable finds in Entrance Hall were a broken Egyptian green schist palette, an amazonite gemstone, and

[3] *Pithoi* for long-term conservation were particularly frequent in the palace and were characterised by an elongated ovoid body and flaring neck, a narrow flat base, and rope-like plastic decorations usually applied at the junction of the different parts of the vessel, such as the base of the neck and the middle of the body (Sala 2014b: 268 figs. 16–17; Nigro 2016b: 142–3).

[4] The *amphoriskos* belongs to the sub-type with slender body and a cylindrical neck similar to other specimens from the repertoire of the palace (Sala 2014b: 267 fig. 11:5).

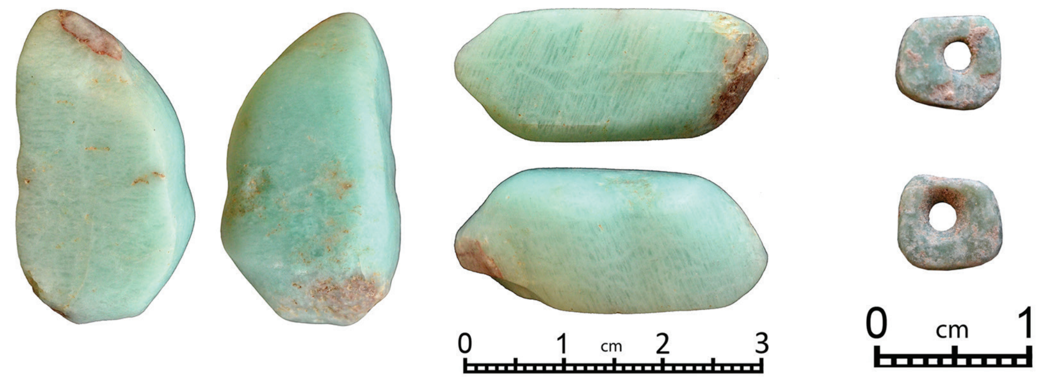


12. Egyptian palette KB.18.B.30 at the moment of its retrieval, not far from the round pillar base B.1285, seen from the west; sketch drawing of Entrance Hall L.1100 and Pillared Hall L.1040, with the finding spots of the two Egyptian palettes (drawing by Lorenzo Nigro).

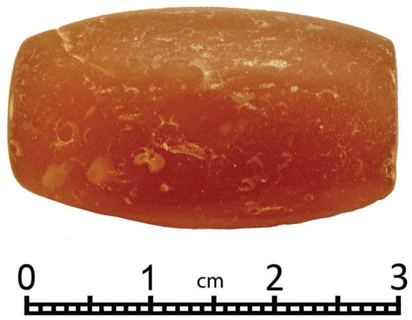
13. Palette KB.18.B.30 (the front side on the left, the reverse side on the right).

a bead of fluoropatite (Nigro *et al.* 2020). Egyptian green schist palette KB.18.B.30 was found just beside the foot of the north-east pillar (B.1285), upside down in the layer of collapse (F.1324), probably fallen from an upper storey or balcony (Fig. 12). The palette belongs to the squared/rectangular type, no more than 1 cm thick, with a grooved frame of one or at least three incised lines on the polished front side, commonly attested to in Egypt since the Early Naqada III period (Petrie 1974: 38 pl. LIX) and typically imported to the southern Levant during the EB IB–III (FIG. 13; Sala 2012: 277–9; 2014a: 66–7). Another fragment of a palette (KB.11.B.100) was found in the "Palace of the Copper Axes", in the south-western corner of Pillared Hall L.1040 (Nigro 2014b: 47 fig. 13; Sala 2014a: 69).

At the foot of pillar base B.1339, an amazonite gemstone (KB.18.B.50) in the shape of a rectangular parallelepiped with smoothed edges and a tooth-like apex and a small pierced bead (KB.18.B.63) were found (Fig. 14). Apparently, the gemstone was in the processes of being worked to become a major pendant in a necklace. The material of gemstone KB.18.B.50 was identified through Raman spectrography as green amazonite (Ostrooumov 2015: 158–61; Nigro *et al.* 2020). This stone is mainly attested in Egypt during Predynastic and Dynastic Periods (Hayes 1965: 95), but amazonite was also used in Mesopotamia in the Royal Tombs of Ur and for manufacturing Neo-Assyrian beads and cylinder seals (Hawkins 1977). Ores of amazonite active in pre-classical periods are known in Egypt in the Eastern Desert (Harrell and Osman 2007; Harrell and Storemyr 2009: 18), but also in southeast Libya's Eghei Mountains (De Michele and Piacenza 1999), Sudan, Ethiopia (Ostrooumov 2015: 17), and in the southern Urals in Russia (Ostrooumov 2015: 14).



14. The green-cyan amazonite gemstone KB.18.B.50 and bead KB.18.B.63 found in Entrance Hall L.1100.



15. The carnelian gemstone KB.19.B.140 found in the Eastern Pavilion.

Two more carnelian beads (KB.06.B.40 and KB.19.B.140), one finished and the other unfinished (Fig. 15), were also found in the Eastern Pavilion (Nigro 2006a: 160 fig. 4.61, a). These finds suggest that the palace hosted a workshop producing ornaments.

Conclusions

Fifteen seasons (2005–2019) of systematic excavations and restorations at Khirbat al-Batrāwī yielded a distinguished set of data that contributed to a deeper and more detailed understanding of Early Bronze Age Jordanian urbanism. The monumental architecture of its defensive system, the inner layout with spatial and functional distinctions within the city, as well as the economy, social organization, technological innovation, and centralisation of goods, including luxury and symbolic goods from long-distance trade, all testify to the central role of al-Batrāwī in the general framework of the Early Bronze Age southern Levantine urbanisation.

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Bone Tools from the EB IIIB "Palace of the Copper Axes" at Khirbat al-Batrāwī, Jordan

Introduction

Bone tools can provide useful information concerning manufacturing, daily life activities (*e.g.*, hunting), and craft production (*e.g.*, weaving; Cakirlar and Genz 2016). These objects have been primarily found during archaeological excavations, as shown at Tall es-Sultan/Jericho (Marshall 1982), Tall al-Mutasallim (Megiddo: Blockman and Sass 2013), Arad (Amiran 1978), Bāb edh-Dhrā' (Adovasio *et. al.* 2003), and Tall Abū al-Kharaz (Fisher 2008), but atelier or production places have yet to be discovered (Horwitz *et al.* 2007). The study of bone tools has always focused on items found in Neolithic contexts (Garfinkel and Horwitz 1988). Bone tools dating to the Bronze and Iron Ages have typically been published in appendices of excavation reports,[1] but recent research has focused on the analysis of this specific category of objects (Cakilar and Genz 2016).

The Palace of Khirbat al-Batrāwī (Fig. 1), known above all for the extraordinary discoveries of the copper axes (Nigro 2015), the ceremonial vase, the bearskin (Nigro 2014), and the necklace (Nigro 2012), provides a good overview of types of bone tools and their production techniques. This paper seeks to illustrate the bone tools uncovered in the "Palace of the Copper Axes" during the 2010–2012 seasons of excavation and to highlight their role in the craft activities centralized by the EBA palatial economy.

Bone Tool Production

The industry of bone tools is characterized by the same production technique from the Early Bronze Age up to the Iron Age (Moorey 1994). The production

[1] Except for some categories, such as ivory carvings (Loud 1939; Adler 1996; Gachet-Bizollon 2007), incised bone tubes (Zarzecki-Peleg 1993; Genz 2003), or bone and ivory bull's heads (Miroschedji 1993; Nigro 2010: 468).

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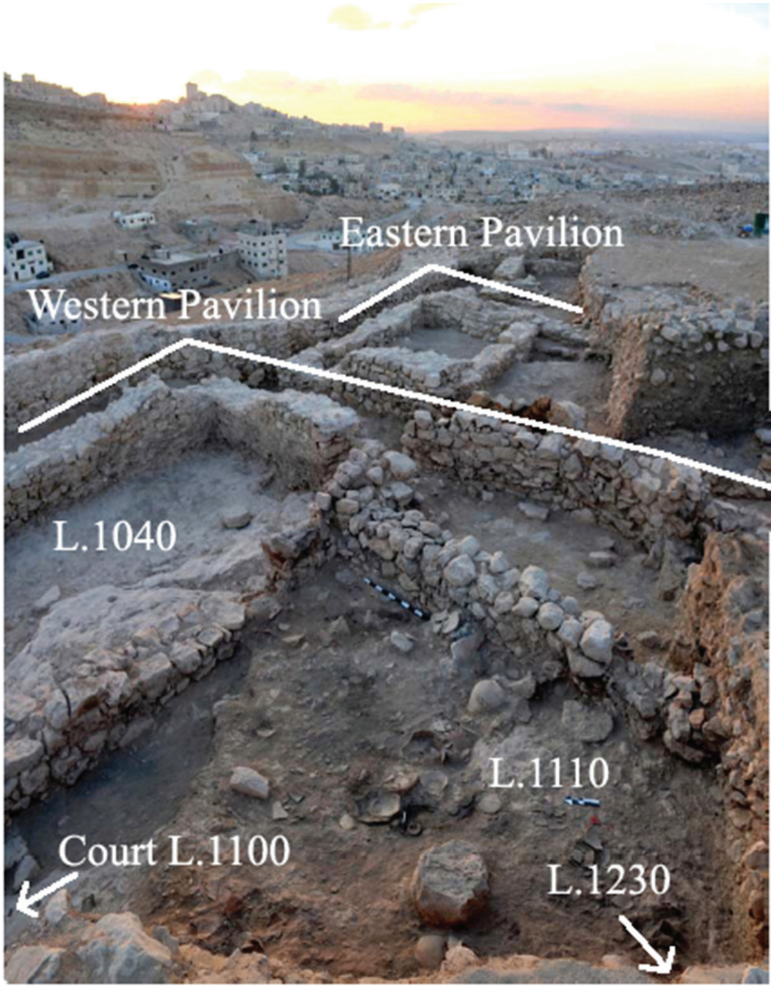


1. View of the Western Pavilion of the EBIII "Palace of the Copper Axes" at Khirbat al-Batrāwī, from the south-west.

of bone tools at Khirbat al-Batrāwī follows the same technique as at the other sites of the southern Levant and the rest of the Near East. Bones of mammals were used, probably from domesticated herbivores of medium to large size (Alhaique 2012). Long and flat bones were selected, especially ribs for spatulas and the epiphysis of femurs for spindle whorls.

The bone was processed as soon as it was extracted from the animal, before the drying and bleaching processes (Marshall 1982), although it was probably first subjected to a hot water immersion or an acid solution to soften it (Peyronel 2004). Before being worked, soft tissue and spongy bone were removed from the bone, and then it was sectioned and cut along the transverse and longitudinal axes, probably using the same tools used for joinery (saws, drills, etc.). Once a coarse shape was obtained, it passed through various finishing phases (such as smoothing, polishing, machining with a drill, engraving, or rotation) to create the specific tool.

Typologies of Bone Tools

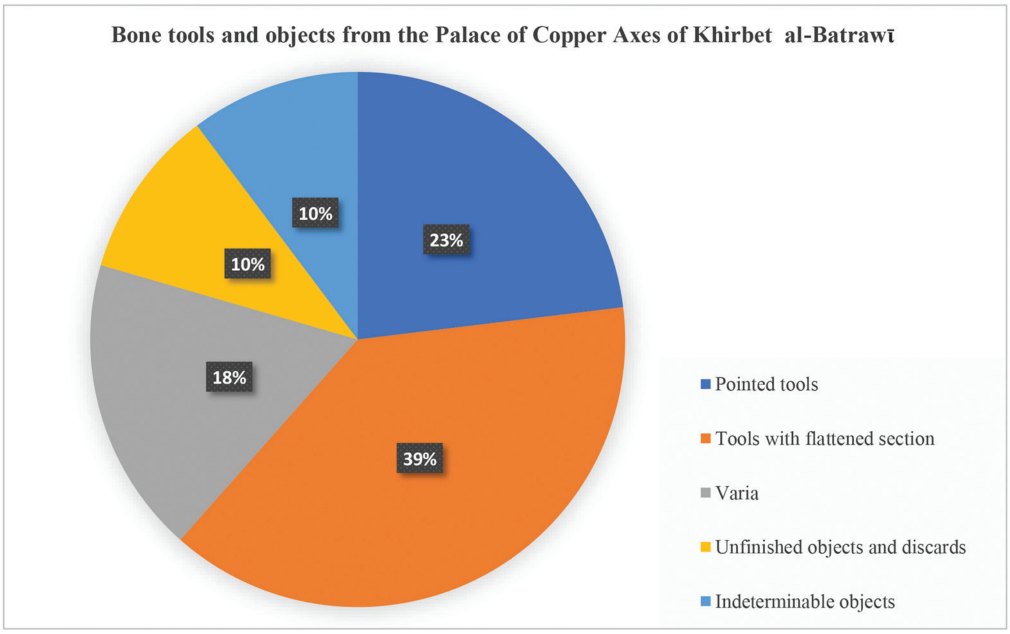
Thirty-seven bone tools have been found in the EB IIIB "Palace of the Copper Axes" of Khirbat al-Batrāwī during the 2010–2012 seasons of excavations (Montanari 2012; Fig. 2): 39% is represented by tools with a flattened section (or spatulas), 23% by pointed tools, 18% by *varia*, and 10% by unfinished objects and waste products. Another small percentage (10%) is represented by indeterminable objects (KB.10.B.92, KB.10.B.99, KB.10.B.107, KB.12.B.96) that are very poorly preserved.

Bone tools almost always keep their own shapes over millennia, making their interpretation difficult. Some tools, such as spatulas or shuttles, can be called "multi-functional tools" (Morrey 1994; Peyronel 2004), as they can be used for different activities besides weaving. The classification of bone tools here presented is based on the type of bone used, as bones were likely chosen by shape and section most suitable for tools (Marshall 1982):

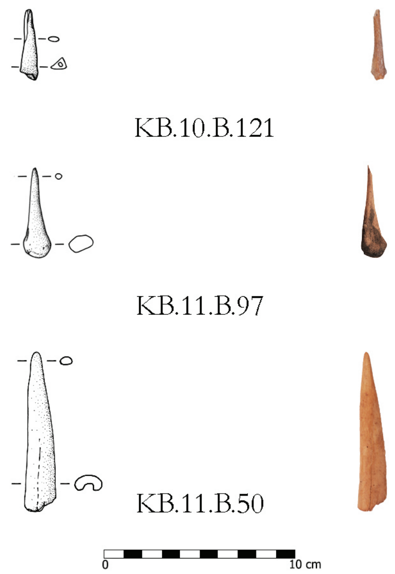
- Pointed tools:
  - Pointed tools
  - Pins
  - Needle
  - Awls
- Tool with flattened section:
  - Weaving swords
  - Long narrow spatulas
  - Short narrow spatulas
  - Large spatulas

Pointed Tools

Pointed tools (Fig. 3) are characterized by a narrow concave section, hard sharp point, and elongated shape with a polished surface. They are made from medium-sized mammals' ribs or narrow long bones. Some tools can be classified just as pointed tools, while others are more specific, such as pins,



2. Percentage of EBA bone tools found in the Western Pavilion of the "Palace of the Copper Axes" at Khirbat al-Batrāwī.



3. Pointed bone tools found in the Western Pavilion of the “Palace of the Copper Axes” at Khirbat al-Batrāwī. From the top down: needle (KB.10.B.121), awl (KB.11.B.97), and pointed tool (KB.11.B.50).

needles, and awls.

Needles are very short, with a length of 3.3/3.6 cm and a base diameter of 0.2/0.6 cm. They have a carefully polished surface, narrow or triangular section, sharpened end, and sometimes a small hole.[2] This kind of tool can be used for many tasks, including sewing textiles and leather, incising pottery, and basketry (Mazar and Rotem 2012: 384–85). The needle shape is common in the southern Levant during the Early Bronze Age, as the comparisons at Tall al-Mutasallim (Megiddo: Bidmead 2013: fig. 23.5:8), Tall es-Sultan (Jericho: Marshall 1982: figs. 251:3–4), and Khirbat Kerak (Beth Yerah: Paz 2014: fig. 6.28:126) attest.

Awls are stronger and broader than needles, with a length of 4.4–7.2 cm and a base width of 0.9/1.2 cm. They have a rounded or flattened section, with a sharpened end, and polished surface.[3] This kind of tool would have been used for piercing leather, for threading thongs, or for pegging out skins. Also, some pierced awls could have been used as toggle pins (Adovasio *et al.* 2003: figs. 20.7–8). Awls found in the “Palace of the Copper Axes” can be divided into a simple shape or handle shape. The first type of awl is characterized by a triangular flattened body shape, very common in the Southern Levant during the Early Bronze Age, as confirmed by comparisons found at Tall Abū al-Kharaz (Fisher 2008: fig. 317:1), Bāb adh-Dhrāʿ (Adovasio *et al.* 2003: figs. 20.7–8), Tall al-Mutasallim (Megiddo: Blockman and Sass 2013: 887; Bidmead 2013: fig. 23.5:14–15), and Arad (Amiran 1978: pl. 75:8–9). The second type of awl is characterized by a handle made by the joint of the bone: metapodials were the bones mostly selected for this kind of tool, with no preference for the distal or proximal end. This shape, identified with the Type B of Peyronel’s classification (2004: 136), is also very common in the southern Levant during the Early Bronze Age, as seen at Arad (Amiran 1978: pl. 75:3, 7), Tall al-Mutasallim (Megiddo: Sass and Cinamon 2006: fig. 18.27:606, 608), Tell Abu al-Kharaz (Fisher 2008: fig. 317:5), and Tall es-Sultan (Jericho: Marshall 1982: fig. 251:7–8, 12).

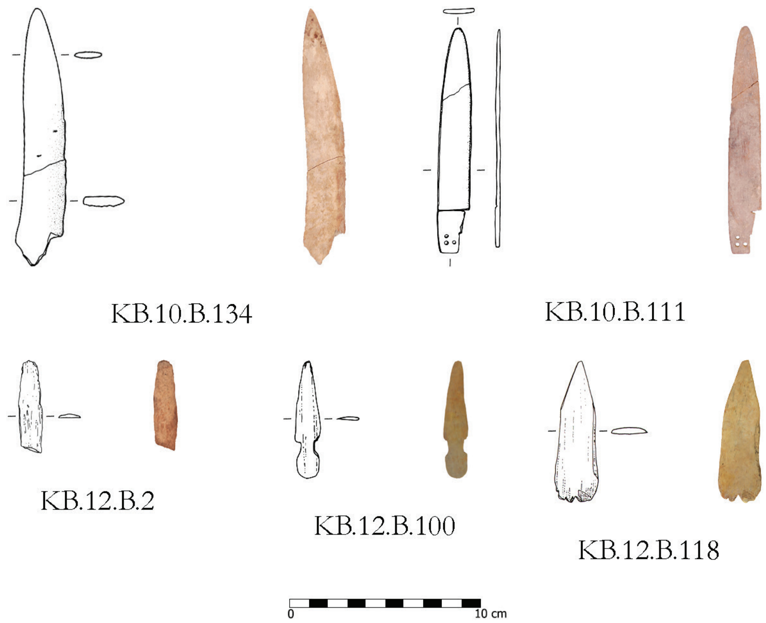
Tools with Flattened Section

This group includes tools characterized by a flattened section (Fig. 4), namely weaving swords and spatulas. They are usually made from ribs or large long bones from medium- or large-sized mammals.

Weaving swords are long looming

[2] Comparisons can be found at Arad (Amiran 1978: pl. 75) and Bāb adh-Dhrāʿ (Adovasio *et. al.* 2003: figs. 20–3).

[3] The earlier awls tend to be more carefully made and more highly polished than those from the later periods (Mazar-Rotem 2012).



4. Bone Tools with flattened sections found in the Western Pavilion of the "Palace of the Copper Axes" at Khirbat al-Batrāwī. Upper line, from left to right: weaving sword (KB.10.B.134) and long narrow spatula (KB.10B.111). Lower line, from left to right: short narrow spatula (KB.12.B.2), spearhead-shaped spatula (KB.12.B.100), and large elongated spatula (KB.12.B.118).

beaters, used with horizontal ground, vertical two-beam, and warp-weighted looms, to beat in a weft row spanning a wide width of weave (Crowfoot 1936–37; Mazow 2017). Made from wood, bone, or metal, they have been worked into a sword shape, with a length between 25 and 75 cm. In the "Palace of the Copper Axes" of Khirbat al-Batrāwī, two swords with missing lower parts have been found, testifying to the use of horizontal ground looms in this building. These tools have also been found at Tall es-Sultan (Jericho: Marshall 1982: fig. 250:8) and in ethnographic contexts from Egyptian and Syrian Bedouin populations (Dalman 1937: fig. 23; Peyronel 2004: pl. CXXV–CXXVI; Mazow 2017: 8 fig. 8).[4]

Spatulas (or shuttles in the opinion of some scholars; see Ariel 1990: 127–34; Fischer 2008: 352–4 fig. 317; Mazar and Rotem 2012: 384–6 fig. 9.16:1–8) are characterized by a narrow or wide flattened section, with a rounded point and a polished surface on both surfaces. They are usually interpreted as loom tools (Dalman 1937: fig. 24), but some bone items from Khirbat Kerak (Beth Yerah) were found in contexts related to the local ceramic industry, showing use-marks that hint at their use in pottery production (Paz 2014: 274; Greenberg and Iserlins 2014: 75). These "multifunction tools" (Moorey 1994; Peyronel 2004) are divided into long narrow spatulas, short narrow spatulas, and

[4] It is difficult to distinguish which kind of loom weaving swords were used for. However, ethnographic and experimental archaeological studies have shown that a handle appears frequently in weaving swords for vertical looms (Vogel 1989: 81; Broudy 1993: 39 fig. 3.1).

large spatulas on the basis of their shape and size.

Narrow spatulas can be divided into long spatulas (about 11.5/7 cm long[5] and 1.8/1.2 cm wide) and short spatulas (4.6/6.7 cm long and 1/1.5 cm wide). This shape is largely diffused throughout the southern Levant during the Early Bronze Age and parallels were found at Tall Abā al-Kharaz (Fisher 2008: fig. 317:2–3), Tall es-Sultan (Jericho: Marshall 1982: figs. 251:13–15), Arad (Amiran 1978: pl. 72:6–8), Tall al-Mutasallim (Megiddo: Sass and Cinamon 2006: figs. 18.29:633–648), and Khirbat Kerak (Beth Yerah: Paz 2014: figs. 6.28:115–116, 122). Alongside common shapes, some items are unique. One long narrow spatula (KB.10.B.111, Fig. 4) has a high quality manufacture, as its handle with three holes of rivets shows preexisting perishable decoration. Probably used to spread cosmetics on palettes, this shape is similar to narrow daggers of Type 2 on Philip's classification (1989: fig. 27:793, 695, 803), like the one found in Tomb F5 at Tall es-Sultan (Jericho: Kenyon 1960: fig. 66:3).

Another short narrow spatula (KB.12.B.100, Fig. 4) has a spearhead shape that is similar to tanged spearheads, similar to Type 6 of Philip's classification (1989: fig. 17:91, 80, 81). It was also probably used to spread cosmetics on palettes. Their similarity to weapons, as well as their excellent manufacture, indicate that they were probably status symbols used by the elite.

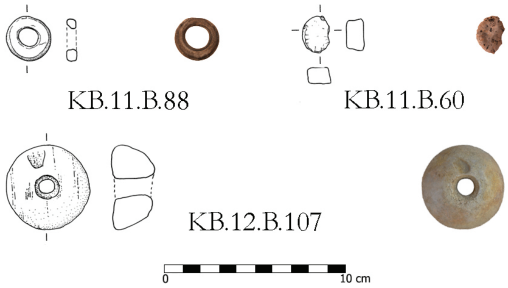
Large spatulas are 10/6.6 cm long and 3.1/1.3cm wide. They are characterized by an elongated (KB.12.B.118, Fig. 4) or fan shape. The first shape was found at Khirbat al-Batrāwī (Montanari 2012: fig. 17:1), and it is very common in the southern Levant, as attested by parallels from Tall es-Sultan (Jericho: Marshall 1982: figs. 251:16–18), Khirbat Kerak (Beth Yerah: Paz 2014: fig. 6.28:119–121), Tall al-Mutasallim (Sass and Cinamon 2006: fig. 18.29:648), Tall el-Husn (Beth Shean: Mazar-Rotem 2012: fig. 9.16:1–5), and Arad (Amiran 1978: pl. 73:1–4). The fan-shaped spatula is a less popular shape than the first one, although it has been used since the Mesolithic (Marshall 1982: fig. 230:8, 12) and found in contemporary contexts at Tall Fadous (Kfarabida: Genz *et al.* 2009: fig. 5:10).

Varia

Five bone spindle whorls, one bone tessera, and one bone ring have also been found (Fig. 5). Spindle whorls have a circular shape with a domed section, as they have all been made from femoral heads that sometimes show the *fovea cavitis*. This shape is similar to Type 6 of Peyronel's classification (2004: 112 pls. IV–V), and it has just been found at Khirbat al-Batrāwī in the room L.940, in Building B2[6] (Montanari 2012: fig. 17:4). Bone spindle whorls are quite common in the Syro-Palestinian area, for example, at Tall Fadous (Kfarabida: Genz 2016).

[5] It is not possible to determine the minimum length, as most of items have a fragmentary state of preservation.

[6] Area B South, east of the Eastern Pavilion.

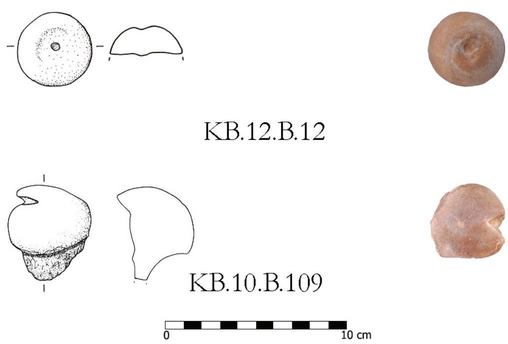


5. Bone ring (KB.11.B.88), bone tessera (KB.11.B.60), and spindle whorl (KB.12.B.107) found in the Western Pavilion of the "Palace of the Copper Axes" at Khirbat al-Batrāwī.

A bone ring, with a diameter of 2.1 cm and a thickness of 0.4 cm, was found, with comparisons at Tall al-Mutasallim (Megiddo: Sass 2000: fig. 12.29:13) and Tall el-Husn (Beth Shean: Mazar and Rotem 2012: fig. 9.17:5–9).[7] Bone rings were produced from the Pre-Neolithic period, as seen at Jarmo (Watson 1983: 356–8), as high-status ornaments, but there are rarely found in later strata (Moorey 1994: 114).

Among other objects, a bone tessera has been found in the "Palace of the Copper Axes", made by a polished vertebral body with a hole along the inner side. This can be interpreted as a gaming piece: bones and ivory have been used for gaming pieces since the Neolithic period in the ancient Near East and Egypt (Moorey 1994: 114; Albaz *et al.* 2017) and they were used by villagers and the Bedouin of Egypt, Sinai, and the Negev until recently (Sebbane 2001: figs. 8–9).

[7] Unfortunately, comparisons from both Tall al-Mutasallim (Megiddo) and Tall el-Husn (Beth Shean) came from undatable contexts.



6. Unfinished spindle whorl (KB.12.B.12) and bone discard (KB.10.B.109, head of a femur) found in the Western Pavilion of the "Palace of the Copper Axes" at Khirbat al-Batrāwī.

Table 1. Distribution of the bone objects and tools in the Western Pavilion of the "Palace of the Copper Axes".

Type	Pillared Hall L.1040	Hall L.1110	Hall L.1230
Pointed tools	1	3	-
Needles	2	-	-
Awls	1	2	-
Weaving swords	2	-	-
Spatulas	5	4	1
Spindle whorls	2	2 (one unfinished)	-
Tesserae	-	1	-
Rings	-	1	-
Indeterminate tools	6	1	-
Discards	5	1	-

Unfinished Tools

One unfinished spindle whorl and some worked bones have been found in the "Palace of the Copper Axes" (Fig. 6). The spindle whorl shows an unfinished hole and a roughly worked lower face.

Archaeological Context

All the bone tools have been found in destruction layers[8] inside the halls of the Western Pavilion of the "Palace of the Copper Axes". As shown in Table 1, bone tools were found in Pillared Hall L.1040 and Hall L.1110 (Nigro 2014), while only a large spatula was found in Hall L.1230, west of L.1110.

Tools such as awls, spatulas, and spindle whorls are equally distributed in Pillared Hall L.1040 and Hall L.1110. All the weaving swords, the needles, and many bone discards were found in Pillared Hall L.1040, while well manufactured tools such as KB.12.B.110 were found in Hall L.1110, together with an unfinished spindle whorl.

[8] F.1054, F.1128, F.1238, F.1244.

Conclusions

During the Early Bronze III, technical skills and craft activities were managed by centralized powers, such as palaces or temples. This is confirmed by the discovery of various technical tools in palatial complexes, such as the case of the potter's wheel recovered in the "Palace of the Copper Axes" (Fiaccavento 2013). Bone tools found in the Western Pavilion of the Palace of Khirbat al-Batrāwī suggest that other craft activities, directly linked to these kinds of tools such as weaving though horizontal looms or leather tanning, were connected to the palatial administration. Furthermore, the presence of bone discards allows to us assume that the production of bone tools was carried out just inside the "Palace of the Copper Axes" by specialized craftsmen.[9]

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[9] Contrary to what was hypothesized by Zaccagnini 1993.

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The Ritual Landscapes of Murayghāt (2014–2018): Excavation, Structures, and Cup-Marks on the Central Knoll

Introduction

The Ritual Landscapes of Murayghāt project started in 2014 and had five seasons until 2018. The site is close to Maʿin Maʿin, situated just west of the fertile Terra Rossa area around Mādābā. The project consists of two main components, namely the landscape study/survey and the excavation. The research history, first season, and preliminary survey results have already been published elsewhere (Kerner *et al*. 2017; Kerner 2018, 2019). This article will concentrate on the central knoll of the site and the structures documented on it.

The large site of Murayghāt consists of the central knoll (Area 1; Fig. 1) that is surrounded by low hills to the north, northwest, west, and southwest (Areas 3, 8, 4, 5, and 6), which all have a more or less dense dolmen cover. A road east of the knoll, running down into the Wādī Zarqāʾ Maʿin, separates it from a large field that slopes first gently then steeply towards the *wadi*. This field (Area 7) contains some rather large dolmens. The entire area of study currently includes approximately 70 ha. The Ritual Landscapes of Murayghāt focuses on the southernmost cluster of dolmens, which form a chain of dolmen sites along the rift valley, mostly on the plateau (Fraser 2018). These dolmen fields include, among others, the ones at Wādī Jadideh and ʿAyn Mūsā (Mortensen *et al.* 2019), the large groups at Tall al-Ḥammām (Schath *et al.* 2011) and Tall iktanū (Prag 1995), around Adeimeh (Stekelis 1935), and end in the north at the excavated dolmen at Tall al-ʿUmayrī (Dabrowski *et al.* 1994; Dubis and Dabrowski 2002; Herr 2002). A second group is found further northeast with Fraser's research in Wādī ar-Rayyān (Fraser 2018) and the large site of Jabal al-Muṭawwaq (Polcaro 2013; Polcaro *et*

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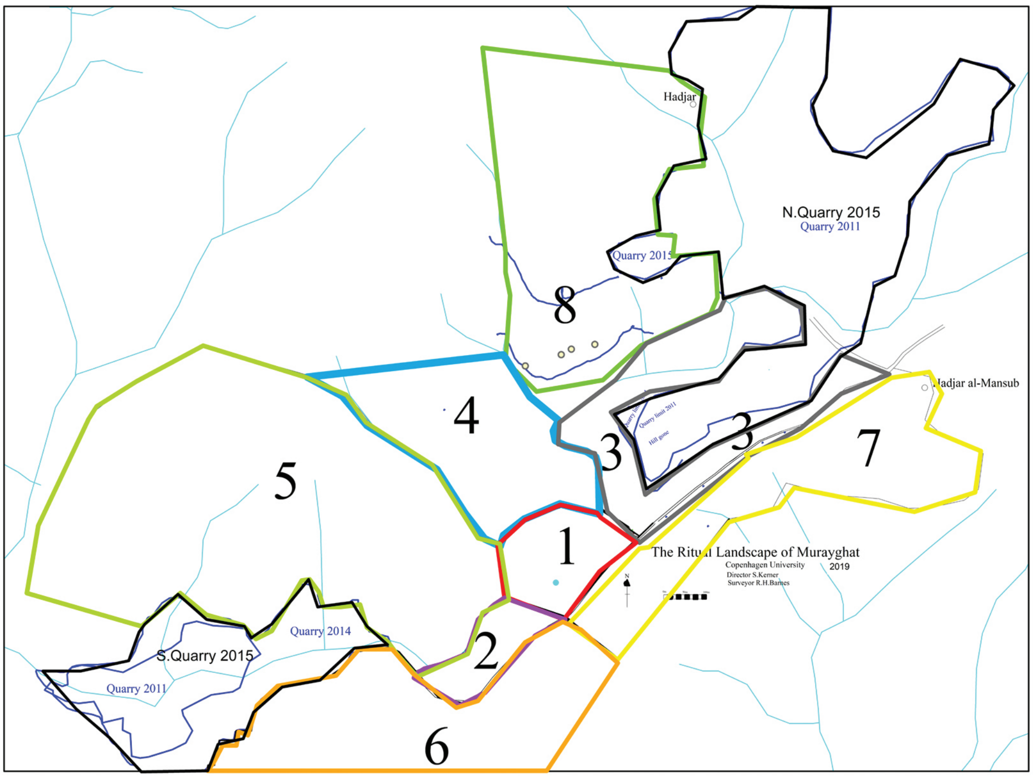


1. Plan of Area 1 (central knoll) and Areas 3–8 with dolmens (H. Barnes).

al. 2014; Polcaro and Muñiz 2018), among others.[1]

The Central Knoll: Introduction

The central knoll (Area 1) measures *ca.* 4 ha and forms the centre of the landscapes of Murayghāt, with all the hills and dolmens surrounding it. The knoll itself consists of hard limestone bedrock, a material that breaks in relatively straight slabs, easy to use for the construction of dolmens without the need of much further work, and some slightly less hard limestone at the eastern edges.[2] Both limestones also shape the surrounding hills and form the building material for the dolmens. The boulders used for the walls in Trenches 3 and 4, north of the central knoll, as well as the stone slabs used for the structures on the top of the central knoll, are mostly made from harder limestone. The central knoll shows several structures, made of large standing stones (Fig. 2), which are the remains of many more constructions that have been removed over the last few centuries when the site was used for agriculture and pastoralism. There has also been a certain amount of erosion, denuding parts of the bedrock at the topmost parts of the central knoll. The outer surrounding of the central knoll, supposedly being the recipient of most of the eroded material, however, shows under the surface much better conserved archaeological remains. All trenches have yielded archaeological

[1] An extensive overview of the literature can be found in Fraser 2018.

[2] Wādī as-Sīr limestone is exposed below the Wādī Umm Ghudran chalks (Fraser 2018, 142).

2. Rows of standing stones on Area 1 (S. Kerner). Parts of Rectangle 1 to the left.

material from these lower bedrock zones and have a stratigraphic depth of nearly two meters (at least in the north).

An artificial rubble wall, formed by bulldozing activities since the 1970s, demarcates the northern edge of the knoll. The edge of the knoll to the west and south is relatively sharp with a height difference of *ca.* 6–7 m between the edge of the knoll and the valley bottom. A long, often interrupted wall, which has for most parts an interior and exterior face, runs parallel to this edge.

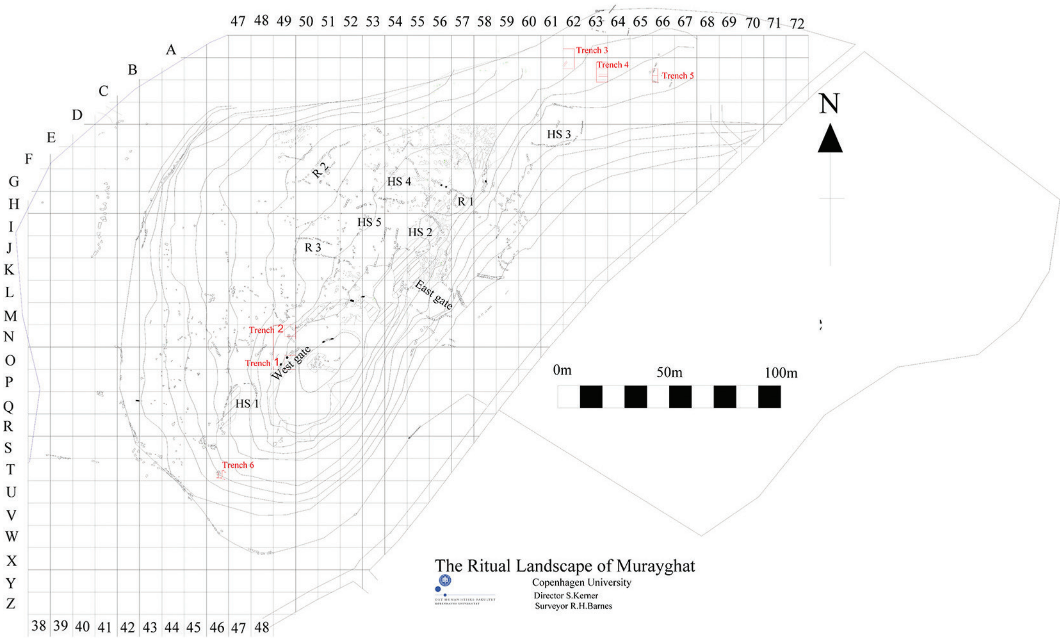
Survey Work

A net of 10 x 10 m squares has been laid over the site and these squares have been intensively surveyed, documenting the visible bedrock, lines of standing stones, cup-marks and assembling surface collections. Currently 113 squares (11,300 m^2 or a little over 1 ha) have been surveyed, documenting the visible bedrock in 1:100 plans (Fig. 3). The documentation of all visible standing stones is continuously carried out in 1:50 plans. The surface collections showed very fragmented material with most sherds hardly above 4 cm^2 and much abraded. Pastoralist and agricultural activities caused some disturbances on the surface, such as surface removal of stones for tent building, but the greatest damage was done by the bulldozing of a road to the cistern at the western edge of the site.

Several structures on the central knoll have been documented, but so far, not many could be further studied. The landowner did not permit us to excavate on the site between 2014 and 2017, so we had to close the trenches at the central knoll after only two weeks in 2014, and were only able to re-start during the 2018 campaign.

The central knoll shows two possible circular alignments on the highest point on the bedrock (O–P/50–51), although their date is unclear and might be relatively recent.[3] They appear more recent as the stones sit loosely on the bedrock surface, which differentiates them from most of the other structures, where the stones are clearly embedded in the ground. The stones used are also smaller than those used in most other recorded structures. From this summit a good view is provided to the

[3] This is contra the assumption that this small circle formed the main cultic structure at the site (Savage 2010).



3. Plan of Area 1 with grid and documented structures (H. Barnes).

4. View of Area 8 towards the highest point of Area 1 (H. Barnes).

surrounding areas; almost all dolmen on the hills (Areas 3, 4, 5, 6, and 7) would have been visible from that point, or, better, that point would have been visible from nearly all dolmens on the surrounding hills (Fig. 4; Kerner 2018, 2019). This includes two dolmens on a site more than 1 km northeast of Murayghāt. The large standing stone,

5. Bedrock showing development of vertical breaks in square P49 (S. Kerner).

Ḥajar al-Mansūb, however, was not visible from that location.

Other structures on the central knoll are four large horseshoe-shaped arrangements, of which HS1 (P–Q/47–48), HS2 (I–J/55–56), HS4 (F–H/54–55), and HS5 (H–J/52–54) appear on the north-western and south-western side of the central knoll (Fig. 3). The latter, although very large, was only just visible on the surface, but has been further distinguished during the geo-magnetic survey in 2016 (see below). HS3 is on the north-eastern side of the knoll (E/61–61), but the dating of HS3 remains uncertain; it might be a much later construct used as an animal pen.

Moreover, three rectangular structures have been documented. The R2 (F51) and R3 (J/50–51) are also on the western side of the central knoll, constructed outside the denuded bedrock (Fig. 3). They are built from orthostats (large, rectangular stone slabs) and constructed on flatter ground, where a substantial amount of soil exists, indicating that these stones might continue down to a considerable depth. The R1, on the higher ground, is built from large standing stones and on the bedrock east of the hilltop (H57) with little fill around them. On the eastern slope of the central knoll are two double-faced walls, forming a trapezoid entrance-like structure (L57 and K58), while the western slope also has an entrance like structure, where two large standing stones form a gap in a longer wall made from orthostats (O49), the "Western Gate".[4]

The limestone of Murayghāt breaks in regular slabs (Fig. 5), and new cracks are developing continuously. The slabs, which are currently in the process of breaking off, are of a similar size compared to the larger

[4] Having a site with so many structures built from standing stones causes some problems in everyday work, as it is difficult to keep talking about, *e.g.*, "the structure in H52", particularly at a site where many newcomers work every year. This led to naming some of them with descriptive terms, such as "Western Gate", which is not meant to be a functional identification.

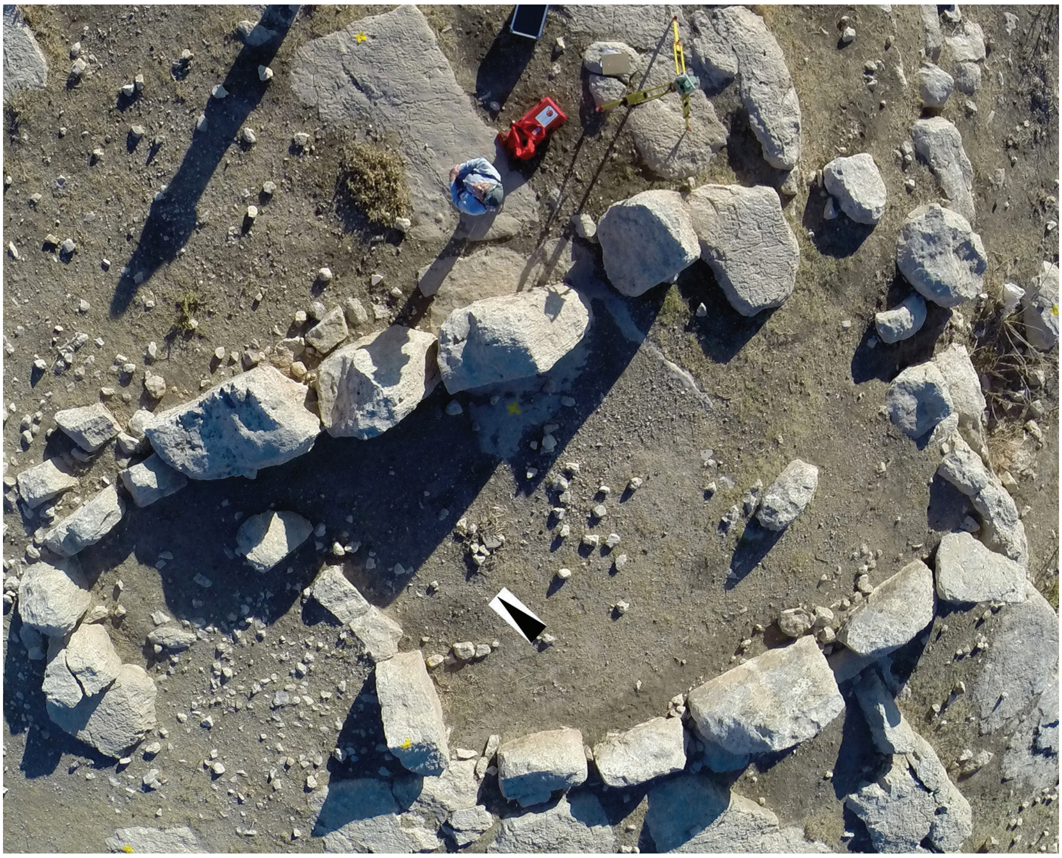
standing stones on site. On at least two spots on the western edge, holes seem to have been bored into the rock in antiquity, supposedly to break off stone slabs.[5] On the bedrock in Area 1 are many holes, of the kind often called cup-marks.[6] They concentrate on the edges of the central knoll, both towards the north (actually in Area 3) and particularly at the western edge towards Wādī Murayghāt. The cup-marks vary in shapes and sizes and are often grouped together. Their creation might have been connected to water in some cases, as chalk lines run towards them.

[5] These stones were kindly pointed out to me by Abu Ibrahim Alamur, landowner and guard.

[6] These items have also been called beaker-marks, bedrock mortars, cupules, rock-cut installations (RCI), or human-made bedrock holes (HBH, Nadel and Lengyel 2009), the latter probably being the most objective one, but I will stay mostly with cup-marks for the moment.

Rectangular Structures

Rectangular 1 (R1) is located at the eastern side of the bedrock outcrop (see Fig. 3), which forms the central part of Area 1, where the rock declines sharply directly next to the structure (see height lines). The structure thus offers a wide view over the entire eastern side of the site and towards Wādī Zarqāʾ Maʿin. The surrounding view also includes almost all dolmens in Areas 3, 4, 5, 6, 7, and 8 (except a very low dolmen located in Area 7). The structure is at the north-eastern corner of the built-up area of Area 1. Rectangular 1 (Fig. 6) has been studied in more detail, which has led to the documentation in its direct vicinity of some



6. Rectangle 1, stones on eastern end on lower level (S. Kerner).

7. Cup-mark (Locus 1573) to the left and 5–6 rows of round indentations (L.1572) to the right, both just north of Rectangle 1 (P. Nielsen).

cup-marks and other interesting markings, consisting of irregular rows of indentations, similar but not identical to the gaming sets known from much later time periods. These markings (L.1572) are on bedrock just north of R1 (Fig. 7) together with a single cup-mark (L.1573). Two further cup-marks are situated a couple of metres further north. The position of the cup-marks is unusual, as most others are towards the western and partly northern edge of the central knoll. Inside R1 is another set of indentations, set next to the largest of the stones in the northern wall. R1 consists of one room of *ca*. 7.3 m x 5.9 m, stretching northwest–southeast, whereas the northern wall continues towards the northwest for another 2.3 m. The wall might continue even further, but there are large breaks in between the aligned orthostats. Large orthostats of varying size, the largest being some 1.3 m high and up to 2 m long (Fig. 8), form these walls. As some of the stones are standing on bedrock while others continue below the visible ground, so their height might be even greater. The stones stand close to each other without necessarily touching. The standing stones are of a rather regular thickness, but of various shapes (rectangular, trapezoid, triangular, squarish, or shaped like a pentagon, as well as a parallelogram; Fig. 8). These shapes are not likely the effect of careful work, but more apt to be outcome of natural breakage. The surfaces are fairly even, without signs of further smoothing, but clear erosion marks are visible. The orthostats thus have characteristics similar to the boulders forming the dolmens, and they were used as they broke off from the surface of the site. The orthostats forming the structures seem to have relatively plain sides (Fig. 9) compared to the dolmens.

8. Southern (front) and northern wall of Rectangle 1. The boulders of the northern wall fit well together (H. Barnes).

9. Rectangle 1: View along the stone boulders of the northern wall (H. Barnes).

The northern wall of R1 consists of large orthostats, some of which fit very closely to each other and could have formed a substantial wall (see Fig. 8). The distance between the stones increases towards the east, where some might have toppled down the slope. Some of the stones, originally forming the eastern wall, will also have fallen down in one of the many slight or heavy earthquakes, which have shaken the region over the last 6,000 years. The northern wall consists of four large boulders, which end at the slightly higher bedrock in the east. The bedrock rises there, which could be the effect of cutting it inside the building, but proving such a possibility will require additional study. The southern wall consists of five stones with the middle one being the largest, while they are less closely set than the northern orthostats. The western wall is made of one large orthostat and four much smaller stones. The ground is slightly higher to the west of the room. Outside the room an L-shaped continuation of the walls appears. The northern wall carries on some two metres, constructed from two stones, one of which has split (showing the clean breaks these stones can produce). The perpendicular wall following them is made from two orthostats ending at a higher bedrock piece. One of these orthostats is split over the entire length.

The function and dating of these structures built from orthostats still remains unclear. Those standing on the nearly denuded bedrock have little material around them that would allow dating.[7] In 2019, excavation started at a building, which is set in a zone of greater soil depth (Trench 8), leading hopefully to a better understanding of these structures. The similarity between the standing stone structures on the summit of Area 1 and those excavated in Trenches 3 and 4 (see below) would indicate that they date to the Early Bronze Age I.

In Jabal al-Muṭawwaq, another EBA site with dolmens as well as domestic structures, a 'great circle' exists, which is mostly built from large standing stones. The circular wall is, however, constructed differently, as it includes smaller stones together with the large stone slabs (Fig. 10). It has thus only limited similarity to the horseshoe-shaped structures in Murayghāt. Other lines of standing stones are known from Hartuv (Mazar *et al.* 1996), where they form one side of a double-faced wall in an EBA IB building but might have been freestanding at an earlier stage. At Wādī Jadideh and 'Ayn Mūsā, several lines of stones have been found, which are sometimes connected to dolmens (Mortensen *et al.* 2019: 23–24, 70, 75). One of these stone lines is 115 m long (Mortensen *et al.* 2019: 44), while most are shorter and the stones tend to be smaller than those in the Murayghāt structures. In Lajjūn, a long line of standing stones might be connected to an EBA II settlement (Scheltema 2008, 109).

[7] It is unclear if the stones could be dated by luminescence dating, as this is not always successful for limestone. A pilot project is underway.

10. Large circular wall in Jabal al-Muṭawwaq (courtesy of A. Polcaro).

Cup-Marks (Human-Made Bedrock Holes: HBH)

The survey on the central knoll has currently resulted in 42 loci containing cup-marks.[8] Some ten more loci have been registered in Area 3, situated at the bottom of the hill towards Area 1. Additionally, four loci were found in Area 5, all situated at the lowermost visible bedrock of the hill, and one locus in Area 7. A locus for cup-marks is defined by the visible bedrock outcrop into which the cupules have been worked, meaning all cup-marks that are on the same piece of limestone belong to one locus. Neighbouring loci might actually be on the same limestone bedrock, but there is a visible limitation of the boulder (soil cover).[9]

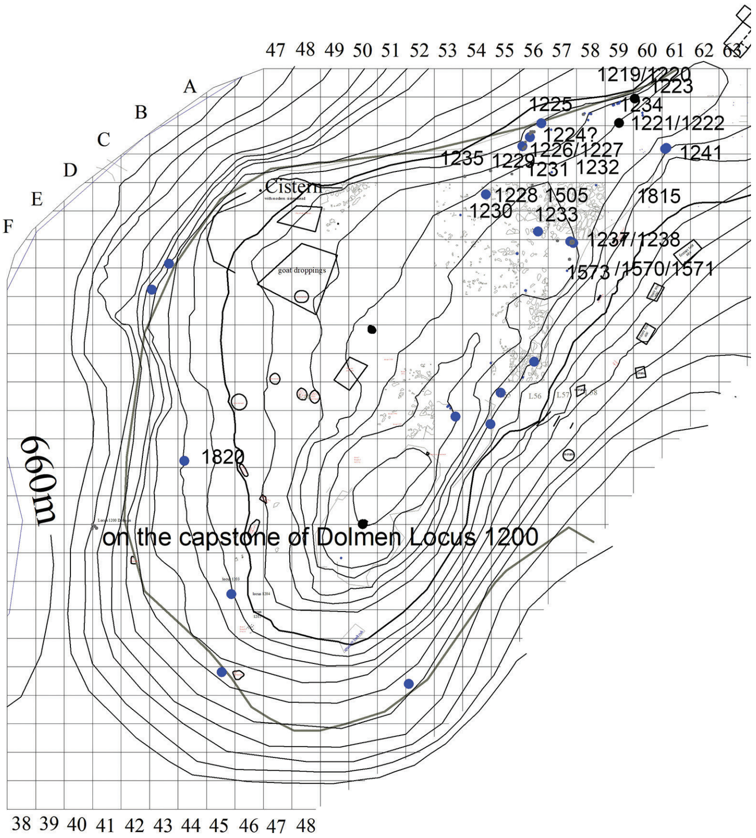
The cup-marks in Area 1 concentrate along the western edge of the central knoll (Figs. 11–12), but a limited number has been found on the higher ground. The cup-marks on the higher ground are mostly single, while many loci along the western edge contain cup-marks in groups of five and more. They have varied shapes and sizes, although the majority are around 15–20 cm in diameter and up to 15 cm in depth. The largest cup-mark, however, is *ca*. 60 cm deep. Their creation might have been in some cases connected to water activities.

To provide examples of cup-marks, squares C56 and D51 will be described. In square C56 at the northern edge of the central knoll are L.1226 and L.1227. Locus 1226 (Figs. 11 and 13) contained 13 cup-marks, showing the whole range of dimensions for the cup-marks in Murayghāt (Table 1) and representing most likely a wide range of function and chronology. The

11. Cup-marks along the edge of the central knoll. Locus 1226 in C56 on the upper end (south). The two single cup-marks on the lower side of the photo are in squares C/B 57 (S. Kerner).

8 There are more cup-marks in the southern part of Area 1, which has not been studied in detail.

9 This is a necessary side effect of doing a survey and not removing surface soil. The cup-marks themselves were, however, cleaned.



12. Plan of cup-marks (H. Barnes).

13. Close-up of L.1226 (nr. 1226.13 is outside the photo, S. Kerner).

Table 1. List of single cup-marks found in L.1226.

Locus	Size	Depth	Form	Description
1226.1	21 x 21	54	cylindrical + bowl	pockmarked on upper part and lower part smooth
1226.2	26 x 26	37	conical	lower part chalky, upper part dark
1226.3	18 x 18	18	conical	upper part pockmarked, lower half concentric rings
1226.4	22 x 23	60	conical + pointed	concentric rings
1226.5	24 x 21	23	cylindrical+ stone	upper part pockmarked, lower half smooth
1226.6	14 x 14	6	bowl	upper half smooth
1226.7	5 x 5	3	shallow bowl	
1226.8	2 x 2	1	shallow bowl	chalky surface
1226.9	2 x 2	1	shallow bowl	
1226.10	4 x 4	2	shallow bowl	chalky surface
1226.11	3 x 3	1	shallow bowl	chalky surface
1226.12	13 x 15	7	bowl	dark surface, slightly pockmarked
1226.13	3 x 3	1	shallow bowl	chalky surface

14. Close up of L.1226.4 containing water in late April (S. Kerner).

13 cup-marks are distributed over the entire length of the bedrock boulder, but more to the western edge of it (Fig. 13). L.1226.1 had an unusual, but not unique, shape, in being conical on the lower part but concave on the upper part with a restricted opening. The largest diameter of this cup-mark was thus not at the rim but a few centimetres below it. The narrow, conical shaped L.1226.4 was the deepest of all cupules in Murayghāt and holds water until after the rainy season (Fig. 14).[10] The small cup-marks (7, 8, 9, 10, and 11) all have a chalky layer on the inside, which might be connected to standing water

[10] The photo was taken in mid-April.

Table 2. List of single cup-marks found in L.1227.

Locus	Size	Depth	Form	Description
1227.1	18 x 16	9	bowl	smooth (including rim)
1227.2	10 x 10	4	shallow bowl	
1227.3	10 x 10	5	shallow bowl	

15. Cup-mark (L.1243) in square D51 (Sean Weston).

evaporating after the wet season. They are too small to have served any of the possible functions for cup-marks and might be showing the development of such holes. Locus 1227 is directly south of L.1226 and consists of 3 cup-marks, one of which is of the most common size, while the other two are smaller (Table 2). The larger, bowl-shaped L.1227.1 is very smooth on the inside as well as along the rim.

The second square described exemplarily is D51 at the north-western edge of the central knoll and marking the northern end of a rather dense concentration of cup-marks along the edge towards Wādī Murayghāt. In D51 are L.1243 and L.1244: each have only one cup-mark on their respective bedrock outcrops. L.1243 is 20 x 22 cm in diameter and 22 cm deep with a cylindrical shape and rounded base. The cup-mark has a dark patina on the upper third and a relatively rough inside surface (Fig. 15). L.1244 is 22 x 15 cm in diameter and 16 cm deep with an irregular bowl shape. Both are at the southern end of their bedrocks.

Cup-marks have been interpreted as mortars/grinding facilities in connection with olive oil or wine production or as threshing floors (Van den Brink *et al.* 2001; Van den Brink 2008; Eitam 2009, 2019). Grosman and Goren-Inbar (2007) related PPNA cup-marks and other HBH with quarrying for flint and rock extraction, which is a particular interesting idea in Muraygh$\bar{a}$t, where so much rock-related work must have been going on. The difference in shape when compared to known grinding facilities in Modai'in (Van den Brink 2008) makes grinding an unlikely function. The deep, conical HBR have been interpreted as Natufian mortars and cup-marks with a small depression (cup) at the base as related to olive oil production (Nadel and Lengyel 2009; Eitam 2019). Some of the cup-marks in Murayghāt show similarities to the examples from Tall Buraygāt, but no Natufian material has been identified in Murayghāt, which makes the chronological interpretation difficult. While there are a great number of cup-marks, they are not as numerous as at sites such as Modai'in or Buraygāt. The stone quarrying seems to have been done in different ways or related completely to natural processes. Thus, the current phase of cup-mark analysis does not allow a final hypothesis for the Murayghāt examples.

Dolmens in Area 1

On the central knoll (and just outside in Area 2) four dolmens have been found. The best-preserved one is in Area 2 (L.1200) just southwest of the double wall surrounding the central knoll and measures 2.60 m x 2.25 m with two large sidestones, two small endstones, and a large roofing slab with many cup-marks and other indentations (Fig. 16). A very similar example with cup-marks is dolmen MN688 in the vicinity of Siyāgha (Mortensen 2019: 177 fig. 113). Two further possible dolmens are collapsed (L.1203 and L.1204), while the better-preserved L.1205 in T46 was excavated (Trench 6). The roofing stone was missing and one of the stones along the long side is broken, while the stone on the south-eastern short side is missing (Andersson and Kerner 2017: 7). The topsoil contained modern contamination (glass, metal, and plastic), while the lowest level was mostly free of modern finds but included small amounts of EBA pottery. There were no foundation cuts for the side stones noticeable. They stood directly on the bedrock, where they were supported by small stones wedged underneath them. The floor stone was wedged very tightly between the two long sidestones and very difficult to remove. We removed it, however, to probe the soil underneath it, finding only small amounts of EBA pottery. Bedrock was uncovered in the southern part of the trench, at the 'entrance' of the dolmen. The soil material was relatively loose in front of the dolmen and to the north of the broken outside stone slab, which might indicate recent disturbance; this would also explain the rather heavy amount of modern contamination in front of the dolmen. Nothing has been found on the stone slab forming the base, but in the rubble around the dolmen, some human bones, most likely distal phalanges, have been excavated. The floor stone was replaced and the trench refilled.

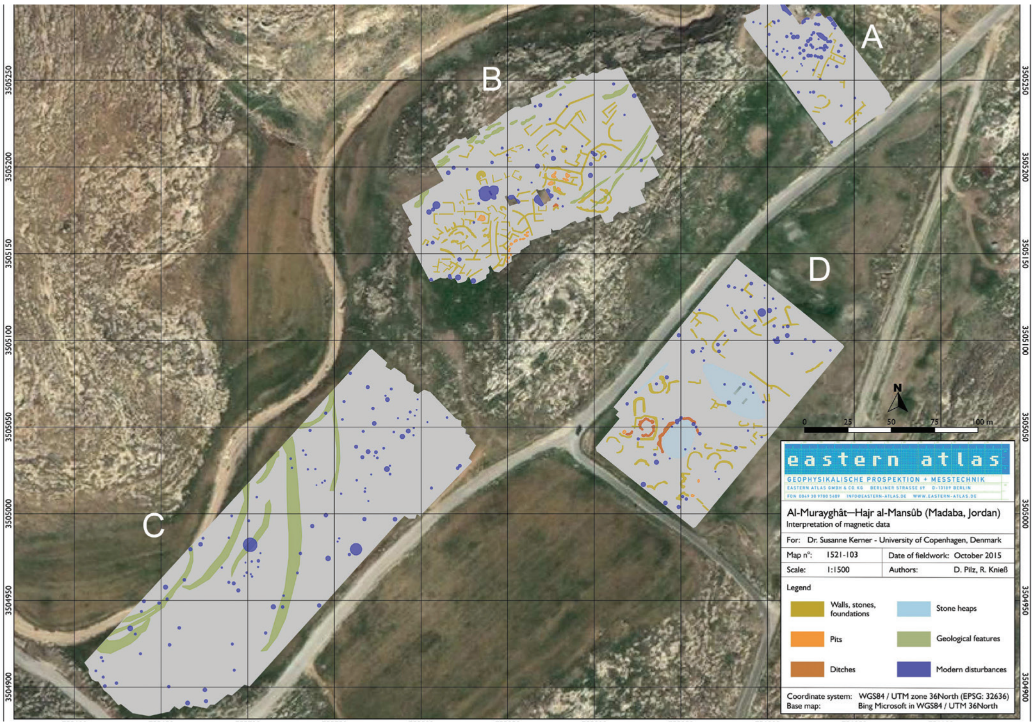
Geo-Magnetic Survey

A team of experts from Eastern Atlas carried out a geophysical survey in 2015 to test the evidence for further architecture at the site. The geophysical survey campaign consisted of magnetic measurements on four selected zones (in Areas 1 [A and B], 2 [C], and 7 [D]) of 4.5 ha and an additional GPR test measurement on a smaller scale (200 m^2) in Area 1 (B). For the magnetic investigations at Murayghāt, an array of seven Förster fluxgate gradiometer probes, mounted on a frame, was used. The probes were mounted on a light and foldable

16. Dolmen L.1200 in Area 2 (just outside Area 1) has a roof stone with many holes and indentations (Ann Andersson).

frame with two wheels. Two handlebar extensions were used to lift up the system in case of surface obstacles. Three areas were prospected by pulling the LEA MAX system. Due to the challenging surface conditions created by the large standing stones, the array was converted into a carrier system for the prospection of one area. For the positioning of the data, a marker wheel as well as a GNSS receiver were incorporated. The measured gradient (the difference between two vertically arranged sensors in a gradiometer probe) is insensitive to the typical large fluctuations of the Earth's magnetic field and is determined only by the magnetic local anomalies in the ground.

The anomalies of metallic or unambiguously modern origin are separated and marked in blue, and anomalies ascribed to geological and geomorphological features are depicted in green. Archaeological remains are marked in yellow, while filling of pits, etc. are orange (Fig. 17). The study of precinct (A) in Area 1 covers the zone north of the central knoll, which included the trenches 3–5, and showed several further wall-lines, a circle and several other anomalies of possible archaeological origin. Particularly the area close to Trench 5 shows remains of long walls. The western part of Area 1 (B) covered largely by soil, herding debris *etc.* showed that the structures already visible



17. Results of the geophysical survey in Murayghāt (Eastern Atlas: D. Pilz, R. Kriess).

on the surface documented during the tell-survey, continue underneath the soil cover. Area 2 (C) on the other hand proved empty, which shows that the area was probably always used for agricultural activities. The last zone surveyed was in Area 7 (D) east of the central knoll and the street, which, due to the irregular surface, proved to be difficult to study and discovered subterranean rectangular and circular structures next to large stone heaps (most likely collected from ancient structures), particularly in the southwest corner between both roads.

Excavation

Two trenches were laid out on the central knoll (Trenches 1 and 2) and three at the northern end of Area 1 (Trenches 3–5). Trench 1 (O49) and Trench 2 (N49) could only be carried out for a short period in 2014 as the landowner then stopped any further excavation (Kerner *et al.* 2017), but Trench 1 was opened up again in 2018. The objective for the trench had been the study of a line of standing stones with a gap in the middle, dubbed the "Western Gate". The trench was excavated down to bedrock on the eastern side of the large standing stones. It contained ashy layers with much fragmented EBA pottery and no construction to hold up or support the large standing stones, sitting directly on bedrock.

The Trenches 3 and 4 lasted from 2014 onwards and had on the top two walls from the classical periods and many heavily disturbed fill layers from the MBA underneath. The MBA layers included several unstable constructed walls, which could not have stood very high and some unrelated, very insubstantial surfaces. Below those, Trenches 3 and 4 contained in the eastern parts a thin surface of chalky material, which looks like repeated flooding events, followed by a layer of nearly sterile silty material, which reached a depth of 0.9 m at the eastern section of Trench 4, but is much less thick further west. This gives the impression that some kind of barrier might have existed east of the excavation area. Underneath this silty layer are more substantial double-faced walls 1, 15 and 19 (L1307, L.1916, L.1919), which form a square filled with rubble layers of mixed MBA–EBA material. Under the rubble layer was a large pit, which had also disturbed walls 15 and 19. It might have been this pit that disturbed the layers around it, because outside the pit were clear EBA layers, which date the origin of these walls, which are set on natural soil. The earliest construction in Trench 4 is a small semi-circular line of stones and a large boulder with two human-made holes in it, which are underneath wall 1 and directly on the reddish paleo-soil. The small amount of material found is clearly EBA I.

In the south-eastern part of Trenches 3 and 4 were walls 14 and 22 (L.2283), which were built from large roughly rectangular stone slabs. The walls run roughly parallel and have a patchy surface between them, on which some large and unusual EBA I vessels have been found. Two Murayghāt bowls with alternating sets of one and two ledge handles (above each other) and a diameter around 50 cm were found on the surface and slightly above, together with other pottery fragments (Kerner 2019; Andersson this volume). The pottery might have been smashed, when a line of orthostats forming the northern border of the room toppled over. These orthostats form a line of at least 8 m, which is, however, not continuous, but consists of very large stones, which must have been some of the earliest constructions in the trenches. The construction and layout of this orthostat line looks very similar to the standing stone structures on top of the central knoll (like Rectangular 1, see above).

Conclusion

The Ritual Landscapes of Murayghāt are made of over 120 dolmens, large structures of standing stones on the denuded bedrock on the central knoll and similar walls made of standing stones or orthostats in the excavated area, which date into the EBA I. The central knoll has at the western, north-western, and north-eastern edges several cup-marks or human-made bedrock holes, which show different dimensions and forms. The site was re-used in the MBA.

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The Early Bronze Age (EB I) Ceramic Assemblage from Murayghāt in the Mādabā Region: Preliminary Results of the Ritual Landscape of Murayghāt Project 2014–2018

The site of Murayghāt in the Mādabā region was noted by early travellers in Jordan (1817–1818), due to the presence of a substantial number of dolmens located on the hills surrounding a central mound, where remains of semi-circular and rectangular stone structures could also be observed (Irby and Mangles 1985: 465–6; Fig. 1). In 1881, as many as 150 dolmens were noted at Murayghāt and some were further described by illustration (Conder 1889: 184). Today, the dolmens and stone structures can still be observed, although damage to the site has been inflicted by three nearby quarries. At present, 122 dolmen structures have been recorded at the site (Kerner 2018: 263, 2019: 181; Figs. 2–3). Even though the dolmen fields west of the central knoll have been purchased by the Department of Antiquities and the Jordan Government, agricultural and industrial development of the area still threatens the landscape and the archaeological remains. Combined, this not only means that the ancient structures on the site are endangered, but also that the landscape, and whatever likeness it has with the ancient landscape, is being rapidly and significantly altered.

The Ritual Landscape of Murayghāt Project studies the relationship between dolmen structures, cultic structures, and the landscape between the 4th to the 2nd millennium BC (Kerner 2019). This paper will present the preliminary results of the study of the Early Bronze Age (EBA) ceramics during the 2014–2018 seasons. A more extensive publication of the material will be forthcoming (Kerner and Andersson forthcoming). So far, the EBA ceramics excavated at Murayghāt have been dated to the earliest part of the EBA, *i.e.*, EB IA (*ca.* 3700–3400/3300 BC).[1]

[1] The EB I (3700–3000 BC) is divided into two phases: the EB IA and EB IB, which may also be designated Early and Late EB I. The transition between the subphases of the EB I is dated around 3400/3300 BC (Philip 2008: 167; Fraser 2018: 6).

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1. View of the central knoll at Murayghāt. Several stone structures are visible on the surface of the small tall.

2. View of an individual dolmen structure.

3. Two dolmen structures on the hills surrounding Murayghāt. Note also the two additional dolmens in the background.

Ritual Landscape of Murayghāt Project 2014–2018

The Ritual Landscape of Murayghāt Project began in 2014 and has been running for six seasons (with its latest season in 2019) and is directed by Dr. Susanne Kerner.[2] The project is also a field school for students of Near Eastern Archaeology at the University of Copenhagen.

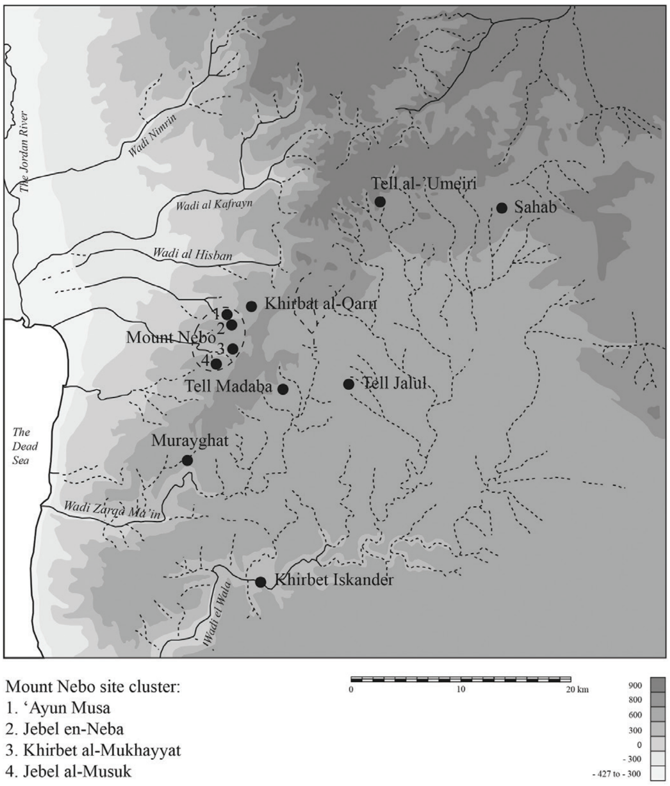
The excavations at Murayghāt have concentrated on an area slightly northwest of the central mound (trenches 3, 4, and 5), which has been excavated over several years (2014–2019) revealing a sequence of Middle Bronze Age (MBA) and EBA architecture. In addition, a small excavation area (trench 6) concentrated on a dolmen at the site (2015). Besides these excavations, an extensive survey has been undertaken since 2014, which documents the landscape and the many structures encountered on and around the central mound of Murayghāt (Kerner 2018).

Murayghāt and the Madaba Region in the Early Bronze Age

Considering the settlement patterns in the Madaba region, it is difficult to distinguished Late Chalcolithic (LC) sites from EB I sites (Fig. 4). The transition between the periods is at present poorly understood and sites of the two periods have often been grouped together in surveys (Harrison 1997: 11). Still, the region exhibits a low number of sites and '. . . settlement during the Late Chalcolithic/EB I was sparse, consisting primarily of isolated clusters of communities engaged in basic subsistence pursuits' (Harrison 1997: 13).[3] Settlement in the region peaked in the EB II/III period with sites increasing in both size and numbers. EB II–III sites often resettled earlier LC/EB I locations (Harrison 1997: 13). During the EB IV/MB I period sites decreased in number and size, which appear to reflect a partial return to nomadic subsistence

[2] Institute for Regional and Cross-Cultural Studies, University of Copenhagen, Denmark.

[3] The division between EB IA and EB IB is similarly difficult, as the period has not been adequately investigated.



4. The Mādabā Plain with selected EB I sites mentioned in the text.

practices, while some larger rural villages remained. EB II–III sites were rarely settled again in the EB IV/MB I (Harrison 1997: 17–9).

While a good number of surveys on the Mādabā Plain[4] have discovered sites of the EB I, excavations have rarely exposed large expanses of the period, as the remains lie below substantial deposits of later phases of occupation. This also means that the EB I ceramic tradition from the Mādabā region is at present poorly understood. Tall Mādabā and Tall Jalūl are two of the dominant settlement sites on the Mādabā Plain, where EB I layers may be present, but not exposed (Harrison 1997: 2). Limited excavations at Tall Mādabā indicate that the tall was settled in the Late EB I/Early EB II (Harrison *et al.* 2000: 222). However, with the extensive modern occupation of the tall, any settlement and archaeological remains of the EBA period are very difficult to study. At Tall Jalūl, only sherd scatters of the EBA period are reported, while no architectural remains have been excavated (Younker 2007). Other prominent archaeological sites with EBA material include Khirbat Iskandar, Tall al-‘Umayrī, Khirbat al-Qarn, and the Mount Nebo site cluster.[5] At Khirbat Iskandar, excavations in Area B reached layers (stratum III, phase D) that may be of EB I date. Furthermore, a cist tomb excavated in area J dated to the EB I indicates that Khirbat Iskandar may have been occupied in EB I (Richard 1990: 35, 2010: 14). At Tall al-‘Umayrī the excavation of a dolmen revealed pottery and secondary burials (stratum 21) dating to the EB IB and it is possible that the site was inhabited during this period (Dabrowski *et al.* 1994: 241–2, 1996: 86–90; Dubis and Dabrowski 2002: 171–7; Herr and Clark 2007: 121).[6] Khirbat al-Qarn only seems to have had a smaller EB I settlement component, perhaps occupying caves at the site. However, any remains at the tall itself are hidden under EB III layers (Savage and Rollefson 2001: 223). At Mount

[4] Such as the early surveys by Glueck, the Ḥisbān survey, the Jālūl survey, the Tall al-‘Umayrī survey and the Sahab survey (Harrison 1997), along with the MOAB Archaeological Resource Survey (Savage and Rollefson 2001).

[5] Sahab is often mentioned as a large EB site (*e.g.*, Harrison 1997), but subsequent excavation uncovered only Chalcolithic remains (Ibrahim 2006).

[6] While this is the only dolmen found at Tall al-‘Umayrī, two more dolmens were noted in the vicinity of the site (Dabrowski *et al.* 1996: 89).

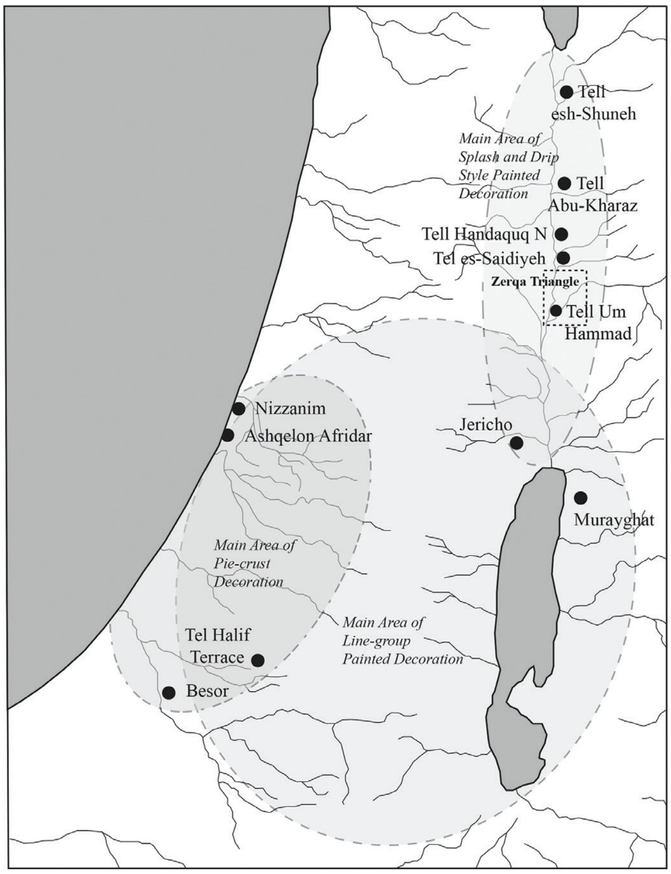
Nebo, a number of locations with EBA material was surveyed between 1992–1995, 1997–1998, and in 2008 (Mortensen *et al.* 2019: 8).[7] Here a large number of dolmens (189), stone lines (35), and standing stones (32) were recorded and excavations were carried out at a large EBA monument called "Conder's Circle" (2000–2001 and 2003–2005). All of these features are dated to the EB I(A), perhaps with very LC components (Thuesen 2009: 606; Mortensen *et al.* 2019: 11). A number of smaller sites at the Mādabā Plain may likewise have been occupied in the EB I, but have not been investigated beyond surveys.

Murayghāt was visited by Mortensen and Thuesen in the 1990s, who noted similarities with the Mount Nebo dolmen field (Thuesen 2004). In 1999–2000, Stephen H. Savage surveyed Murayghāt and determined that the majority of the archaeological material found here dated to the EB I (Dubis and Savage 2001: 96; Savage and Rollefson 2001: 225; Savage 2010: 33). The results of the survey conducted by Savage have been verified by the pottery assemblage excavated and collected since 2014 by the Ritual Landscape of Murayghāt Project (Kerner 2018: 265). Therefore, the excavations at Murayghāt present a unique opportunity to study the EB I, which is not readily available at other sites in the region and will help clarify the EB I ceramic tradition of the Mādabā Plain.

[7] The Mount Nebo site cluster investigated by Peder Mortensen, Ingolf Thuesen, and Inge Demant Mortensen includes the EBA sites recorded as ʿAyūn Mūsā, Jabal an-Neba, Khirbat al-Mukhayyaṭ, and Jabal al-Musuk (Harrison 1997).

The Early Bronze Age Ceramics

The ceramic material is characterised by a high degree of fragmentation, both in survey material and in the excavated material (Fig. 5). Partially complete vessels are rarely preserved, and it is also relatively unusual to find joining sherds. Therefore, it is difficult to assess how the vessels might have looked when complete, and additionally difficult to find suitable parallels (Tables 1–3). The following will present some form types and decoration types, which are relevant to the dating of the ceramic material. Furthermore, a vessel form, where parallels have so far not been found and appear particular to the Murayghāt assemblage, is also presented.



5. Map of the southern Levant with EBA sites mentioned in text and schematic distribution of decoration styles.

Holemouth Jars

Plain Holemouth Jars

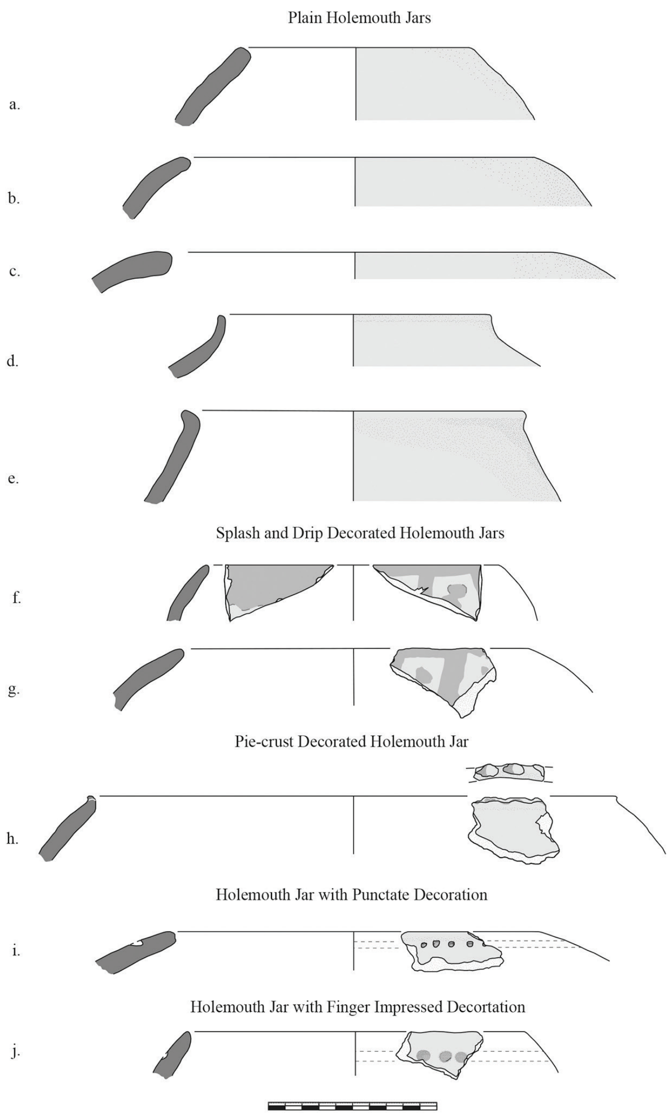
At Murayghāt, plain holemouth jars represent the greater part of the holemouth jar assemblage, and the diversity of plain holemouth jars may point towards different uses. The plain holemouth versions vary in form, with rims that are both simple, thinned, and bulbous (Fig. 6a–c), and these rims offer no chronological indications. Other variants of the plain holemouth jars have upturned straight thinned rims or inwards sloping walls and a slightly everted rim, which makes them appear bag shaped (Fig. 6d–e). While the two latter forms are less common than the typical holemouth jars, parallels may be found at many EB I sites.

Holemouth Jars with Splash and Drip Paint Decoration

Splash and drip paint decoration is distributed at sites along the central and southern Jordan Valley and is described as a purely local style (Fig. 6f–g). This decoration type is known from the LC through the EB IA, and as the name suggests, the decoration consists of splashing and dripping of red paint on holemouth vessels or jars. The decoration type can be found at sites such as Tall ash-Shūna, Tall as-Saʿīdiyy, Tall Abū-al-Kharaz, Tall Umm Ḥammād, and at Jericho (Milevski 2011: 76). This type of decoration is not well represented in the Murayghāt assemblage and only a few examples have been recognized, but their presence does suggest a dating to the very late LC or the EB IA.

Pie-Crust Decorated Holemouth Jars

Another kind of decoration present in the Murayghāt assemblage has been described in several different ways but is usually called either scalloped, thumb-indented, or pie-crust decoration (Fig. 6h; Golani 2008: 27). Here, the term "pie crust" has been adopted due to its descriptive



6. EB I holemouth jars from Murayghāt.

Table 1. EB I holemouth jar parallels.

Fig. 6	Description	Parallels
a.	Plain Holemouth Jar	Tall Umm Ḥammād (Helms 1992: 45–7 fig. 141.5, G1) EB IB.
b.	Plain Holemouth Jar	Jawa (Helms 1991: 74–5 fig. 118.107, GA) EB IA; Tall Umm Ḥammād (Helms 1992: 55–6 fig. 172.6, G15) EB IB.
c.	Plain Holemouth Jar	Jawa (Helms 1991: 74–5 fig. 116.80, GA) EB IA; Tall Umm Ḥammād (Helms 1992: 55–6 fig. 168.7, G15) EB IB.
d.	Holemouth Jar with Vertical Raised Rim	Tall Umm Ḥammād (Helms 1992: 66 fig. 204.10, G29).
e.	Holemouth Jar with Everted Rim (Bag-shaped?)	Tall Umm Ḥammād (Helms 1992: 49 fig. 152.3, G6) EB IA.
f.	Holemouth Jars with Splash and Drip Decoration	Splash and Drip Decoration: Jericho, Tell Abu-Kharaz, Tell esh-Shuneh, Tel es-Saidiyeh, Tall Umm Ḥammād (Milevski 2011: 76) LC/EB IA.
g.	Holemouth Jar with Splash and Drip Decoration	Splash and Drip Decoration: Jericho, Tell Abu-Kharaz, Tell esh-Shuneh, Tell es-Saidiyeh, Tall Umm Ḥammād (Milevski 2011: 76) LC/EB IA.
h.	Holemouth Jar with Pie-crust Decoration on Rim	Pie-crust Decoration: Ashqelon Afridar, Besor Site H, Tell Halif Terrace and (Golani 2008) Chalc./EB I.
i.	Holemouth Jar with Punctate Decoration below Rim	Punctate Decoration: Kataret es-Samra, Jawa, Jebel Mutawwaq, Tell esh-Shuneh, Tell Handaquq (N.), Tall Umm Ḥammād (Helms 1991: 58 fig.112–5, 1992: 47–8 fig. 143.8, fig. 145.2, fig. 145.5, G2; Philip 2008: 199, 201) EB IA.
j.	Holemouth Jar with Finger Impressed Decoration below Rim	Finger Impressed Decoration: Tall Umm Ḥammād (Helms 1992: 47–8 fig. 143.10, fig. 145.3, fig. 145.10, fig. 146.5, G2) EB IA/EB IB.

nature. The decoration type is known from the Chalcolithic and the Early EB I (Golani 2008: 32). Pie-crust decorated rims on holemouths, which are relatively frequent in the Murayghāt assemblage, are usually found at sites west of Murayghāt, *i.e.*, in the southern Shephelah and the coastal region. Although less common at LC sites, such pie-crust decorated holemouth jars are known from Shiqmim BP II, Abu Matar, and Besor Site A. Pie-crust decorated holemouth jars became more common during the EB I and occur at sites such as Besor Site H, Tall Halif Terrace, and Ashqelon Afridar (Golani 2008: 32). Pie-crust decoration occurs at many EB I sites outside the main distribution area of pie-crust rim decoration, but generally represent minor parts of the ceramic assemblages.

Holemouth Jars with Punctate Decoration

Punctate decoration along the rims of holemouths are known from the stage 2 assemblage at Tall Umm Ḥammād, which is dated to the Early EB I (EB IA; Fig. 6i). At Tall Umm Ḥammād, the decoration is usually connected with rounded or slightly pointed, pushed up lug handles at or near the rim (Helms 1992: 47–8 figs. 143–6). No vessels with a combination of these features have been found at Murayghāt, which may be due to the fragmented state of the pottery. Alternatively, the vessel may not have had any handles. Besides being present at Tall Umm Ḥammād, this vessel type is reported from EB IA sites in the Wādī az-Zarqā (Kataret as-Samra and Jabal Muṭawwaq) and at Jāwā towards the northeast in the black desert, but also towards the north at

EB IA Tall Ḥandaqūq (N.) and Tall ash-Shūna (Helms 1992: 47–8; Philip 2008: 199, 201). Examples with punctate decoration, but probably without handles, can be found at Jāwā (Helms 1991: 58 figs.112–5). There are not many examples represented in the Murayghāt assemblage, but the presence of this decoration on holemouth jars supports an EB IA date.[8]

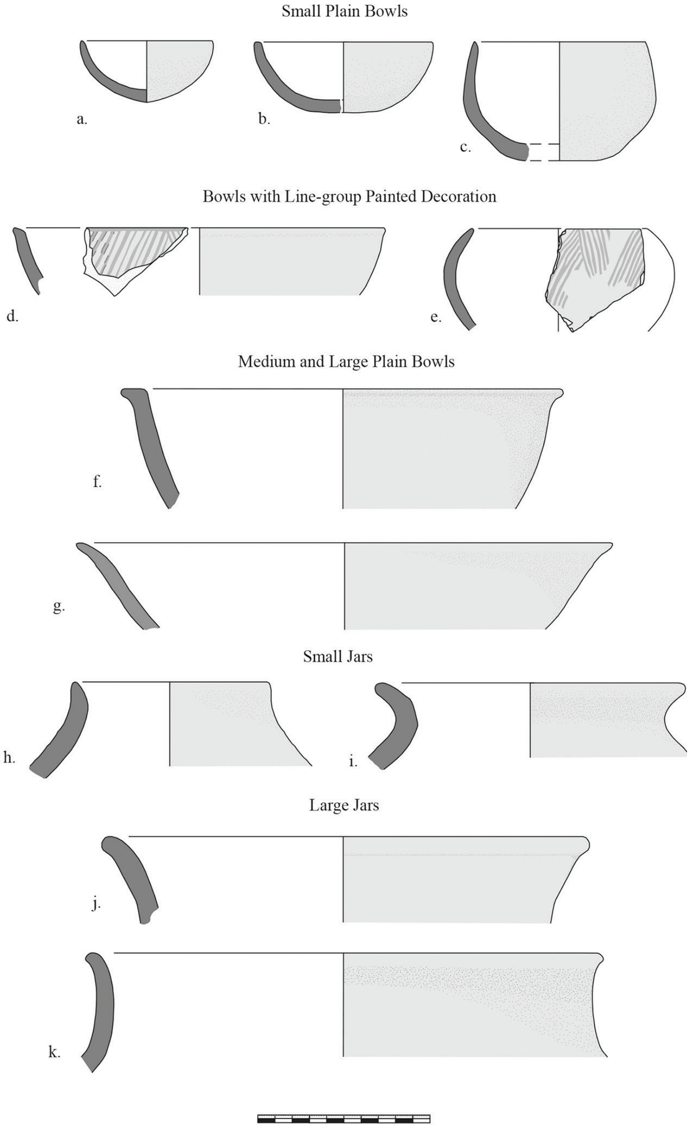
Holemouth Jars with Finger-Impressed Decoration

Some holemouth jars are decorated with slight finger-impressed decoration below the rim, forming slight round depressions (Fig. 6j). In some cases, fingernail imprints can be seen in these impressions. While this kind of decoration is not frequent at Murayghat, possible parallels may be found in EB IA and EB IB contexts at Tall Umm Ḥammād (Helms 1992: 47–8 figs. 143.10, 145.3, 145.10, 146.5).

Bowls

Small Plain Bowls

Many small bowls (or cups) are present in the assemblage. The majority of small bowls are plain and occur in different forms, such as open and shallow bowls with rounded or thinned rims (Fig. 7 a–b) and closed and deep bowls with thinned rims (Fig. 7c). The diameters of these small bowls are generally around 10 cm. Such small bowls may have been connected with burial practices, since they are found in large numbers in burial contexts and generally only make up a small percentage of settlement assemblages. They might have been used as drinking vessels or as small lamps (Kaptijn 2009: 102). The parallels from Mount Nebo ("Conders Circle", MN1), Tall al-ʿUmayrī, Tall Umm



7. EB I bowls and jars in different sizes from Murayghāt.

[8] The presence of Tall Umm Ḥammād, stage 2 (EB IA) decorative features in the assemblage is significant, as the stage 3 assemblage (EB IB) decoration style changes significantly (see for instance Helms 1992 and Bar 2010) and this decoration style has not been identified at Murayghāt. This could indicate that Murayghāt was only settled during the EB IA.

Table 2. EB I bowls and jar parallels.

Fig. 7	Description	Parallels
a.	Small Open Plain Bowl	Mount Nebo, "Conders Circle", MN1 (Thuesen 2009: 607 fig. 5.1; Mortensen et al. 2019: 99 fig. 85.1) EB I; Tell al-'Umeiri, Field K, dolmen (Dubis and Dabrowski 2002: 171–3 fig. 8.3.4.) EB IB; Tall Umm Ḥammād (Helms 1992: 74 fig. 214.4, G39) EB IB; Zerqa Triangle, Field 81 (Kaptijn 2009: 121–3 fig. 4.46.10, no. s81.5.xp15) EB IA.
b.	Small Open Plain Bowl	Asqelon Afridar – Area G (Braun 2000: 122 fig. 7.3.1.) EB I; Tell al-'Umeiri, Field K, dolmen (Dubis and Dabrowski 2002: 171–3 fig. 8.3.5) EB IB.
c.	Small Closed Plain Bowl	Zerqa Triangle, Katār Dāmiyah (Kaptijn 2009: 101–4 fig. 4.31.13, no. 500.x.7p15) LC/EB I.
d.	Open Bowl with Line-group Painted Decoration	Line-group Painted Decoration: Jericho (Nigro 2008: 653; Milevski 2011: 83) LC/EB IA/EB IB.
e.	Closed Bowl with Line-group Painted Decoration	Jericho, Tomb 13 (Kenyon 1960: 51 fig. 22.2) EB I. Line-group Painted Decoration: Jericho (Nigro 2008: 653; Milevski 2011: 83) LC/EB IA/EB IB.
f.	Deep Open Bowl with Everted Flattened Rim	Zerqa Triangle, Field 27 (Kaptijn 2009: 85 fig. 4.13.5, no. 27.10.5p1) LC.
g.	Wide Shallow Open Bowl	Mount Nebo, Tell al-Jadidah North, MN354 (Mortensen et al. 2019: 90 fig. 95.j), EB I; Zerqa Triangle, Katār Dāmiyah (Kaptijn 2009: 100 fig. 4.29, no. 500.x.5p6) LC/EB I.
h.	Circular Necked Small Jar	Zerqa Triangle, Katār Dāmiyah (Kaptijn 2009: 104–5 fig. 4.32.7., no. 500.x.3p1 and fig. 4.32.11., no. 500.x.1p1) LC/EB I.
i.	High Necked Medium Jar	Jawa (Helms 1991: 88–91 fig. 139.378-381, GE) EB IA; Tall Umm Ḥammād (Helms 1992: 67–8 fig. 206.4, G31) EB IB.
j.	Large Jar with Everted Flared Rim	Jawa (Helms 1991: 78–80 fig. 127.207, GB) EB IA; Tall Umm Ḥammād (Helms 1992: 55–7 fig. 184.7-12 and fig. 185.1-4, G16) EB IA/EB IB.
k.	Large Jar with Slightly Everted Rim	Jawa (Helms 1991: 78–80 fig. 126.193, fig. 127.205, and fig. 127.208, GB) EB IA; Tall Umm Ḥammād (Helms 1992: 55–7 fig. 184.7-12 and fig. 185.1-4, G16) EB IA/EB IB.

Ḥammād, and at Katār Dāmiyah and Field 81 in the Zerqa Triangle date between the LC and EB IB.

Small and Medium Bowls with Line-Group Painted Decoration

A small number of bowls are decorated with paint, which has been identified as line-group painted decoration (Fig. 7d–e). This decoration consists of thin red lines, applied either to the exterior/interior or both. The two examples presented here are the rim of an open bowl with remains of line-group pattern decoration on the interior and a rim of a closed bowl form with much of the body of the vessel preserved with remains of line-group pattern decoration on the exterior. The decoration consists of thin lines arranged in sections of right-slanting and left-slanting lines arranged around the rim and upper part of the bowl. Line-group painted decoration has been found at various sites over a wide area including '. . . the central coastal plain, the central hill country, southern Shephelah, the Northern Negev and the Dead Sea plain' as early as the LC (Milevski 2011: 83). At Jericho, this type of decoration first appears in stratum IIIa1 (EB IA), which however, becomes a diagnostic element of the material culture in stratum IIIa2 (EB IB) and in funerary assemblages of the same period (Nigro 2008: 653).

Medium and Large Plain Bowls

At Murayghāt, medium and large bowls are generally plain and occur in a variety of forms. Here only a few examples are shown.

One is an open deep bowl with an everted flattened and thinned rim (Fig. 7f), while the other is a shallow open bowl with a thinned rim (Fig. 7g). Both probably had flat bases. While no precise parallels have yet been found for the deep open bowl with the everted flattened rim, a roughly similar large bowl has been found at the Zerqa Triangle, field 27 (Kaptijn 2009: 85 fig. 4.13.5, no. 27.10.5p1). This example is dated to the LC. The wide shallow open bowl also has a parallel at the Zerqa Triangle, *i.e.*, Katār Dāmiyah, which is dated between the LC and the EB I (Kaptijn 2009: 100 fig. 4.29, no. 500.x.5p6). A possible EB I parallel is found at Mount Nebo (Tall al-Jadidah North; Mortensen *et al.* 2019: 90 fig. 95.j).

Necked Jars

Small to Medium Plain Jars

The repertoire of small jars is quite diverse and only a few examples will be shown here (Fig. 7h–i). One is a small simple rounded or circular necked jar. Such jars are known to occur in both LC and EB I periods (Kaptijn 2009: 104–5). The other jar is a high-necked medium-sized jar, which probably had a globular body. The parallels from Tall Umm Ḥammād and Jāwā are dated to the EB IA/EB IB (Helms 1991: 88–91 fig. 139.378-381, 1992: 67–8 fig. 206.4).

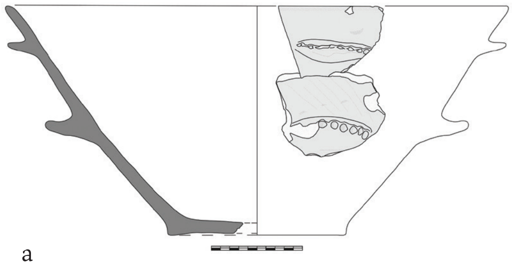
Large Plain Jars

Only a few rims, which can be identified as large jars, have been recovered (Fig. 7j–k). These are vessels with a plain rounded rim and a large rim diameter. The rims are everted and may be either flared or sit on rather vertical necks. Even though nothing can be said for certain about the form of the body of the vessel, the rims likely belong to large globular storage vessels. While none of the parallels from Tall Umm Ḥammād are precise parallels, as many of these vessels have painted decoration, similar jars (Genre B) from Jāwā do not exhibit the same painted decoration. The two sites provide form parallels dated between the EB IA/EB IB. However, the general form of these vessels is simple and according to Helms, these may also find form parallels in the Chalcolithic or even earlier (Helms 1991: 78–80 figs. 126.193, 127.205, 127.208; 1992: 55–7 figs. 184.7-12, 185.1-4).

V-Shaped Muraygḥāt Bowls

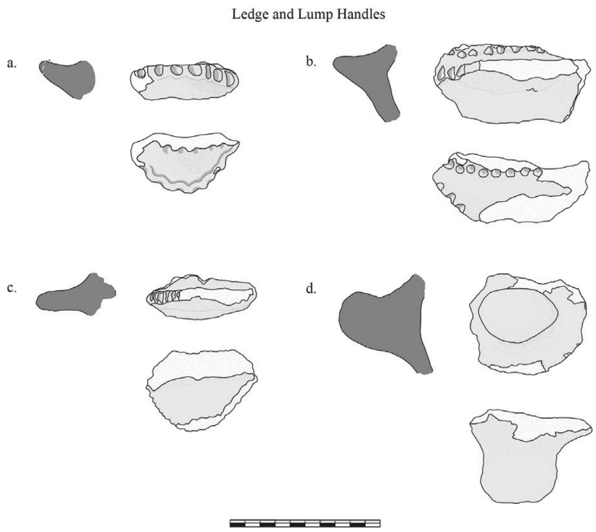
Even though the majority of the ceramic assemblage from Muraygḥāt is very fragmented, it has been possible to reconstruct profiles of some vessels. In one case, a full profile of a large V-shaped bowl was reconstructed. The vessel is handmade and has a very large diameter around 50 cm. It is a large deep V-shaped form with straight-sided walls, a straight rounded rim and double ledge handles (*i.e.*, a smaller ledge handle placed above a larger one) with a flat base. The edges of the ledge handles are decorated by scalloped decoration (Figs.8a and 8b). The multiple ledge handles may represent a local feature, as parallels have so far not been found in other EBA ceramic assemblages. The form of this vessel is similar to smaller bowl forms, *i.e.*, V-shaped bowls, which may also be described as flat-based bowls with flaring or straight-sided walls. At Ashqelon Afridar, small V-shaped bowls are a vessel type, which appears in the Chalcolithic and continues to be used in the EB I (Golani 2008: 27–8). An occurrence of larger versions of the earlier LC V-shaped bowls is described by Yekuteili in relation to EB Ia1 ceramics (here designated as kraters) from the southern Canaan (Yekuteili 2000: 132). The very large V-shaped bowls are not frequent at Muraygḥāt, but represent a minor and distinctive part of the ceramic assemblage and the few large and fairly elaborate vessels of the V-shaped bowl type may have had a special function at the site.

Joffe suggests that the 'continuity' between the Chalcolithic and EB I in terms of V-shaped vessels, may not only



8a. Illustration of the complete profile of the V-shaped vat with double ledge handles.

8b. Photograph of the complete profile of the V-shaped vat with double ledge handles.



9. EB I ledge handles from Murayghāt.

point to a high degree of continuity in craft production, but '. . . may also include ritual and behavioral aspects connected with food and commensality' (Joffe 2018: 43). In the LC, V-shaped bowls are suggested as a primary vessel type for food consumption, which may also have been used in ritual contexts to present quantities of food, such as stews, soups, and porridges (Joffe 2018: 42). It is tempting to propose the EB I V-shaped bowls from Murayghāt were used in the context of burial rituals and associated food consumption.

Ledge and Lump Handles

Ledge handles are usually considered good chronological indicators, which can be dated due to form and decoration, but only a small selection of the ledge handles found at Murayghāt are shown here (Fig. 9). The ledge handles found at Murayghāt exhibit a range of different styles of decoration. While incised ledge handles and scalloped ledge handles are well represented (Figs. 8a and 9a–c), there are also plain ledge handles present in the assemblage. To this should be added a few lump handles (Fig. 9d). Among other sites, the incised and scalloped ledge handles find parallels at Mount Nebo, where similar ledge handles have been found, either at 'Conder's Circle' (large circular structure) or at Tall al-Jadidah North (settlement site) dated to the EB I[9] (see Fig. 9a–c; Mortensen *et al.* 2019: 89–90). The close proximity between the Mount Nebo site cluster and Murayghāt, along with comparable ledge handles, point towards some shared traditions of the EB I ceramic tradition on the Mādabā Plain. The feature of puncture decoration on top of the ledge handle (near the join between the handle and the vessel body) may be reminiscent of decoration on ledge handles from Tall Umm Ḥammād (*e.g.*, Helms 1992: G66 fig. 237.6, G68 fig. 238.5-6, G69 fig. 238.9, all dated to the EB IA), but no exact parallels have yet been found. Lump handles are not well represented at Murayghāt with only a few occurrences, but parallels are present at Tall Umm Ḥammād, Jāwā, and the Jerash region (Helms 1991: 80–1 fig. 128.213, 1992: 90 fig. 239.10).

Early Bronze Age I Fabrics from Murayghāt

During the study of the EB I ceramics, seven different fabric types were established by macroscopic examination. In the majority of the fabrics, chert is the dominant inclusion type (fabrics I–IV).[10] Other fabric types also contain chert, but these are dominated by other inclusions such as chalk (fabric V), limestone (fabric VI), and grog (fabric VII). The ceramics are handmade and usually nicely smoothed on the exterior. Part of the material is slipped in slips closely matching the colour of the fabric (Table 4).

Fabric I

Fabric I is a heavily chert-tempered ware. The chert inclusions are very frequent and range from medium to large in size. Other inclusion types (such as basalt, chalk,

[9] With some possibility of the construction of 'Conder's Circle' and the founding of the Tall al-Jadidah North settlement site going back to the very LC (Mortensen *et al.* 2019: 89–90).

[10] Chert-tempered fabrics are also noted as typical of the EB I ceramics excavated at 'Conder's Circle' at Mount Nebo (Thuesen 2009: 607).

Table 3. EB I ledge and lump handle parallels.

Fig. 9	Description	Parallels
a.	Ledge Handle with Scalloped Decoration	Asqelon Afridar – Area M (Golani 2008: 34 fig. 9.15 and fig. 10.10) EB IA; Mount Nebo, "Conders Circle", MN1 (Thuesen 2009: 609 fig. 8.6; Mortensen et al. 2019: 101 fig.87.6) EB I.
b.	Ledge Handle with Incised Decoration and Punctate Decoration on Top of Handle	Zerqa Triangle, field 81 (Kaptijn 2009: 131–2 fig. 4.57.12, no. 81.9.1p19-2) EB IA. Punctate Decoration on Top of Handle: Tall Umm Ḥammād (Helms 1992: G66 fig. 237.6 and G68, fig. 238.5-6 and G69, fig. 238.9) EB IA.
c.	Ledge handle with Incised Decoration	Mount Nebo, Tell al-Jadidah North, MN354 (Mortensen et al. 2019: 109 fig. 96a/b), EB I; Mount Nebo, Tell al-Jadidah South, MN 401 (Mortensen et al. 2019: 112 fig. 99.d) EB I; Tall Umm Ḥammād (Helms 1992: 88 fig. 236.6-9, G64) EB IA/EB IB; Zerqa Triangle, Al-Rweihah (Kaptijn 2009: 150–1 fig. 4.77.1, no. s232.x.xp7) EB IA/EB IB.
d.	Lump Handle	Jawa (Helms 1991: 59–60 fig. 128.213, GB) EB IA; Tall Umm Ḥammād (Helms 1992: 90 fig. 239.10, G71).

Table 4. EB I fabrics from Murayghāt: inclusions and surface treatments. Features which occur occasionally: (+), (slip), (paint). Surface treatments: Sm.: Smoothing of the surface.

Fabric Type / Inclusion	Fabric	Fabric	Fabric	Fabric	Fabric	Fabric	Fabric
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
Inclusion							
Basalt	(+)				(+)		
Chaff		(+)	(+)				
Chalk	+	+	+			(+)	+
Chert	+	+	+	+	+	+	
Grog	+	+	+	+	+	(+)	+
Hematite					(+)		
Limestone	+	+	+	+	+	+	
Surface treatments	Sm.	Sm.	Sm.	Sm.	Sm.	Sm.	?
	-	(slip)	(paint)	-	(slip)	-	slip

grog, and limestone) are far less numerous and smaller in size. The clay of the fabric varies from orange to pink in colour. The vessels made in this fabric are handmade, generally well fired, and surfaces appear smoothed.

Fabric II

Fabric II is a moderately chert-tempered fabric, with frequent occurrences of chalk and sporadic occurrences of grog. The clay of the fabric ranges in colour between pale pink and a reddish yellow. The appearance of the fabric and the nature of inclusions range from fine to coarse. Vessels made of this fabric are hard, handmade, and well fired. The exterior surfaces are smoothed. A small number of the sherds have a light slip on the exterior surface in the colour range of very pale brown to pale yellow.

Fabric III

Fabric III is a moderately chert-tempered fabric. Other kinds of inclusions either occur rarely (chalk and limestone) or sporadically (grog). Chaff is rare and only present in a small part of the sherds. The fabric has a bright orange colour on the exterior surfaces. The interior colour varies from a light red to a pale yellowish pink. The fabric is well fired, very dense and hard. The exterior of the fabric is well smoothed. A small portion of the sherds have red paint on the exterior surface. Fabric II and III are closely related and are distinguished by the hardness and composition of the fabrics.

Fabric IV

The dominant inclusion in fabric IV consists of flakes of ground chert, while grog and limestone either occur regularly or frequently in sizes ranging from small to very large. Fabric IV is a coarse fabric with a light core colour and all sherds appear to have been slipped in a light slip on the exterior surface. The surfaces of the sherds range in colour from pink to very pale brown. The interior surfaces are either somewhat uneven or nicely smoothed. The composition of the fabric ranges from medium hardness and somewhat crumbly to dense and hard.

Fabric V

The visually dominant feature in the

fabric is white chalk inclusions, which stand out against the red colour of the clay matrix. However, the fabric also contains grog, limestone, and dark reddish brown to black mineral components, identified as small basalt or hematite grits. Fabric V is characterized by a bright light red to reddish yellow colour. The fabric is hard and dense in composition. Both the exterior and interior surfaces are well smoothed. A small portion of sherds have exterior surfaces with evidence of a lighter yellow colour, which is likely the remains of a slip.

Fabric VI

Fabric IV is characterised by limestone grits that are visually dominant in the fabric IV clay matrix, but the fabric also contains few inclusions of grog, chalk, and some ground chert. The fabric is generally hard and dense. Many of the sherds have fully reduced cores, but may also be reddish orange. The exterior sherd colour ranges from a reddish orange nuance to a very characteristic high red colour, and the exterior surfaces may also take on a completely greyish black to purple hue.

Fabric VII

Fabric VII is a light whitish to yellowish coloured fabric with some reddish beige to dull red rounded (grog) inclusions. Small white inclusions (chalk) are seen in a few places. The composition of clay is quite hard and dense, but has large pores and cracks on the interior surface. The exterior surface is heavily slipped in whitish shifting to a slight orange hue.

Conclusion

Murayghāt is at present considered to be a ceremonial site used during burials, but possibly also used for large ritual gatherings, on account of the dolmens, the standing stones, and the structures present on the central knoll of the site. Additional excavation and survey may further uncover the significance of the site in the EBA Mādabā Plain settlement landscape. The relatively simple vessel forms of the Murayghāt assemblage can be found in both Chalcolithic and EB I contexts, which complicates a precise dating of the ceramic assemblage. Some decoration techniques and styles present in the assemblage (*i.e.*, splash and drip decoration, pie-crust decoration, and punctate decoration) dates from the LC to the EB IA, while others (*i.e.*, finger impressed decoration) dates from the LC to the EB IB. Additionally, line-group painted decoration dates from the LC to the EB IB. Combined, the presence of the different decoration types reviewed above are interpreted as indicating a predominantly EB IA assemblage. Another strong indication of the dating of the Murayghāt assemblage to the EB IA is the absence of any of the characteristic Tall Umm Ḥammād stage 3 (EB IB) ware. The ceramics have to be analysed further to more accurately determine the dating of the assemblage, but as of now, the ceramic assemblage points to the site of Murayghat beinsg used, possibly to some extent in the LC, but more extensively in the EB IA.[11] The reason for the presence of the different types of decorations in the assemblage, especially related to holemouth jars, has not yet been determined. The vessels could be imported, showing ties towards the west and north (*e.g.*, pie crust and splash and drip decoration). Alternatively, the vessels may also have been produced locally either at or in the vicinity of Murayghāt. But since the general EB I assemblage at the Mādabā Plain is not well known, it is at present difficult to answer such questions. Hopefully, further analysis of the Murayghāt assemblage will answer questions about the EB I ceramic tradition at the Mādabā Plain.

[11] The excavations have also uncovered a MB IIA settlement component, which will be published elsewhere.

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New Insights about the Early Bronze Age Sequence at Khirbat Iskandar: The 2016 Excavations

Introduction

Khirbat Iskandar (Fig. 1) is a major Early Bronze Age site in central Jordan. The site is known particularly for the settlement of the non-urban Early Bronze IV period (now dated *ca.* 2500–1950/1920 BC), because of a multi-phase stratum that showed rural complexity and continuity of urban-like traditions during this non-urban period (Richard and Long 2007a, 2007b, 2009; Richard 2016: 595, 2020). However, evidence for a substantial occupation during Early Bronze III (2850–1950/1920 BC) was uncovered over several seasons of excavations suggesting that Khirbat Iskandar may be paradigmatic for the urban period in the region too (Richard and Boraas 1984: 76–9; Richard and Long 2007a: 73, 2007b: 275; Richard 2016; Richard and D'Andrea 2016; Richard *et al.* 2016: 450–2; Richard *et al.* 2018, 603–4; Richard *et al.* 2018). In particular, the most recent excavations have thrown new light on the urban stage at Khirbat Iskandar, through the investigation of a long sequence of occupation in the urban Early Bronze II–III periods (now dated to *ca.* 3000–2500 BC; see Regev *et al.* 2012: 558–62).

The 2016 excavations were crucial for a better understanding of the Early Bronze Age sequence at Khirbat Iskandar. Building on previous reports, this paper presents a short overview of the site and a summary of the discoveries of past excavations in order to outline the site's periodization and history. This will provide a background to present and contextualize a summary of the results of the 2016 excavations. This way, it will be possible to illustrate how the new data improved our understanding of the Early Bronze Age sequence of Khirbat Iskandar, but also raised new questions on the site's developmental trajectory that define next steps for our continuing research at the site.

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Amman: Department of Antiquities, 2022

1. Aerial view of Khirbat Iskandar and the surrounding landscape, looking west (photo courtesy APAAME: APAAME_20141013_REB-0157, photographer Robert E. Bewley).

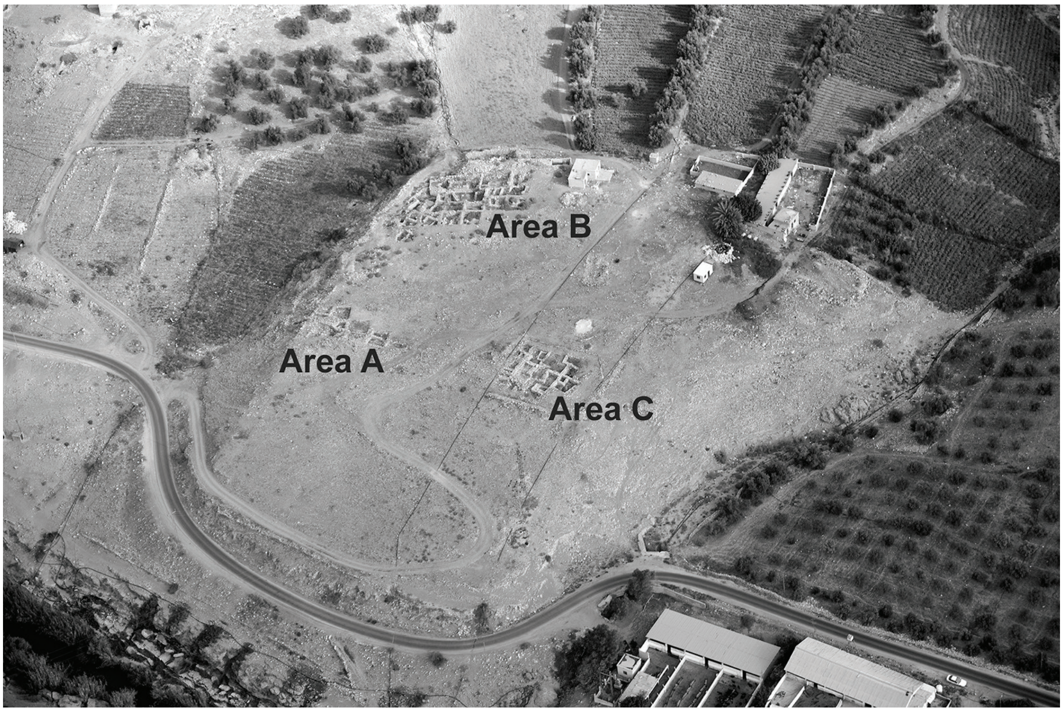
Archaeological Investigations at the Site and its Surroundings

Khirbat Iskandar is a 2.7 ha site located in central Jordan, at the south edge of the Madaba Plains, close to the King's Highway, and lies on the north bank of the Wādī al-Wālah (Fig. 1). Several investigative surveys around Khirbat Iskandar (Glueck 1939: 123–8; Richard 2009, 2017) revealed a ceremonial landscape surrounding the settlement including four Early Bronze IV cemeteries (except for one Early Bronze I tomb) and Early Bronze Age megalithic structures, stone circles, and a "high place".

The Archaeological Expedition to Khirbat Iskandar and its Environs began in 1981 and, until 2016, accomplished twelve major excavation seasons and three seasons of restoration (Richard 1982, 1983, 1986, 1988, 1989, 1990, 2009, 2013, 2016; Richard and Boraas 1984, 1988; Richard and Long 1995, 2005, 2007a, 2007b, 2009; Richard *et al.* 2010, 2016, 2018). The exploration of the *tall* concentrated in three areas: Area A at the southwest corner, Area B, at the northwest corner, and Area C at the southeast corner of the mound (Fig. 2), among which Area B and Area C are currently the main focus of attention. The Area C Early Bronze IV settlements and the cemeteries were published in the first volume of the Khirbat Iskandar Excavations Series (Richard *et al.* 2010), and the second volume dedicated to the Early Bronze IV settlements in Area B is in preparation (Richard forthcoming). Moreover, the excavations over several seasons have revealed an earlier substantial Early Bronze Age urban settlement in Area B with multiple phases of occupation and expansion of the fortifications.

Khirbat Iskandar: The Phasing

The occupational sequence of the site has thus far been reconstructed thanks to the stratigraphic sequences in Area B and Area C. The following paragraph provides



2. Aerial view of Khirbat Iskandar looking northwest (photo courtesy APAAME: APAAME_20141013_REB-0162, photographer Robert E. Bewley, edited by Marta D'Andrea for this article).

an overview of the phasing for the Early Bronze Age sequence at Khirbat Iskandar building on previous publications and the latest discoveries (Richard and Long 2005; Richard 2016; Richard *et al.* 2016, 2018).

Three Early Bronze Age strata have been identified at Khirbat Iskandar so far. From the latest/upper to the earliest/lower, they are: Stratum I, which is Early Bronze IV (Phases 3–1 in Area C and Phases A–B in Area B); Stratum II, which is Early Bronze III (Phase C, with sub-phases, in Area B); and Stratum III (Phase D in Area B), which might be late Early Bronze II (see below).

Phase D has thus far been identified only in Area B and is represented by the earlier fortifications found previously: two curvilinear "towers" (W. B2A077 and W. B2108) and an inner fortification line made of mudbricks on stone foundations (W. B5A043; Richard and Long 2005: 270 fig. 9; Richard *et al.* 2016: 550–2 figs. 4, 6–8; Richard 2016: 589–91 figs. 3–5; here Fig. 3). In addition, evidence of the earlier settlement phases came to light in 2013. A 1.0 m high stone structure with multiple surfaces was found to run under the Phase C bastion/platform and whose foundation would seem to predate Phase D as well (Richard *et al.* 2016: 455–6 fig. 14; here Fig. 4). The pottery associated with it was not very distinctive, so it is wiser, for now, to ascribe it generally to Early Bronze II–III.

The following Phase C settlement comprises a lower Phase C2 foundation level, and an upper Phase C1 destruction level uncovered previously (Richard and Long 2005, 270–3; 2007a: 73; Richard *et al.* 2016: 450–2, 454–5; 2018: 602–4; here Fig. 5). The Phase C stratum also comprises the outer walls excavated earlier (Richard 2016), including multi-phase segmented fortifications, and now better known thanks to the 2016 excavations on


a

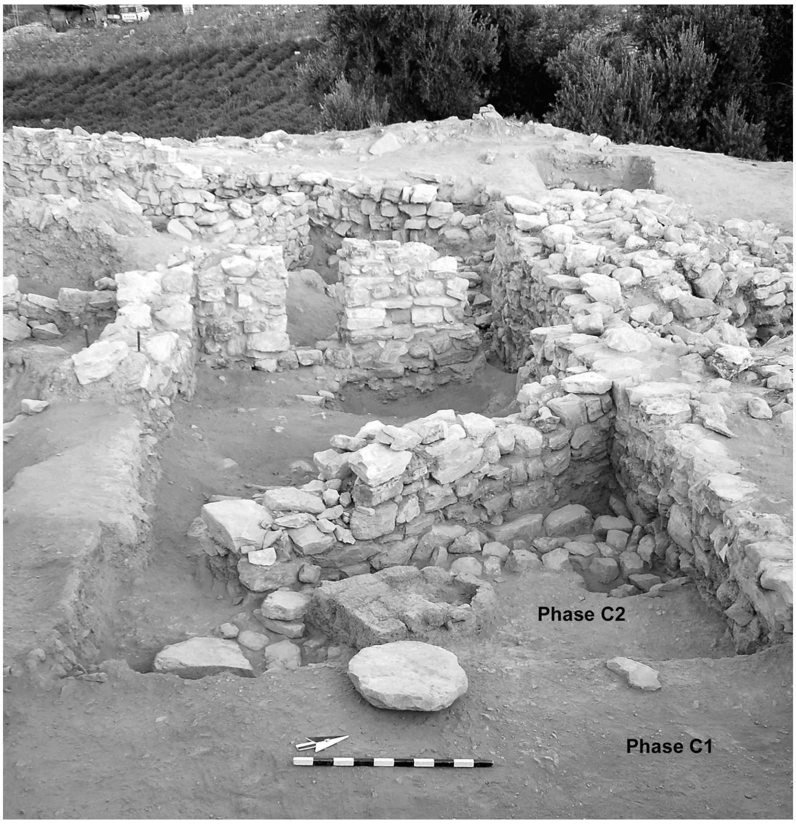

b


c


d

3. Khirbat Iskandar, Area B: Phase D circular towers; a) North tower W. B2A077, looking north; b) North tower B2A077 with western extension uncovered in 2013, overrun by the "Rubble Wall", from the top, looking northwest; c) View of south tower B2108 connecting with pier, from the top, looking southeast; d) The passageway in between the circular tower B2A077 and B2108, looking east (© Khirbat Iskandar Expedition).

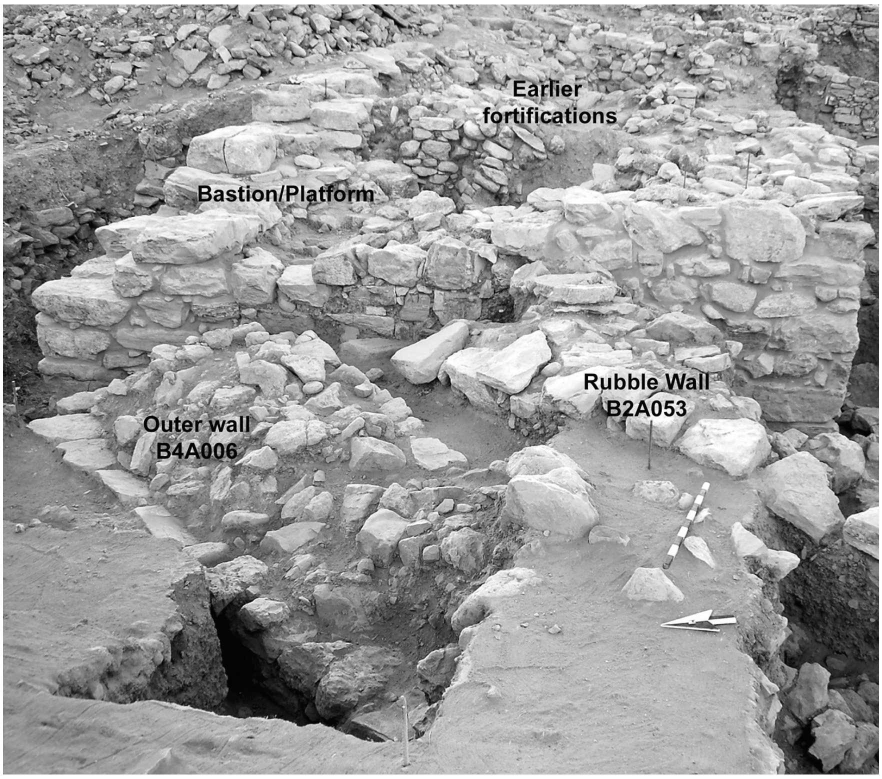
4. Khirbat Iskandar, Area B: the Phase D structure partially uncovered below the Phase C2 settlement before the excavation, June 2013, looking north (© Khirbat Iskandar Expedition).



5. Khirbat Iskandar, Area B: remains of the Early Bronze III stratum: Phase C1 destruction level in the foreground, Phase C2 foundation level with horseshoe-shaped hearth uncovered in 2016 in the background, looking west; the bastion/platform is visible to the north, on the right side (© Khirbat Iskandar Expedition).

the western perimeter of the site (Richard *et al.* 2018: 603–4). In this sector, two parallel fortification lines run from southwest to northeast along the western perimeter of the mound, both connecting with an imposing bastion/platform to the northeast: an outer, western and narrower wall, W. B2A120/ B4A006, uncovered in 2013 and considered earlier, and an inner, eastern, larger, and coarser wall, W. B2A053, called the "Rubble Wall" for its construction technique, uncovered previously, and considered later than the outer wall discovered recently (Richard 2016: 589 fig. 3, 591-592 fig. 6; Richard *et al.* 2016: 450–1 figs. 6, 8, 2018: 602, 604; here Fig. 6).

Although a palace has not thus far been uncovered at Khirbat Iskandar, the available evidence in Area B suggests that the Phase C1 exposure over a number of rooms and courtyards (Richard and Long 2005: 272–3; Richard *et al.* 2016: 452) might be part of a non-residential complex or a public area. This is hinted at also by the wealth of goods found in these rooms, including weights and a macehead (Richard and Long 2005: 275; Richard 2016: 591–3), and the concentration of limestone, basalt, and ceramic *tournettes* (Richard and Long 2005: 272–3) that may suggest the presence of a pottery workshop attached to this public area (D'Andrea 2021: 31–32 fig. 3.1). Comparative evidence of pottery production associated with a non-residential building in Early Bronze III has been uncovered at Khirbat al-Batrāwī in Transjordan (Nigro 2010: 70, 74, 108–9;



6. Khirbat Iskandar, Area B: the fortification on the north-western perimeter of the site; the new western wall line uncovered in 2013, Wall B4A006, is in the foreground, with the Rubble Wall B2A053 behind it; the Phase C bastion/platform is visible to the north, embedding previous Phase D fortifications (© Khirbat Iskandar Expedition).

Fiaccavento 2013) and Khirbat al-Yarmūk in Cisjordan (Roux and de Miroschedji 2009: 155–9, 171). Paired with substantial construction and expansion of the fortifications, these data document the urban nature of the Early Bronze III settlement at Khirbat Iskandar.[1]

Phase C1 in Area B ended in a violent conflagration, and a considerable quantity of complete or restorable vessels (Richard and Long 2007a: 73 fig. 2; here Fig. 7), including large *pithoi* and a number of jars, were found in the destruction layer along with the materials listed above. Interestingly, the Phase C1 pottery does not seem ascribable to a late or final Early Bronze III phase, but, rather, to an Early Bronze III stage within Early Bronze IIIA (now dated to *ca.* 2850–2700 BC after the ARCANE project chronology).[2] This observation is consistent with the available absolute dates for the Phase C1 destruction layer, placed by radiocarbon determinations in the interval between 2900/2850 to 2650/2600 cal BC that corresponds to Early Bronze IIIA according to both traditional and revised higher absolute chronologies for the southern Levantine Early Bronze Age.

In Area B, the Early Bronze IV stratum comprises two phases thus far identified (Richard and Long 2007a: 77–9, 2007b:

[1] On the debate of Early Bronze Age urbanism in Transjordan, see Richard 2014 and D'Andrea 2021, reviewing alternative theoretical models with relative bibliography.

[2] See the periodization table on the project's website: https://www.arcane.uni-tuebingen.de/EA-EM-EL_phasing_v5-4-6.pdf

7. Khirbat Iskandar, Area B: selected pottery from the Phase C1 destruction level, Early Bronze IIIA (© Khirbat Iskandar Expedition).

273–4, 2009: 95–9). The lower Phase B includes re-use and probable rebuild of the fortifications, a public building/storeroom, stone-hewn bins, and much restorable and whole pottery found in the roof collapse, probably due to an earthquake. In terms of pottery types and styles, the Phase B pottery is not ascribable to an initial Early Bronze IV phase comparable to the one identified in Area C (see discussion in D'Andrea 2016), but to a more developed one (Fig. 8). The following, upper Phase A settlement is an Early Bronze IV village occupation with multi-roomed houses, not too much different, ceramically, from Phase B (D'Andrea 2014: II 150–1), although quantitative analysis by Holdorf found statistically relevant late forms in this layer along with numerous other characteristics of statistical significance, which clearly distinguished two chronological and typological ceramic phases. This last Early Bronze IV phase seemingly ended with abandonment and door blockages.

In Area C, a longer, three-phase Early Bronze IV stratigraphic sequence was excavated previously, is already published in a final report (Long 2010; Richard 2010), and was further investigated in 2016 (Richard *et al.* 2018: 598–602). This sequence documents the passage from a domestic neighbourhood in Phase 1 and in Phase 2 (in the latter phase associated with a lithic workshop) to a non-residential complex in Phase 3, interpreted as a "Gateway", with two sub-phases, 3A and 3B (Long 2010; for the gateway, see Richard and Long 2010: 274–5).

8. Khirbat Iskandar, Phase B whole and restored vessels uncovered in Square 21 in 2013, Early Bronze IV (© Khirbat Iskandar Expedition).

The multi-phase Early Bronze IV sequences excavated at Khirbat Iskandar revolutionized traditional interpretations of this non-urban period as a nomadic interlude in the southern Levant as a whole (*e.g.*, Dever 1980, 1992, 1995, 2003; Prag 1974, 1985, 2009, 2011, 2014; Bunimovitz and Greenberg 2004; and more recently, Greenberg 2017; Schloen 2017; and see overviews of Early Bronze IV studies in Long 2003; Palumbo 2008; D'Andrea 2014; Cohen 2018), showing continuous sedentary occupation and social complexity (Richard 2003: 295–6, 2006, 2016, 2020; Richard and Long 2007a, 2007b, 2009).

Summary of the Results of the 2016 Excavations

Moving from the historical and archaeological backgrounds delineated above, the 2016 four-week season focused on four major objectives. They were: 1) to expose more of the Early Bronze III settlement, 2) to further investigate the fortifications on the western perimeter, 3) to clarify their use/reuse or rebuild in Early Bronze IV, and 4) to test the 3-phase Early Bronze IV stratigraphy in Area C.

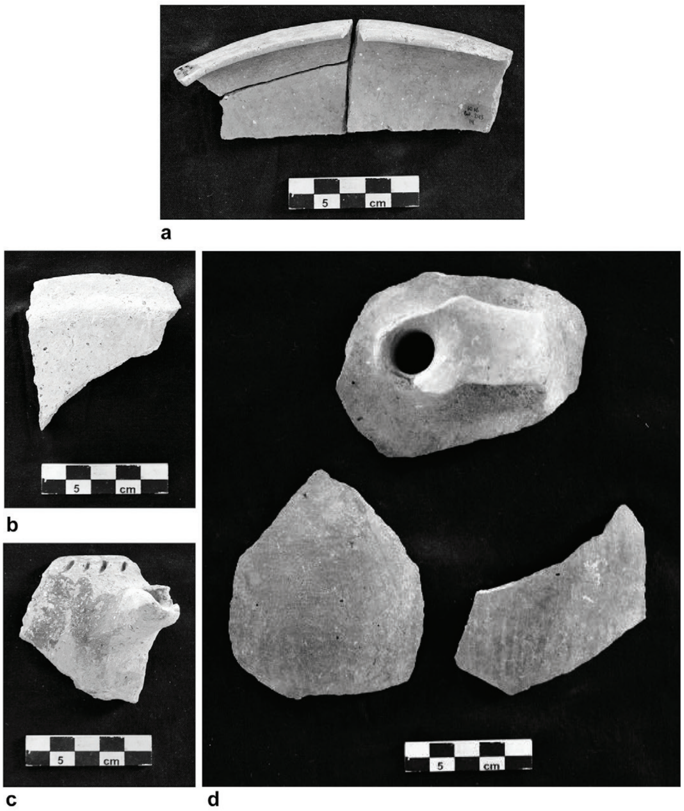
Area B

In Area B, to expose more of the Early Bronze III (Phase C) settlement (Objective #1), we reopened Square B1 at the northwest corner in Area B. As we saw before, only the western half of the square had been excavated down to earlier levels in 2013 (Richard *et al.* 2016: 455–6). In 2016, we excavated only the eastern half of the square, which remained still at the upper Phase C1 level, and expanded the lateral exposure of the Phase C2 remains (Richard *et al.* 2018: 603). Under the last Early Bronze III settlement phase (Phase C1) and immediately above the presumed interior of the earlier Early Bronze III domestic structure discovered to the west in 2013, we uncovered a mudbrick platform and a horseshoe-shaped *tabun* situated on a well-made surface (Fig. 9). The pottery collected from the *tabun* and the associated surface (Fig. 10) dates to either the very beginning of Early Bronze III or the Early Bronze II/

9. Khirbat Iskandar, Area B: Phase C2 mudbrick horseshoe-shaped hearth with platform uncovered in 2016, looking southeast (© Khirbat Iskandar Expedition).

III cusp, as is suggested, in particular, by the shape of the carinated platter bowls (Fig. 10:a–b). This datum may fit well the observation that Phase C2 is earlier than Phase C1, which falls in the interval between *ca.* 2900 and *ca.* 2700 cal BC.

To further investigate the new Early Bronze III fortification discovered in 2013 (W. B4A006) on the western perimeter (Objective #2), we reopened Square B4A in Area B at the northwest corner of the mound. In a probe against the exterior of the fortification to investigate possible surfaces, a foundation trench, and the foundation of the wall, the remnants of a stone structure (W. 4A024) were uncovered lying on a mudbrick layer (Fig. 11). The confined space makes interpretation difficult, but it is plausible that it may have been a revetment or even the badly preserved remains of W. B2A077, a curvilinear "tower" discovered on the interior of fortification W. B4A006 in 2010 and 2013. This curvilinear structure of stone and mudbrick is considered Phase D in the overall phasing of the fortifications in Area B (and see further below on phasing). By end of the season, work reached the bottom of W. B4A006, illuminating its



10. Khirbat Iskandar, Area B: selected pottery from the Phase C2 occupation level, very early Early Bronze IIIA or Early Bronze II/III cusp: a) Carinated platter with outer red-slip; b) Carinated platter with inturned rim, with inner and outer red slip and inner vertical burnish; c) Fragment of spouted holemouth bowl with dark paint and incised slashes; d) Red-slipped and burnished jug (© Khirbat Iskandar Expedition).

height at 1.75 m and its width at 2.0 m, thus reflecting the base of a substantial earlier western perimeter fortification in Phase C (Richard *et al.* 2018: 603–4; here Fig. 12). As mentioned above (and shown in Fig. 6), this trace wall runs outside and parallel to the "Rubble Wall" (W. B2A053) whose foundation level is higher than the top of W. B4A006. A further short stretch of the "Rubble Wall" appears in the probe opened in Square B5A/B where it partially overlies a substantial segment of an earlier wall, although it will be for the next season of excavations to clarify the nature and chronology of the latter structure, running parallel to the "Rubble Wall" in this sector of Area B.

The "Rubble Wall" B2A053 is key for understanding reuse and rebuild of the fortifications in Early Bronze IV, because of its relationships with the structures dating from this period: a late Early Bronze IV Phase A runs up to it, and earlier Phase B intersects it, as it is visible in Square B 19A (Fig. 13). Therefore, to further investigate the use/reuse of the Early Bronze III fortifications in Early Bronze IV (Objective #3), we opened Square B21A at the southwest edge of Area B where we encountered again the top of the "Rubble Wall" (Fig. 14). The season ended before we could clarify the relationship between the fortification line and Early Bronze IV Phase B, but it was clear that Early Bronze IV Phase A domestic structures were built against the "Rubble Wall".

Summing up, the 2016 excavations in Area B allowed us to establish definitively that the construction history of the fortifications has three phases. An earlier phase is represented by the circular towers ascribed to Phase D and tentatively dated to Early Bronze II/III. An intermediate phase is represented by the first western wall, W. B4A006, dating to Early Bronze III, and connected to the bastion/platform. A third phase is represented by later "Rubble Wall" B2A053, also connected to the bastion/platform, and possibly appears to date to

11. Khirbat Iskandar, Area B: remnants of earlier stone structure (W. 4A024) on the exterior of the Phase C fortification wall B4006, looking northeast (© Khirbat Iskandar Expedition).

12. Khirbat Iskandar, Area B: the new segment of Phase C outer fortification line W. B4A006 uncovered in the probe excavated in 2016 down to the bottom of the wall in Square B4, looking southeast (© Khirbat Iskandar Expedition).

13. Khirbat Iskandar, Area B: Phase B Early Bronze IV wall continuing to/intersecting with the "Rubble Wall" in Square B19A, looking northwest (© Khirbat Iskandar Expedition).

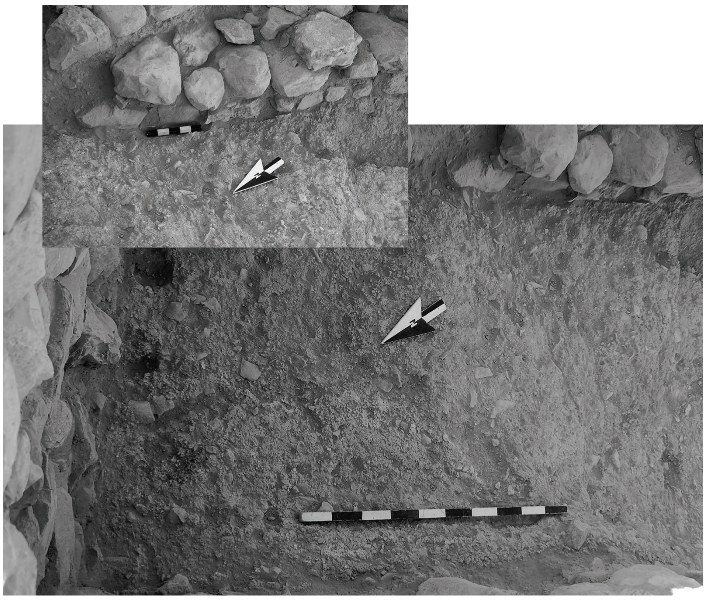
14. Khirbat Iskandar, Area B: general view of Square B21 at the end of the 2016 season, looking east; the top of the "Rubble Wall" emerging is visible in the southwest corner of the square (© Khirbat Iskandar Expedition).

the late Early Bronze III/IV periods (see Fig. 5). Thus, the 2016 excavations also confirmed that the latest Early Bronze III fortification wall was reused during Early Bronze IV, as proposed earlier (Richard 2016: 595). In this sector, no archaic or initial Early Bronze IV phase comparable to that uncovered in Area C (see below) has been identified thus far, and this will be one of the objectives of the next excavations at Khirbat Iskandar.

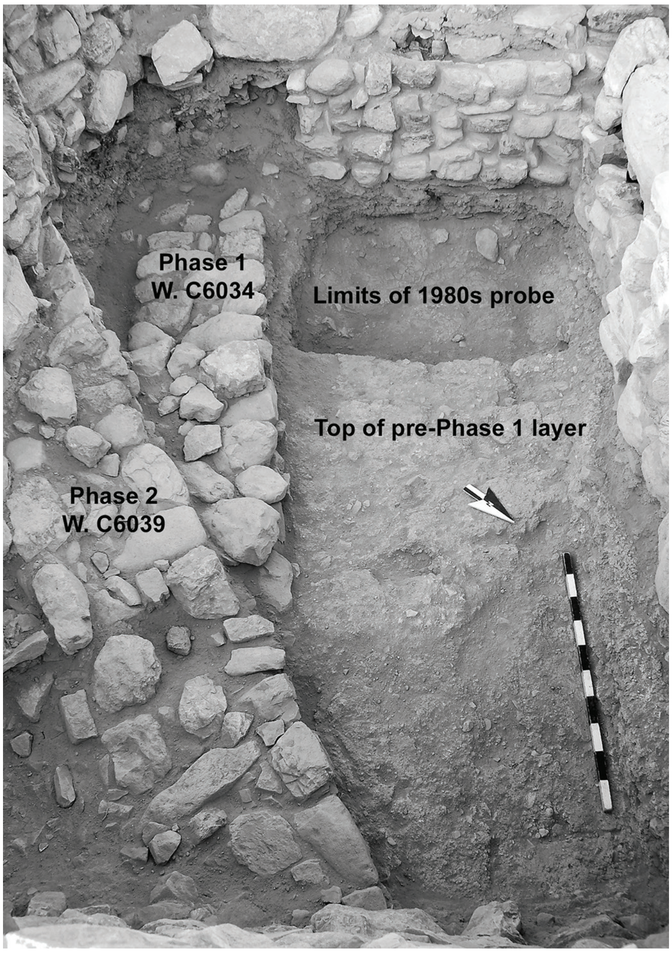
Area C

In 2016, we decided to return to Area C on the southeast corner of the mound to test the three-phase Early Bronze IV stratigraphy (Phases 1–3; Objective #4) articulated in Volume 1 (Long 2010). This sequence includes an earlier stage—Phase 1—that, based on the pottery assemblages collected, might be either an initial Early Bronze IV phase or a transitional Early Bronze III/IV phase (Long 2010: 63; Richard 2010: 105 fig. 4.5; Richard and Long 2010: 272–3; Richard *et al.* 2016: 598; see D'Andrea 2014: I 73–4 fig. 3.14 pl. III, 2016: 537, 339, 542 fig. 5). To preserve the Gateway, excavation concentrated on Squares C8 and C6 on the east. We decided to re-open Square C6 that had been excavated down to Phase 1 and, therefore, offered the possibility to collect more materials for better defining this stage, and to excavate the eastern half of Square C8 that had not been excavated earlier. Work in C8 concentrated on Phases 2 and 3.

Phase 1 is represented by evidence of domestic occupation. In Square C6, we removed the Phase 1 surface, belonging to a room identified previously and consisting of a fine plastered surface associated with a stone wall oriented south-north (Fig. 15). We thus noticed that the Phase 1 surface and wall in Square C6 are laid on top of a layer of mudbrick that might belong to a phase of occupation preceding the earliest Early Bronze IV Phase 1, but the end of season



15. Khirbat Iskandar, Area C: Phase 1 architecture in Square C6, with close-up of the plaster surface with the associated stone wall W. C6034 in Square C6, looking southeast; note the surface tying up to the wall; Early Bronze IV (© Khirbat Iskandar Expedition).



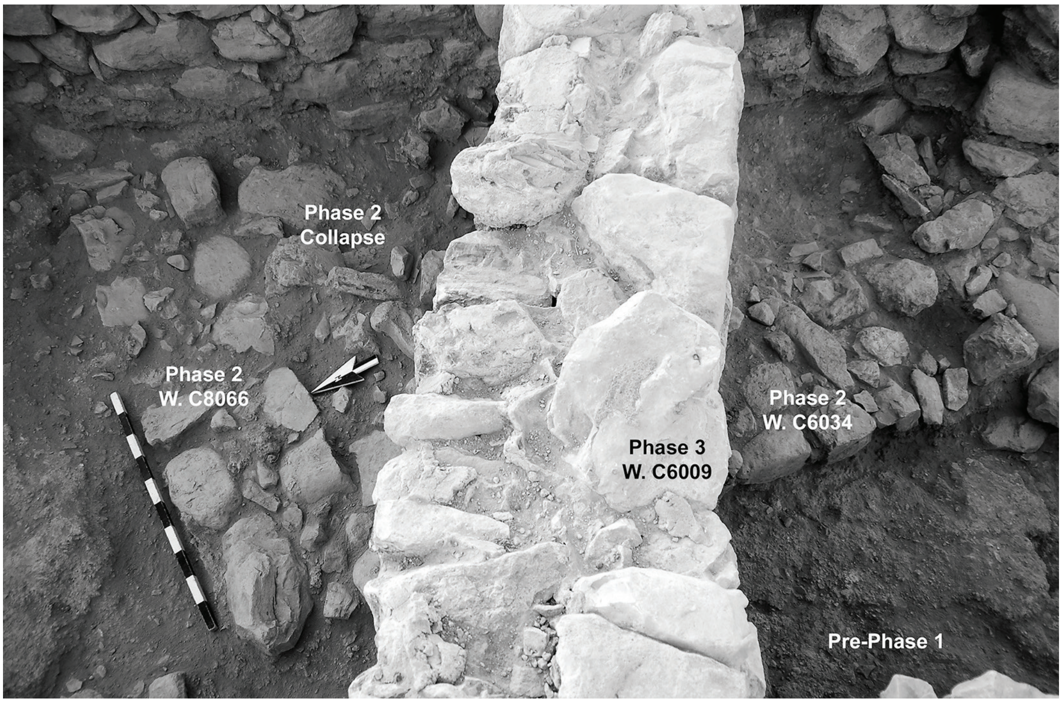
16. Khirbat Iskandar, Area C: Early Bronze IV Phase 1 and Phase 2 walls and top of pre-Phase 1 mudbricks in Square C6, looking south-west, at end of the season in the square (© Khirbat Iskandar Expedition).

prevented us from excavating this layer (Fig. 16). Re-analysing the final photos of Square C6 during the post-season processing and study of the excavation record, we identified possible wall lines, to further articulate and excavate in 2019 (Figs. 17–18). In fact, to investigate and understand the nature and chronology of these pre-Phase 1 remains will be one of the objectives of future excavations in this area of the *tall*.

Although the Phase 1 lateral exposure is limited in Square C6 thus far, the presence of a fine, thick plastered surface, paired with contemporary substantial stone walls, suggests the non-ephemeral and permanent nature of the early Early Bronze IV settlement. Remarkably, this situation is different from that identified for initial Early Bronze IV at sites located in other areas (see D'Andrea 2014: I 270–2, 2015: 32–3), like Khirbat al-Karak (Greenberg and Eisenberg 2006: 156–7 figs. 5.96–213), Tall Umm Ḥammād (Helms 1986: 42–8 figs. 17:1–3, 9, 18:1–3, 19:1), and Tall as-Sulṭān, ancient Jericho (Nigro 2003, 133–4), and may confirm the hypothesis that Khirbat Iskandar more than other sites preserved Early Bronze III traits during the non-urban Early Bronze IV period (Richard and Long 2007a: 73, 2007b, 2009).

The removal of the Phase 1 surface in Square C6 allowed us to collect more Phase 1 pottery that was crucial to further investigate the question of a possible "transitional Early Bronze III/IV" nature of the assemblage. The ceramic assemblages from this phase

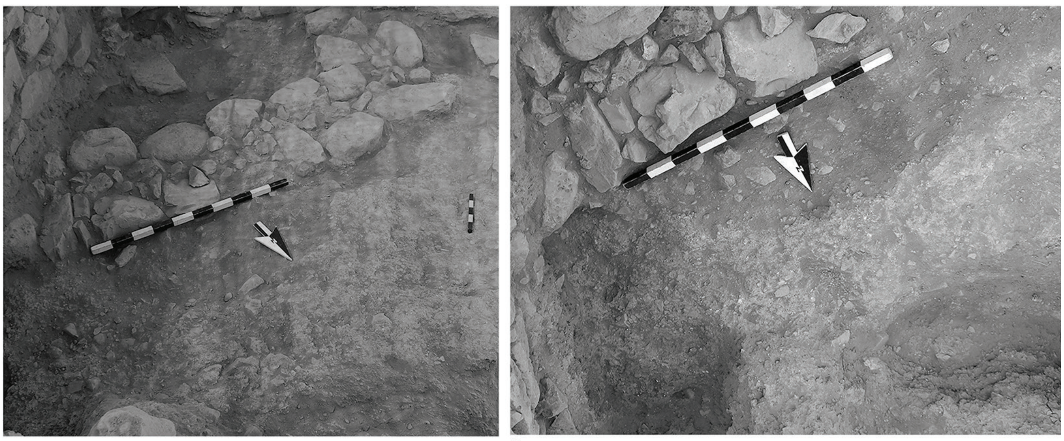
17. Khirbat Iskandar, Area C: pottery collected in Square C6 from the removal of the Phase 1 surface, early Early Bronze IV (© Khirbat Iskandar Expedition).



18. Khirbat Iskandar, Area C: Phase 2 room in Squares C6 and C8; pre-EB IV wall lines visible in the bottom right corner of the photo, indicating possible pre-Phase 1 structures; limits of 1980s probes in the foreground, Phase C3 wall C6009 running east-west in the centre, Phase 2 architecture (© Khirbat Iskandar Expedition).

are scanty due to continuous clearing and rebuilding operations from one phase to the next; however, the Phase 1 pottery collected in 2016 (FIG. 17) confirmed the impression gained from past excavations that it blends Early Bronze III and Early Bronze IV typological, stylistic and technological features (Long 2010: 63; Richard 2010: 105 fig. 4.5; Richard and Long 2010: 272–3; see also D'Andrea 2016: 539, 544–5). The Phase 1 assemblage seems to blend coarser, handmade vessels reminiscent of the Early Bronze III tradition and finer, red-slipped and burnished bowls that anticipate some developments of the following Phase 2 Early Bronze IV tradition (D'Andrea 2014: I 133, 2016: 54[5], 2019: 66–7). Red-slipped and burnished bowls comparable to our Phase 1 vessels from Khirbat Iskandar were found also at Khirbat al-Munsahilāt in the Karak plateau (Chesson *et al.* 2005: fig. 26:c, e), which have been described, too, as either very early Early Bronze IV or transitional Early Bronze III/IV materials (Chesson *et al.* 2005: 47). As noticed in previous works (D'Andrea 2012: 20, 44, 2020), this comparative evidence supports the previous hypothesis of stronger Early Bronze III–IV continuity in central Jordan than elsewhere in the southern Levant (see already Dever 1973, 1980: 48; Richard 1980: 19, 21). It also suggests that this area of Jordan was characterized by a regional ceramic development during Early Bronze IV (D'Andrea 2012: 42–44 figs. 15–16, 2019: 66–7), for which it is worth recalling that substantial parallels between the pottery assemblages of Khirbat Iskandar and Bāb adh-Dhirāʿ had been noticed already (Holdorf 2010; Richard 2013; see also D'Andrea 2012: 42–4 figs. 15–16).

In 2016, we clarified the nature of the Phase 2 remains in this sector, where it had been hypothesized previously that W. C6039 was a curvilinear wall enclosing an open area with installations devoted to flint-knapping situated on a plastered surface (Long 2010: 40 fig. 3.6, 65). We also uncovered the extension of Wall C6039 in Square C8 (W. C8061) and a perpendicular wall connecting to it to the east (C8066), showing that, instead, it was part of a room, a corner of which was uncovered (FIG. 18). Two subsequent surfaces were associated with this building on the exterior (FIG. 19): a lower, earlier, thick plastered surface



a b

19. Khirbat Iskandar, Area C: Phase 2 outer surfaces in Square C8; a) Earlier, thick plastered surface with preparation of pebbles and flint cherts (C8071); b) Upper, later, fine beaten earth surface with flat-lying pottery (C8068), looking southwest (© Khirbat Iskandar Expedition).

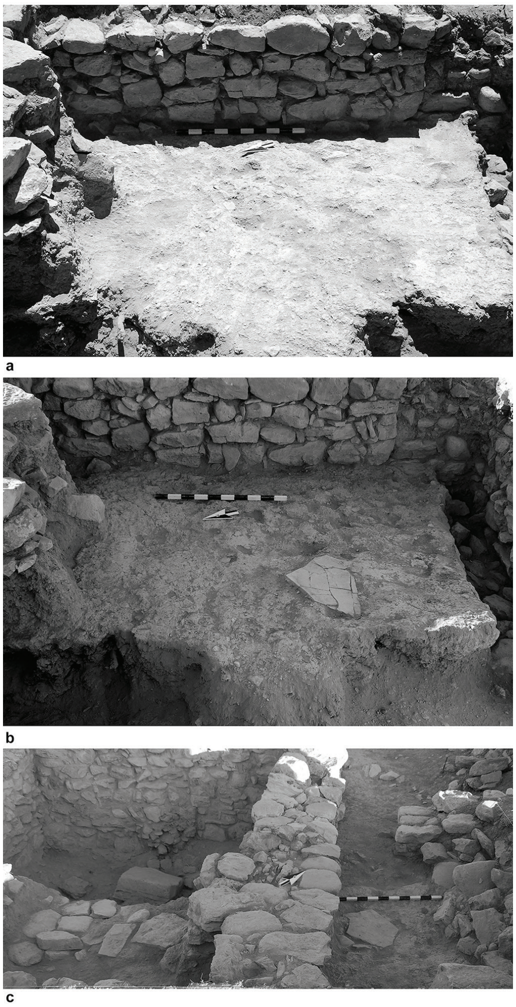
20. Khirbat Iskandar, Area C, Square C8 east balk: Phase 3A wall C8047 in the background, built on top of the razed remains of the Phase 2 architecture and collapse, looking east (© Khirbat Iskandar Expedition).

with preparation of pebbles and flint cherts (C8071; Fig. 19:a) and an upper, later, fine beaten earth surface with flat-lying pottery (C8068; Fig. 19:b), which equal the occupational surfaces connected with the installations uncovered previously in Square C6 and connected with flint-knapping (Long 2010: 40 fig. 3.6, 46–7). This shows that this activity took place in an open area. The Phase 2 room was filled with a layer of collapsed stones (shown in Fig. 18), which we tentatively connected with the event that caused roof collapse at the end of Phase B in Area B.

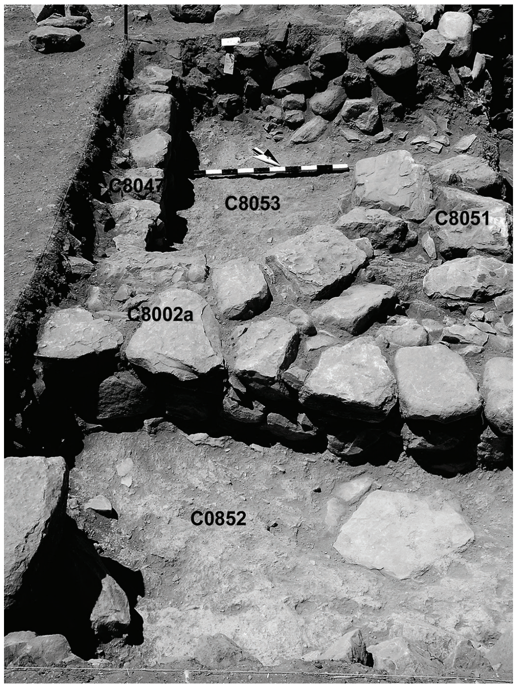
In Phase 3, Area C saw major transformations due to the construction of the "Gateway" on top of the remains of the residential neighborhood of Phases 1–2. The 2016 excavations allowed us to revise the plan of the Phase 3 remains in Square C8 delineated previously.

At the beginning of Phase 3, in the earliest sub-phase, Phase 3A, Wall C8047 (thus far identified only in the section, with two rebuilds) was built on top of the razed remains of the Phase 2 room and its collapse (Fig. 20), which were also covered with a thick reddish-yellow clayish fill. This fill was laid against the Phase 2 structures and above the debris and levelled as a makeup for the Phase 3A structures and surfaces. Two successive hard-packed beaten earth surfaces (C8060 and C8057) are associated with the first Phase 3A use (Fig. 21:a–b). The last Phase 3A surface connected with this wall is a beaten earth surface (C8056) associated with a cobbled platform (C8055) that likely extended also in the northeast sector of the square (Fig. 21:c). Still in Phase 3A, those layers were cut, at the southern edge, by the foundation trench (C8058) of a major wall running east-west (C6009), which would remain in use until the end of Early Bronze IV.

In the second Phase 3 sub-phase, Phase 3B, other modifications of the area took place. A thick fill (C8054) was laid above the last Phase 3A surface in Square C8 as makeup for the Phase 3B structures above it. In 2016, we clarified that a line of stones

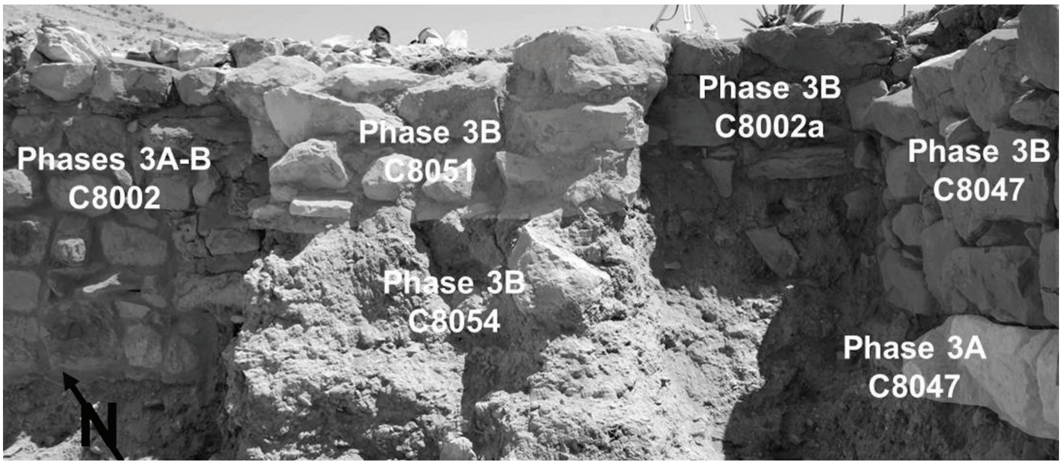


21. Khirbat Iskandar, Area C: Phase 3A sequence of surface used with the first phase of Wall C8047 (in the background in the first two photos): a, b) Two successive hard-packed beaten earth surfaces (C8060 and C8057), looking east; c) Last Phase 3A surface connected with this wall is a beaten earth surface (C8056) associated with a cobbled platform (C8055) on the left, and Phase 3B east-west wall C8002a and plaster surface C8052 on the right, looking west (© Khirbat Iskandar Expedition).



22. Khirbat Iskandar, Area C: Phase 3B semi-circular wall C8051 connected to the east extension of Wall C8002 (Wall C8002a), running east-west and the associated thick yellowish-gray plaster surfaces (C8052 and C8053) to the north and south of the wall, looking south (© Khirbat Iskandar Expedition).

identified in the past as north-south wall C8024 was, instead, the bottom of a layer of stones collapsed from Phase 3B semi-circular wall C8051, which was already visible in the eroded east balk in the past (Long 2010: 61–62 fig. 3.53) and was brought to light in 2016 (Fig. 22). Semi-circular wall C8051 is connected to the east extension of Wall C8002 (Wall C8002a), running east-west, that was clearly added to the western stretch only in Phase 3B (Figs. 22–23). The rebuild of Wall C8047 also belongs to this phase, when the upper three courses were added, forming a doorjamb for a threshold at the wall's south edge—later blocked, as visible in the section (Fig. 20). North and south of wall C8002a, the Phase 3B thick yellowish-gray plaster surfaces (C8052 and C8053) were identified (Fig. 23). This was the last phase of use of the area, after which the site was deserted. In fact, the Phase 3B rooms



23. Khirbat Iskandar, Area C, Square C8: sequence of phase 3A–B architecture, looking north (© Khirbat Iskandar Expedition).

to the north and south of wall C8002a, identified in 2016, were found virtually empty, except for a few sherds found among the debris and collapsed stones, as if the rooms had been cleared purposely.

This datum is consistent with the observation of door blockages not only in Area C but also in several sectors of Area B that might have no structural function, but, rather, be related to the abandonment of the site as a planned, collective decision taken by the Early Bronze IV inhabitants. This event might be correlated to progressive *wadi* incision and lateral erosion that towards the Early Bronze IV/Middle Bronze I transition brought the destruction of the floodplain, as determined by Cordova's geoarchaeological survey of the Wādī al-Wālah (Cordova 2008: 448–52; Cordova and Long 2010: 34–5).

Summing up, the 2016 excavations allowed us to check the three-phase Early Bronze IV stratigraphy in Area C. In the first place, we confirmed that, at Khirbat Iskandar, the Early Bronze IV occupation was well planned and permanent already in the initial Early Bronze IV phase, as demonstrated by the substantial nature of the Phase 1 architecture, despite the current limited horizontal exposure. In the second place, we clarified the plan of the Phase 2 structures in this sector of Area C and suggested that their collapse correlates with the same event that in Area B brought Phase B to an end. Finally, we further investigated rebuilds and expansions of the Phase 3 "Gateway", suggesting a lengthy duration of this phase, ending with abandonment after Phase 3, possibly in connection with climatic changes and environmental degradation.

Conclusion: Results Achieved and Future Objectives

Excavations at Khirbat Iskandar over several seasons have gradually uncovered substantial Early Bronze III remains below the well-known Early Bronze IV layers at the site. The last three field seasons have concentrated on achieving a larger exposure of the Phase C Early Bronze III settlement that comprised a central structure, adjacent work areas, and a courtyard, within the fortifications. Moreover, as a result of the discoveries of a new fortification line and an earlier Early Bronze III phase in 2013 and 2016, we have a view of the construction history of the fortifications and the more extensive depth of Early Bronze III occupation at the site.

In Area B, we clarified the three-phase

construction history of the fortifications on the western perimeter. We further elucidated the nature of the Phase C settlement, thanks to expanded lateral exposure of the lower (earliest) Phase C2. New ceramic evidence provided additional new data for dating the Early Bronze III stratum. In fact, we understood in a better way the chronology of the Phase C settlement, clarifying that Phase C2 dates, ceramically, to either the beginning of Early Bronze III or the Early Bronze II/III cusp, and that Phase C1 can be ascribed to Early Bronze IIIA thanks to pottery assemblages anchored to radiocarbon dates.

Although the site has not been included on recent summaries on early urbanization in Jordan (Chesson 2018), growing evidence is bringing the Early Bronze II/III occupation at Khirbat Iskandar into sharper focus, as discussed before. The archaeological evidence seems to indicate that the site, better known for its long occupation in Early Bronze IV, may also be a key site for the study of Early Bronze II/III in Jordan, along with hitherto better-known sites in the region.

Moreover, with a firmer grasp on the phasing of the fortifications in Area B, it was also possible to revisit the topic of Early Bronze IV walls on site, connected with the interpretation of the "Rubble Wall" that appears to have been in use in the Early Bronze III/IV period. A refinement of the chronology of the "Rubble Wall" will be one of the objectives of the next campaigns in this area.

In Area C, we confirmed the three-phase Early Bronze IV sequence published previously (Long 2010), and showed that Phase 1 was an early phase in the period with transitional Early Bronze III/IV features (see discussion and references above), characterized by permanent occupation with a well laid plaster surface associated with considerable stone walls. This earliest Early Bronze IV occupation was established on top of a mudbrick layer whose nature and chronology within the Early Bronze Age sequence will be investigated during future excavations.

In conclusion, although the season was short, with focused objectives in Area B and Area C, we enhanced our understanding of the Early Bronze Age sequence at Khirbat Iskandar. However, the recent discoveries at Khirbat Iskandar in both areas, Area B and C, raised new questions concerning the critical Early Bronze III/IV nexus. When and how did the crisis of the Early Bronze III settlement take place? And what was the site's response to this event? The answers to those questions may lie in the understanding of what happened between the Phase C1 destruction identified in Area B and the earliest Phase 1 occupation during Early Bronze IV exposed in Area C. This might eventually allow us to re-evaluate this critical nexus at the site in the context of the higher absolute chronology proposed for the 3rd millennium BC in the southern Levant (Regev *et al.* 2012). To investigate the stratified profile of the Early Bronze III/IV transition at different sectors of the *tall* and to connect Areas B and C stratigraphically may be the keys to reconstruct these events and will be the objectives of future investigations at Khirbat Iskandar.

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Cultural Multiplicity in Northern Mo'āb: Figurines and Statues from Khirbat al-Mudaynah on the Wādī ath-Thamad

Introduction

In the past, our knowledge of Moabite culture was confined to information contained in a limited group of textual and cultural resources. Literary sources included the Mesha Inscription (Dearman 1989) and occasional references in Hebrew texts and Assyrian royal inscriptions, while the results from regional surveys and a small number of excavations at Iron Age sites contributed to a partial understanding of Moabite material culture. These sources yielded a rather homogeneous, if not sporadic, view of Moabite life on the Dhībān plateau. However, the discovery, excavation, and publication of a wayside shrine in northern Mo'āb (WT-13) revealed a complex assemblage of pottery and artefacts reflective of diverse cultures, many of which surpass known textual information. At the same time, excavation at the town site of Khirbat al-Mudaynah on the Wādī ath-Thamad (henceforth, Mudaynat ath-Thamad; also known as Khirbat al-Mudayna and Mudayna Thamad) has yielded dozens of unique Iron Age figurines and statues whose cultural affinities have yet to be fully explained.[1] This paper is an investigation of these objects in an attempt to understand the influences evident in the finds from the small town and their implications for the temple cult, the history of the site, and the interactions of peoples in the region and beyond.

State of the Question

In 1980, Abdel-Jalil 'Amr published the first synthetic study of Iron Age figurines from Jordan. This was followed by

[1] Excavations at WT-13 (2000) and at Mudaynat ath-Thamad (2005) were funded by grants from the Social Sciences and Humanities Research Council of Canada. An initiatory grant (1997) for the commencement of excavation at WT-13 was provided by the American Schools of Oriental Research. Short term grants were also provided by Wilfrid Laurier University.

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reports on figurines from newly excavated Ammonite sites, such as Tall al-ʿUmayrī, Ḥisbān and Tall Jāwah (Daviau and Dion 1994; Dabrowski 1997, 2009; Daviau 2002, 2014, 2015). More recent finds in Moʾāb (Worschech 1995; Daviau 2001, 2014a, 2017) have already revealed several iconographic traditions represented in both female and male ceramic figures, especially at site WT-13 that served as a shrine site during Iron Age II. What was special about the assemblage from WT-13 is the inclusion of hollow ceramic statues and stone figurines (Daviau 2017: figs. 4.7–4.12, 4.15:1–4). Even more unusual is the corpus of anthropomorphic figures from Mudaynat ath-Thamad, 3 km to the west, which contains figures in a wide variety of styles, ranging in size from 3–50 cm in height. Although there are several parallels to the figurines found at WT-13 and Tall Mādabā, the differences are striking. The Mudaynat ath-Thamad corpus under discussion here consists of 67 items: three collected by Glueck in his 1933 survey, one protome(?) published by Sauer, and the remainder recovered in controlled excavations.[2] Due to the collapse of stone masonry at the site, many figurines and statues are fragmentary. Nevertheless, the better-preserved figures will greatly expand the number of types established in previous iconographic studies and contribute to a broader understanding and preservation of Moabite culture and the foreign influences that enriched it.[3]

Typology of Ceramic Figurines

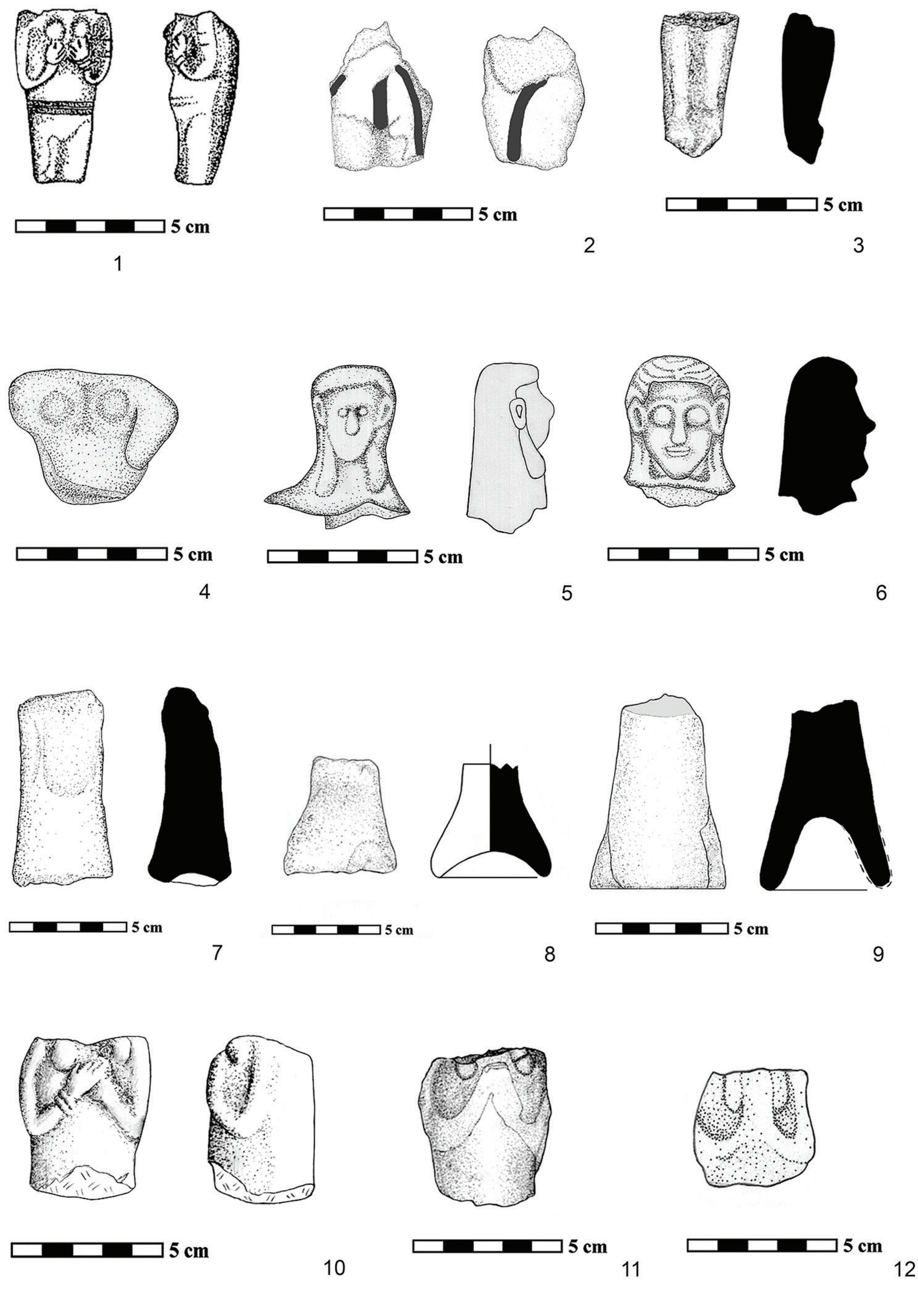
Following the typology of previous studies (Daviau 2001, 2017), this analysis begins with free-standing ceramic figurines, primarily the naked female and secondarily the pillar figurines, the largest single group at Mudaynat ath-Thamad. These are followed by attached figures or protomes. Also free-standing, but less well represented, are male figurines, some in ceramic and others in stone. In another class altogether are miniature stone figures consisting of schematic figurines that represent a unique tradition. Finally, there are stone sculptures, including two unusual examples of large male figures, one in the form of a bust, the other a standing statue.

Free-Standing Modelled Figurines

Naked female figurines have a widespread distribution in the Levant, where they are represented holding their breasts or holding a small disc in their hands. Such figurines were mould-made in one piece with details of their face, arms and legs on the front. Typically, the legs are low on the body and detailed ornamentation consists of jewellery and a girdle. Manufactured by professional potters, these small figures were made of carefully prepared clay, slipped or hand painted, and fired in a kiln (Daviau 2014b).

At Mudaynat ath-Thamad, no intact figurines were recovered, although parallels with figurines from other sites in the area help us to identify the broken figurines in our corpus. The most complete example of a naked female (Fig. 1:1; MT 566) is preserved from her neck to her knees; her arms are bent and appear to be holding the breasts from below. Her only ornaments are twin bracelets on each wrist and a girdle just below the level of her navel. In one fragment representing the lower torso (MT 745) there are strips of red paint (Fig. 1:2). The gently rounded back indicates that the excess clay was removed manually before firing. Lower legs of mould-made figurines are parallel with a vertical depression between the legs (Fig. 1:3; MT 1120). Typically, there are

[2] Ceramic fragments too badly broken to identify with certainty raise the number of possible figurines to 74. Of these, six were previously published (Daviau 1997: 226, figs. 2–4; 2014a: figs. 12:1, 13:5; 2015: fig. 3:1, 2).
[3] The elaborate typology designed by Holland (1977) and employed by Gilbert-Peretz (1996) to analyze the figurines from Jerusalem includes a number of types not seen or, at most, rarely seen in Moʾāb.



1. Naked female figurines: 1) MT 566, 2) MT 745, 3) MT 1120; handmade figurine: 4) MT 2812; attached heads: 5) MT 2638, 6) MT 2651; pillar bases: 7) MT 1956, 8) MT 827, 9) MT 759; pillar figurine torsos: 10) MT 1, 11) MT 3313, 12) MT 263.

anklets around the ankles, although the grooves above and below each bangle are difficult to discern on very small figurines.

Parallels

Buṣayrah: In Jordan the largest assemblage of naked female figurines holding their breasts (12) comes from Edom, primarily from Buṣayrah (Sedman 2002: 369–75).

WT-13: The position of the hands and the presence of a girdle are similar to the features of a free-standing naked female figurine (WT 286-4/514) and to a female attached to the fronton of an architectural model (WT 88), both from WT-13 (Daviau 2017: figs. 4.1:5, 4.3:4).

Dhībān: At Dhībān, the head and upper body of a female with long locks of hair falling on her chest holds a disc in front of her breasts (Morton 1989: fig. 15).

Tall Dayr ʻAllā: Four fragments showing female figurine legs, each with two anklets, were found at Tall Dayr ʻAllā (ʻAmr 1980: 89 figs. 91–94).

Tall as-Saʻīdiyyah: Figurines with moulded anklets in pairs were compared by Green (2007: 298) to actual burial customs at Tall as-Saʻīdiyyah.

Taʻanach: The presence of bracelets around one or both wrists and a broad girdle around the hips are clear signs that the figurines in a group from Taʻanach were mould-made, even when the leg portion is broken off. These figurines are similar to figurines from the earlier Canaanite tradition (Lapp 1964: figs. 21, 22:3, 5).

Phoenicia/Syria/Cyprus: During the Iron Age, the Canaanite tradition was continued among the Phoenicians. This is seen most clearly on the bronze horse frontlet embossed with four naked females standing on lion heads and incised by Hazael of Damascus. This frontlet was sent as a votive gift to the Hereion on Samos (Ephʻal and Naveh 1989: pl. 24; Dion 1997: 431 fig. 13). Each embossed female figure has a Hathor-style hairdo and is adorned with a necklace, bracelets, and anklets. A limestone sarcophagus found at Amathus on Cyprus was decorated on one end with four naked females holding their breasts.

Egypt: Although much less elegant, ceramic figurines of naked females found in the Mut Precinct date to the 21st–26th Dynasties (Waraksa 2009: 30–3, 37–8 fig. 7 pls. 5, 29–31). Type 3 figurines are shown holding their breasts, while those in Type 6 have only their legs preserved.

A second type of free-standing seemingly naked female consists of the upper torso and one arm (MT 2812). Of note is the formation and unnatural position of the breasts (Fig. 1:4). Nevertheless, this figurine has parallels among the handmade figurines from WT-13, especially WT 280, a female torso with arms at the sides, and WT 439-6/501, a seated figurine with a similar body shape (Daviau 2017: figs. 4.2:1, 4.4:6).

Pillar Figurines

The dominant type of female figure at Mudaynat ath-Thamad is the pillar figurine with a mould-made head and pillar-shaped torso and lower body. Of the 67 registered pieces in our corpus, 36 can, with some certainty, be identified as pillar figurines. The head and neck appear to be mould-made along with details of coiffure, headdress, or shawl. Glueck (1970) identified one male head with a prong in the neck as being from Khirbat al-Mudaynah (see below).[4] In this case, the prong would be inserted into the top of the figurine body

[4] Glueck (1933–34: 24) described two figurines, one with a prong from the dump at ʻel-Medeiyineh on the Wadi Themed' and its twin without a prong from al-Bālūʻ. However, the caption for the illustration is reversed. This was corrected in a later publication (Glueck 1970: fig. 94). In view of this confusion, Worschech (1995: fig. 3e) published the head with a prong as coming from al-Bālūʻ.

or pillar and extra clay added to seal the join, with the result that the shoulder line was somewhat distorted (Fig. 1:5). A second head also retains evidence for a tenon (Fig. 1:6; MT 2651); without this evidence, it is often difficult to confirm the type of figurine in question. Below the neck, the pillar was cylindrical at the top but flared out on the bottom, evidence that it was formed on the wheel from a stump of clay with the rim constituting the lower edge. The base itself may be solid but is more often concave or hollow up to the waist (Fig. 1:7–9), similar to the technique evident on figurines from WT-13 and sites in Judah (Kletter 1996: 29; Daviau 2017: fig. 4.5:1, 2).

The most common style of pillar figure at Mudaynat ath-Thamad shows a female with her arms bent at the elbow and her hands clasped just below or between the breasts, possibly holding a small disc-shaped object (Fig. 2:1–3). Figurine MT 1, the first object recovered during the 1995 surface survey, depicts the arms, hands, and central body of a female with hair locks resting on the shoulders. The arms are bent with the right hand clasped over the left and positioned between the breasts. The hands appear to be holding a small disk although this is not as clear as on comparable figurines from al-Bālūʿ (see below) or from WT-13. Two bracelets on the right wrist and the fingers of the right hand are well preserved.

The point of transition from the cylindrical torso to the flaring lower body is marked by a slight 'waist' visible below the level of the elbows; however, as expected, there are no anatomical details and the figurine is broken at this point. On the upper back there is evidence of vertical tooling, although there are no details of clothing or body parts. The cylindrical shape of the torso suggests a pillar figurine wearing a long skirt, although the presence of bracelets on both wrists is usually the sign of a mould-made naked figure. Two other upper torso fragments (Fig. 2:2, 3; MT 263, MT 3313) represent the same stance and features, while a fourth example (MT 2052) is badly worn.

Parallels

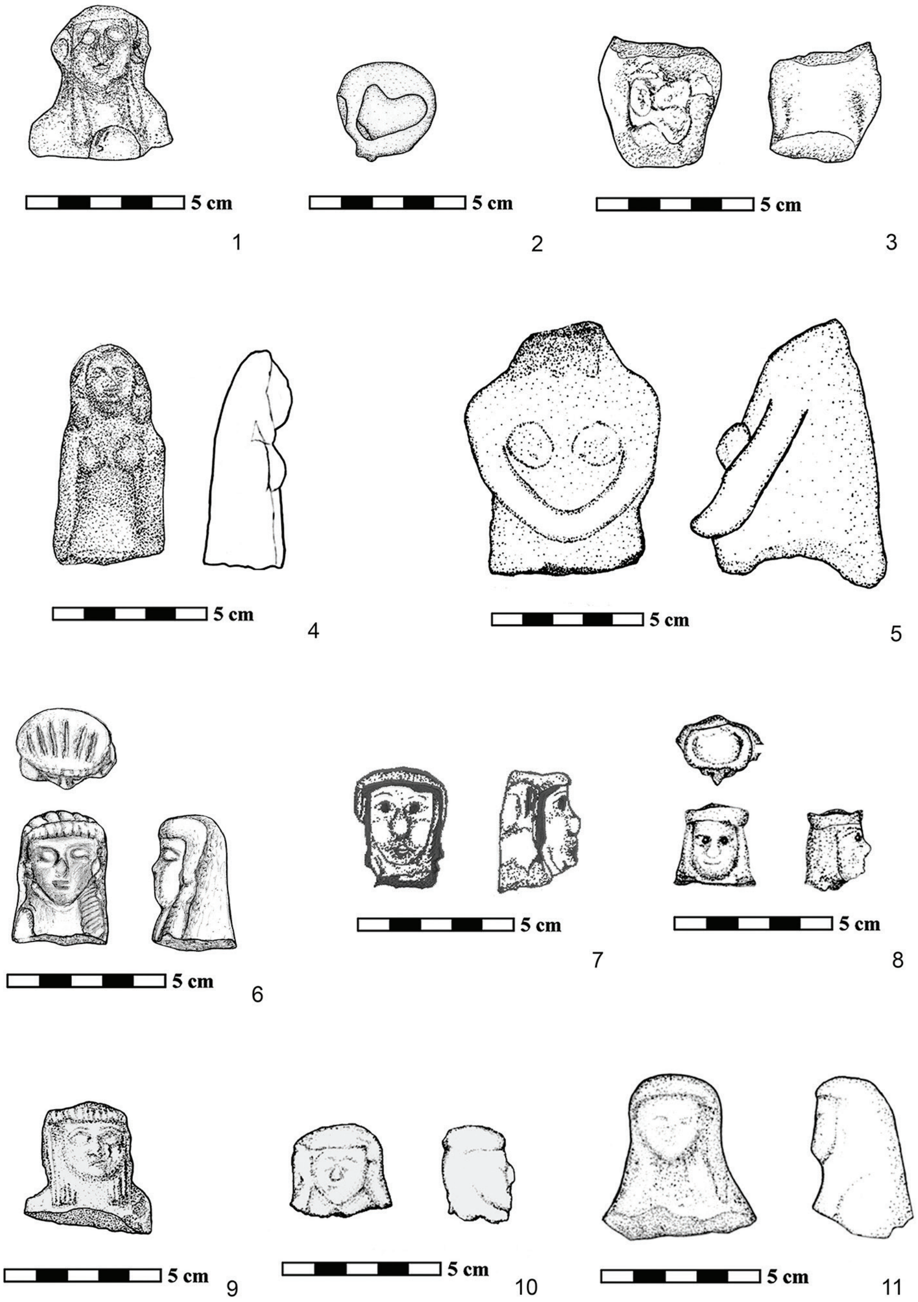
WT-13: The same stance and position of the arms can be seen among the figurines from the shrine at WT-13, such as WT 72 (Daviau 2001: fig. 3; 2017).

The best evidence for the female holding a disc or playing a drum is represented by one female head and upper body where the disc or drum is partially preserved (Fig. 2:1; MT 3246). Two detached drums, one with a mitten-shaped hand still attached (Fig. 2:2; MT 2320) and one fragment (MT 3450) that would have been placed in the hands of the figurine, are examples of this type of votive figurine. Extensive studies of drummers and drumming in ancient Israel (Paz 2007) suggests a link between the figurines from Jordan and those throughout the southern Levant where naked figures hold a disc against the chest and pillar figurines appear to hold the drum on an angle as if they are making music in the cult of the living and the dead.

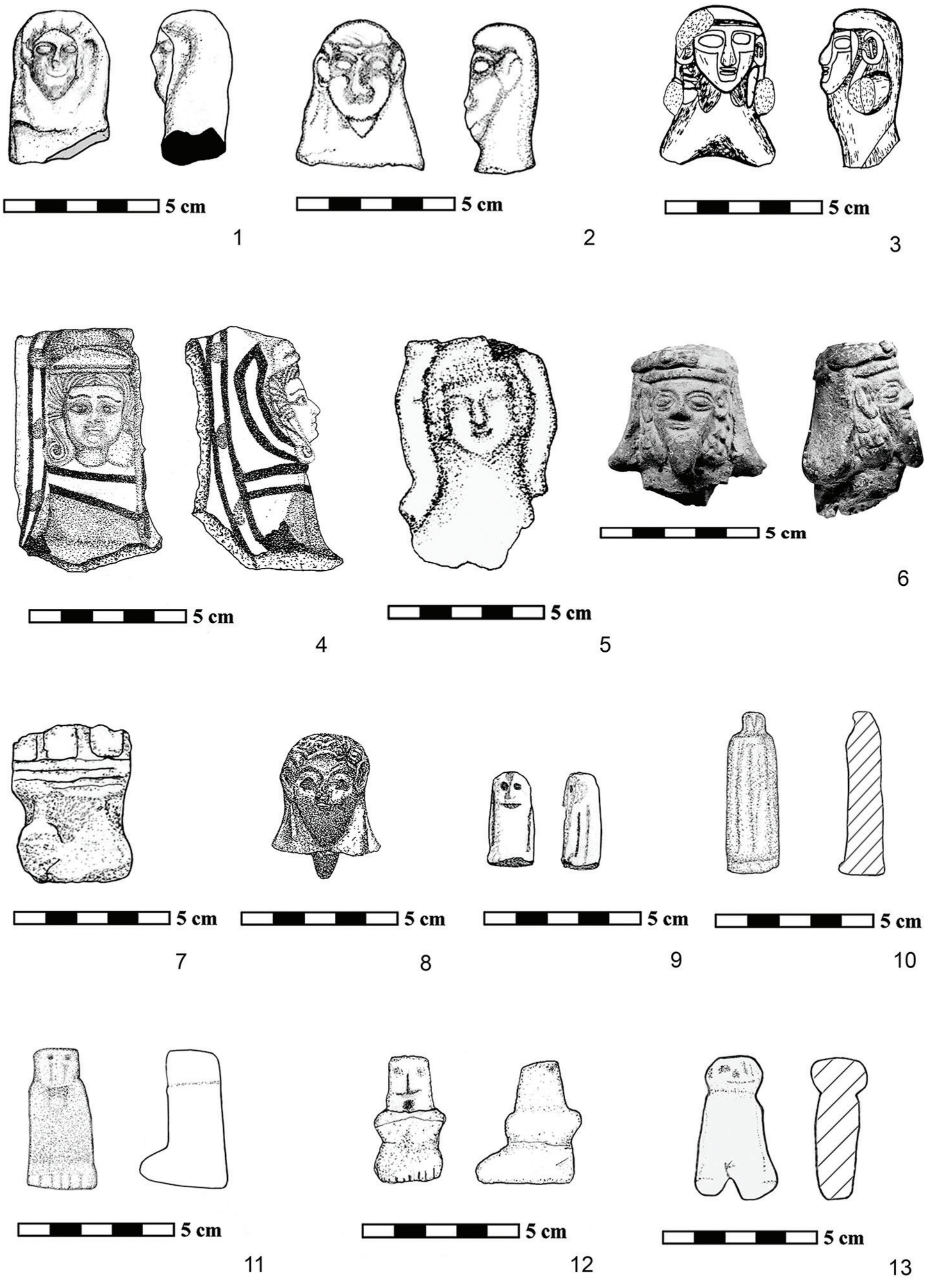
Parallels

WT-13: A pillar figurine with the drum angled away from the body (Daviau 2017: fig. 4.5:5) reflects a stance seen also on Phoenician pillar musician figurines. Separate drums, usually with one hand attached, are indicators of this style of musician figure (Daviau 2017: fig. 4.5:8, 9).

AL-Bālūʿ: The best known parallel is a complete figurine from al-Bālūʿ, measuring 11.8 cm (Worschech 1995: fig. 2), which is an example of the Moabite style of pillar figurine with tooling below the elbows suggesting a long garment. In this case, long plain locks of hair rest on the shoulders flanking the clasped hands. The same head style appears on two other figurines from al-Bālūʿ that Worschech (1995: 187, 189



2. Female with drum or child: 1) MT 3246, 2) MT 2320, 3) MT 541; other stance: 4) MT 1111, 5) MT 3595; various head styles: 6) MT 20, 7) MT 565, 8) MT 519, 9) MT 1591, 10) MT 487, 11) MT 1934.



3. Veiled heads: 1) MT 61, 2) MT 309; protomes: 3) adapted from 'Amr 1980: fig. 83; relief on jug neck, 4) MT 2402; combined styles: 5) MT 1884; male head: 6) adapted from Glueck 1933–34: fig. 6=1970: fig. 96; lower body, 7) MT 1541; head with prong, 8) adapted from Glueck 1933–34: fig. 7 right=1970: fig. 94; miniature figures: 9) MT 25, 10) MT 3137 11) MT 1950, 12) MT 24, 13) MT 1909.

fig. 3a, b) compares with those from sites in central Mo'āb, especially Dhībān and al-Mashadd.

Two other figures are severely damaged but appear to represent females holding a child. Even in the best-preserved example (Fig. 2.3; MT 541), it is not clear whether these were pillar figurines or were naked. Several other styles of figurine may also have been pillar figurines, although they are different from the common style of a female holding a disc or holding her breasts. At Mudaynat ath-Thamad, one figurine has her hands at her sides (Fig. 2:4; MT 1111), another has her hands clasped on her abdomen (MT 3595). From the front, figurine MT 1111 has locks of hair that rest on each shoulder, even though the left shoulder is lower than the right. Two breasts are evenly spaced on the upper torso with a slight indentation below them, indicating a pinched waist. From the side, the head is covered with a shawl that extends on either side covering the arms and hands. Figurine MT 3595 (Fig. 2:5) is preserved from the neck to the hips. The lower part of the body is hollow and larger from the front to the back than from side to side, suggesting a pregnant female. However, she does not resemble the Phoenician seated pregnant female wearing a long cloak.

Hair Styles

Both free-standing and pillar female figurines may have simple locks of hair falling on their shoulders, or elaborate coiffures, while others may wear a headdress or shawl that covers the hair. Two heads with long locks falling from behind their ears represent a local style seen at WT-13 (Daviau 2017: Fig. 4.1:7). In some instances, the locks are incised with diagonal strokes (Fig. 2:6; MT 20) or covered with black paint (Fig. 2:7).[5] One figurine appears to wear a crown (Fig. 2:8) and another has an Egyptian-style blunt cut coiffure (Fig. 2:9), similar to figurine WT 86 at WT-13.

Heads without details of their coiffure appear to wear a veil or head covering. Two are worn and facial details are faint (Fig. 2:10, 11; MT 487, MT 1934), but two are better preserved. In the latter, the chin is covered with extra clay compressing it into the neck (Fig. 3:1, 2) and elongating the face, similar to that of male figurines.

Protomes

Protomes are attached figures, which were either mould-made or handmade. In the two examples from al-Mudaynah, both heads appear mould-made, although the one surface find is poorly preserved (Fig. 3:3; ʿAmr 1980: fig. 83; Sauer and Khalayly 1981: 64). By contrast, a beautiful head attached to the neck of a jug (Fig. 3:4; MT 2402) has a Hathor-style coiffure with elaborate curls, a headdress, and shawl. The addition of these features may be a regional style. The face of this figure retains the detail of a new mould, but no other figurine heads of this type were found at the site.

Parallels

Tall al-Mazār: The closest parallel to the female relief on a jug is a female head on a decanter neck from Tall al-Mazār. In this case, the hair style is more difficult to identify, due to damage on the left side (Yassine and van der Steen 2012: 134 cat. P004, cover).

One mould-made head is unique. MT 1884 is a Judean pillar figurine head as shown by Kletter (1996: figs. 25, 6:5, 6), who illustrates both a complete female pillar figure and a group of the most characteristic heads with tight curls on the top and sides. The head at Mudaynat ath-Thamad was modified by the addition of long curls (Fig. 3:5), possibly to represent the goddess Hathor.

[5] Hübner 1989: pl. 7, illustrated a female head from Tall al-Milḥ (Malḥata) with the same hairdo showing locks with diagonal strokes.

Male Figurines

Although several small ceramic and stone male heads and torsos were recovered at WT-13 (Daviau 2017: 4.4:1–5), few such figurines were found at Mudaynat ath-Thamad. However, the first figurine head, discovered by Glueck during his 1934 survey, shares several features with the royal statue of Yeraḥ-azer. This ceramic head (Fig. 3:6; Glueck 1933–34: fig. 6; 1970: fig. 96) depicts a smiling male with large eyes and ears, a beard, and long hair held in place by an ornamented headband. An extension from the neck is evidence that this head was attached to a larger figure. The lower part of a robed figure cannot be shown definitively to be part of the same figurine but is suggestive of what it might have looked like. In this instance, standing figurine MT 1541 (Fig. 3:7) preserves the base, feet, and lower part of a garment with three tassels extending to just above the hem. A second head, with an intact prong (Fig. 3:8), was initially identified as a male due to the elongated chin and appearance of a beard on the cheeks (Glueck 1933–34: 24 fig. 7), but was later included in the group of female figurines with a long chin (Glueck 1970: 188).

Miniature Schematic Figurines

A group of five miniature figures made of stone have stylised facial features and a truncated body (Fig. 3:9–13). In two examples, the base represents the toes of two feet (Fig. 3:11, 12), while another has short stumpy legs (Fig. 3:13). Two additional fragments cannot with certainty be assigned to this group (MT 81, MT 310). The first of these consists of the base without details of the head and the second was badly broken so that only the eyes and the back remain. Both are from Nabataean structures located at the base of the mound although the latter (MT 310) may have come from the northeastern dump immediately above Reservoir 700 (Daviau *et. al.* 2000).

Parallels

Although these schematic figurines share some features with Nabataean figurines, they have a much earlier occurrence in the southern Levant.

Tall ar-Rumayth: Two stylised miniature figurines were perforated and may have been pendants ('Amr 1980: figs. 101, 103).

Tall Dayr 'Allā: Two handmade heads representing miniature figures, classified by 'Amr (1980: figs. 38, 39, 102) as miscellaneous, had incised and applied features. A third stylised figurine may have been used as a pendant.

Ta'anach: Figurine TT 1400 is a triangular-shaped figure with incised eyes and a mouth supported by a thick base (Lapp 1969: 45 fig. 30, right). This figurine was recovered in a mixed fill of Middle Bronze and Late Bronze Age pottery.

Jerusalem: Although described as ceramic pillar figurines (Gilbert-Peretz 1996: fig. 10:12–14), these are true miniatures with a pinched face.

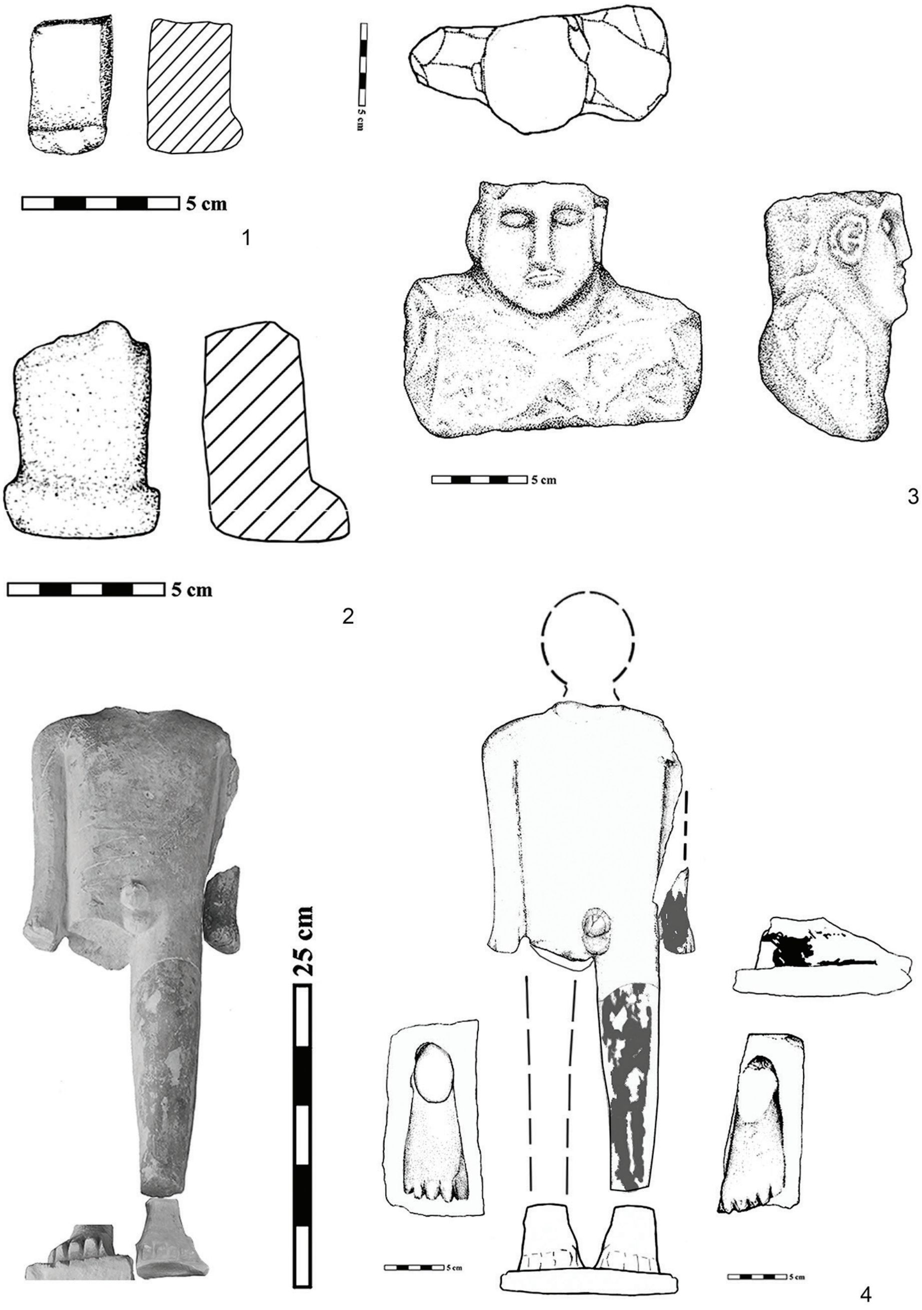
Stone Sculptures

Two stone sculptures (Fig. 4:1, 2; MT 481, 499) resembling the base and lower garment are so simply styled that it is not possible to ascertain the sex with certainty, although their style suggests that they should be classed as male figurines. More recognisable as male figures are a limestone male bust (Fig. 4:3; MT 1936) and a standing male statue (Fig. 4:4; MT 2968).[6]

Description

Bust MT 1936 consists of the head, flattened on the top, the shoulders and upper chest of a male figure. The eyes are somewhat misaligned, the nose is long and straight above a small mouth. The right ear is well preserved and has a circular shape. Altogether these features represent a serious

[6] Measurements in the database include H/height, L/length, W/width, T/thickness (forthcoming).



4. Stone sculptures: 1) MT 499, 2) MT 1855; 3) MT 1936, 4) MT 2968.

expression. From the front the chest is flattened, the right shoulder is bevelled and higher than the left, which is flattened. The bust is broken on an angle at mid-chest, rendering its function uncertain although the flattened head suggests a support in a balustrade.

A statue of a male (MT 2968) standing more than 46 cm in height was found in a number of pieces, the largest of which was the torso from shoulder to ankle of the left leg. The head is missing and there is no evidence for locks of hair on the shoulder suggesting a short hairstyle or bald head. Fragments include part of the left arm and hand and both feet, recovered separately. The hands were in the shape of fists with the knuckles to the front and the fingers turned to the back. There was no evidence for clothing, although red paint was preserved on one leg and on the left hand and foot. Even though the genitalia were clearly indicated, the penis is now chipped, eliminating the evidence of circumcision or the lack thereof. Although both feet were recovered it is not possible to determine whether one foot was ahead of the other in a striding position.

Parallels

This sculpture stands in stark contrast to the repertoire of stone statues from the Amman region, where 12 robed male statues wearing the *atef* crown were uncovered, and from the Egyptian-style figures on the al-Karak statue fragment and the al-Bālūʿ and Shīḥān stelae (Routledge and Routledge 2009; Hunziker-Rodewald and Deutsch 2014; Parker and Arico 2015). Apart from a number of small ceramic figurines, there are no known parallels to this statue from the southern Levant.[7] The closest parallels are from the northern Levant, Egypt, and Greece.

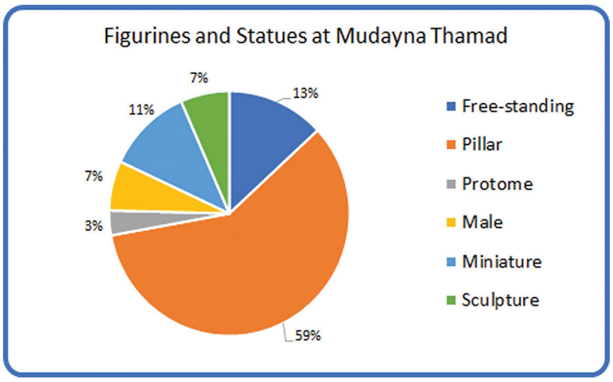
Egypt: A nude striding male statue of Snofru-nefer, inscribed with his titulary, 'The venerable, with the great god, the Overseer of Singers at the royal court', dates to the 5th Dynasty and is currently in the Kunsthistorische Museum in Vienna (Satzinger 1994). Another example from the 6th Dynasty is a wooden sculpture of the master of ceremonies Merire-hashtef (Michalowski 1978: 111). Although the early date of these examples puts them in another category, the main features are similar, especially the lack of hair locks on the shoulders, the red paint on the body, and the lack of musculature that is in contrast to later kouros figures.

Greece: The kouros statue from Sounion dating to *ca*. 600 BC is an early example of this well-known type (Johnston 1993: 52 fig. 39). Two aspects are at variance with MT 2968: its size (over 3.0 m tall) and certain features; namely, the long hairstyle and the position of the hands with the knuckles facing outward.

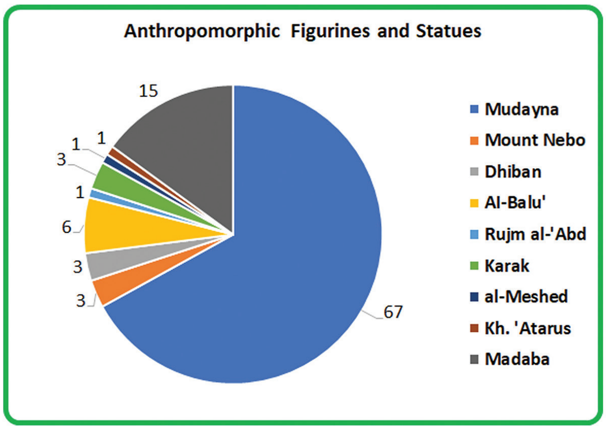
Reflections

The figurines and statues recovered at Mudaynat ath-Thamad (Fig. 5) were located across the entire site; in the gate and casemate rooms, the temple, the domestic and high-status areas, the street and the northeastern dump, while only one pillar base (MT 2581) was recovered from the complex of industrial buildings (B200; Field B). The stone bust and naked male statue were both from Complex 400 at the south end of the mound, along with Assyrian glazed bottles and a collection of alabaster and faience cosmetic vessels (Daviau and Klassen 2014: figs. 2, 3). The three broken figurines found in Temple 149 (Daviau and Steiner 2000: fig. 11:5–7) include the torso of a naked female, one painted female head, and one veiled head (Figs. 1:1, 2:7, 10). These fragments stand in stark contrast

[7] Three naked male figurine torsos were reported from Tall Dayr ʿAllā (ʿAmr 1980: figs. 9, 10, 48) and one each from Rujm al-Ḥinū, north of ʿAmman (McGovern 1983: fig. 14:9), Tall Jāwā (Daviau 2002; TJ 1877) and WT-13 (Daviau 2017; WT 323).



5. Figurines and Statues at Mudaynat ath-Thamad.



6. Iron Age II Figurine Totals in central Jordan (published examples only).

to the well-preserved altars that were the focus of the cult. The remaining figurines and statues suggest an active domestic and industrial cult concentrated in the domestic structures (Daviau 2014a).

Of importance for this study is the wide variety of influences reflected among the figurines and statues from Mudaynat ath-Thamad. Beginning with naked female images, we find Canaanite and late Phoenician, Israelite, and Egyptian styles along with their incorporation in a combination of Phoenician and Cypriot traditions (Karageorghis 2000: fig. 215).

Pillar figurines embody various styles, including local and Phoenician characteristics. Similar figurines are found at sites throughout Jordan, especially at WT-13, in the Jordan Valley, ʿAmmūn and ʾĪdūm (Edom). Drum playing musician figurines had a wide distribution under Phoenician influence, as seen on Cyprus (Karageorghis 2000: fig. 232). Judean influence is seen in one example of a mould-made head subsequently modified by long curls, while an Egyptian-style hairdo appears on the female relief on the neck of a jug.

Among male figurines, the ceramic male head found by Glueck and the robed leg fragment evoke Ammonite traditions. More difficult to situate are the miniature figures, although different styles are seen at

Jordan Valley sites and in Jerusalem. The stone bust has no true parallels, while the standing statue appears to follow Egyptian prototypes that later impacted Greek sculpture.

One other aspect derived from this study is the unusual number of figurines and statues at the small site of Mudaynat ath-Thamad when compared to neighbouring town sites (Fig. 6). The only other site with a comparable number is the one-room shrine, WT-13 (Daviau 2017). At present, Mudaynat ath-Thamad and WT-13 have yielded nearly 50% of all published figurines and statues in Jordan. Hopefully, the publication of currently unpublished anthropomorphic figures from Ammonite sites will put these numbers in better perspective.

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The Iron IIB Period at Khirbat ʿAtarūz

In the summer of 2000, a research team from La Sierra University initiated a multi-year excavation project at Khirbat ʿAtarūz and a survey of its surrounding areas. According to the results, the acropolis area of the site was intensely settled and used throughout most of the 9th c. BC (Late Iron IIA period), continuing into the subsequent centuries. Most of the architectural remains on the acropolis are associated with an Iron IIA temple complex, which was violently destroyed in the middle of the 9th c. BC (Ji 2011, 2012).

Based on the results of 2001–2009 fieldwork, the 2010–2019 excavations were expanded to the areas north and east of the acropolis, which yielded buildings dated to the Iron IIB period, covering the late 9th to the early 7th c. BC (Ji and Bates 2014, 2017, 2020; Fig. 1). In this paper, we attempt to summarize these later findings from ʿAtarūz. The Iron IIB period of ʿAtarūz so far comprises two phases. We will here label them "Early" and "Late" Iron IIB for the convenience of discussion. The Early Iron IIB at ʿAtarūz corresponds to the transition from Iron IIA to Iron IIB with its suggested date of late 9th to early 8th c. BC. Late Iron IIB is attributed to the 8th c. BC even though it may extend to the early part of the 7th c. BC. The Early Iron IIB phase witnessed the erection of a Moabite shrine near the acropolis as well as the evolution of distinctive Moabite scripts at the site (Bean *et al.* 2018). Other noteworthy developments in the later phase include the prevalence of peculiar Moabite painted wares and the appearance of ashlar, single-row, and pillared walls, building techniques that were rarely used during the Iron IIA period at ʿAtarūz.

The prominent feature of Iron IIA at ʿAtarūz was that it was cultic and religious in nature, as best characterized by the large temple complex on the acropolis (Ji 2011, 2012). The situation for Iron IIB is

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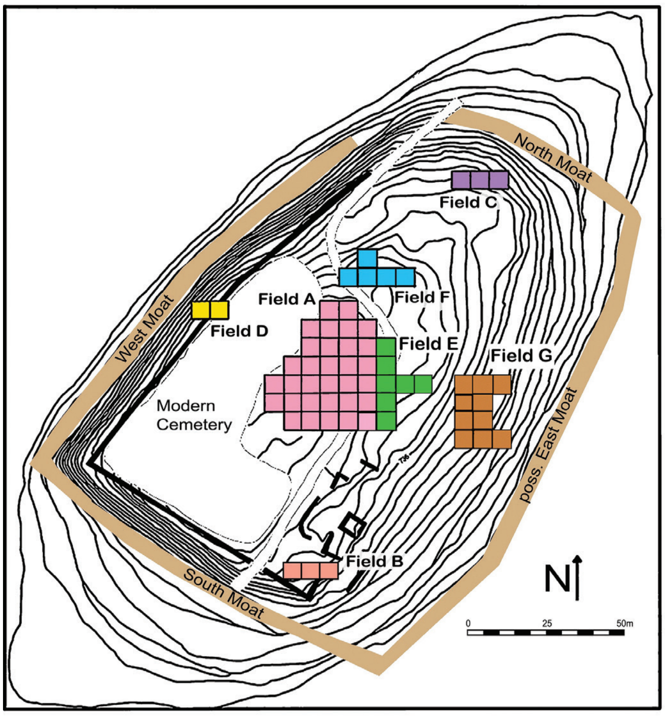


1. ʿAtarūz contour map and excavated areas.

2. Moabite sanctuary in Field E.

different (*cf.* Schade 2017; Bean *et al.* 2018 for the historical context of the transitional period from Iron IIA to Iron IIB). It was predominantly domestic. To date, no unequivocal cultic architecture or installations, except for a small sanctuary in Field E, have been recognized as initially constructed in an Iron IIB context. None of the installations in the excavated areas could be definitively identified as cultic. Hence, this paper begins with a summary of the Moabite sanctuary before turning to the other Iron IIB remains. The accounts on the Moabite sanctuary were published in detail elsewhere (Ji 2018).

The Moabite Sanctuary

In 2010–2014, the excavations of Fields A and E, the latter being situated east of the acropolis area, revealed a small cultic building (Fig. 2) with a portable stone altar with inscriptions on the body. The building was defined as Moabite and assigned to the late 9th to the early 8th c. BC in light of stratigraphy, ceramic evidence, radiometric dating, and the script on the inscribed altar (Bean *et al.* 2018; Ji 2018). The interior of the building measured roughly 5 m x 5 m. The sanctuary was constructed directly above earlier architecture, which was part of the Iron IIA temple complex, with substantive renovation and modification.

This architectural development not only constituted the end of the Iron IIA impressive cultic and building activities on the acropolis, but also marked the beginning of the Iron IIB era at ʿAtarūz, characterized by the arrival of new material culture and people, most likely the Moabites or local tribes allied with the Moabite Kingdom (*cf.* Routledge 2000, 2004 for the exapansion of the Moabite kingdom during this period). Stratigraphic evidence inside the sanctuary was found for six primary field phases (FP E1–E6). The sanctuary was associated with Field Phase E4 (see below).

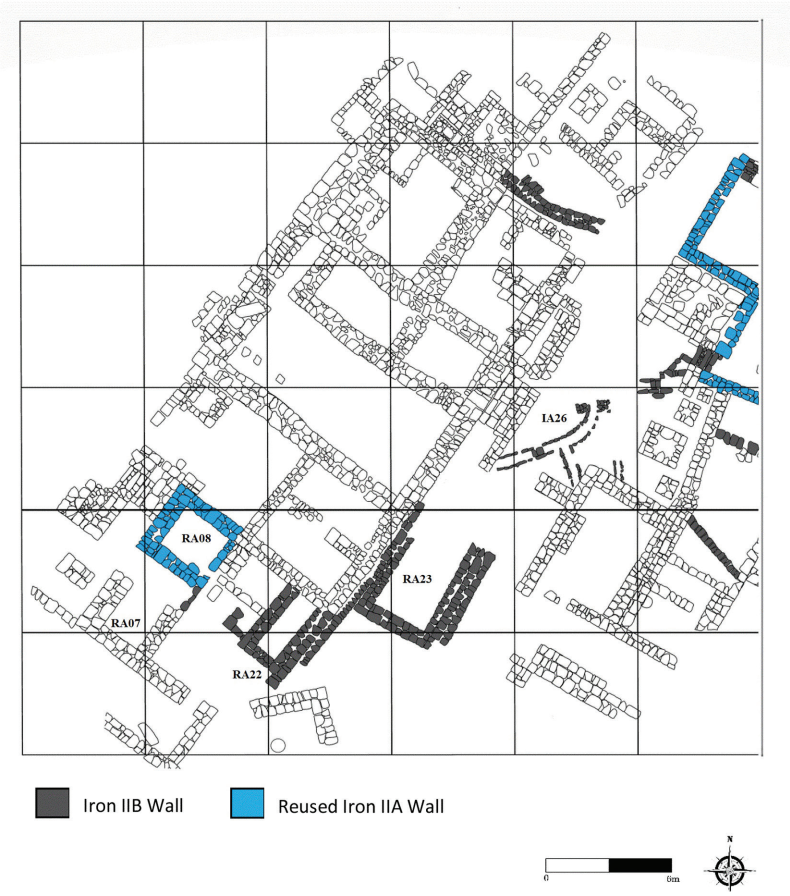
The Moabite sanctuary was distinctive in the way that it follows a square plan rather than the long-room design that was more or less standard for the majority of Iron II temples in the Levant (*cf.* Ji 2018 for a detailed treatment of this topic). A stone platform, offering tables, and a square altar were found inside the sanctuary. The finds from the sanctuary include a portable cuboid stone altar, a terracotta cup-and-saucer stand, and the aforementioned inscribed altar. The sanctuary now seems to be the earliest known example of Moabite cultic building from central Jordan (*cf.* Daviau 2017; Steiner 2019; Daviau and Steiner 2000 for the later Moabite cultic buildings in the region of Mudayna ath-Thamad).

Field A

Field A, composed of 32 squares (6 x 6 m), corresponds to the acropolis of the site and the area around it. The excavations yielded a large Iron IIA temple complex equipped with three sanctuary rooms, two high places, and a courtyard with multiple altars and cultic installations. A description of this temple complex is beyond the scope of the present paper, but its architectural and material finds were published in different venues over the years (Ji 2011, 2012; Ji and Bates 2014, 2017).

In Field A, the Iron IIB remains were unearthed above a thin layer of the Iron IIA debris that covered the temple's courtyard (Fig. 3). For example, a rectangular building (RA23; *ca.* 5 x 7 m) found in Square A7 is dated to the Iron IIB period. It abuts the eastern outer wall of the Hearth Room of the Iron IIA temple and has a preserved height of 70 cm. Approximately 3 m west of this building is another small rectangular room (RA 22) butting up against the southeast corner of the Hearth Room. It is 2 x 4 m in size. The room contained large quantities of neckless storage jar sherds from the Iron IIB–IIC period.

At the western entrance to the Iron IIA



3. Architectural remains in Field A.

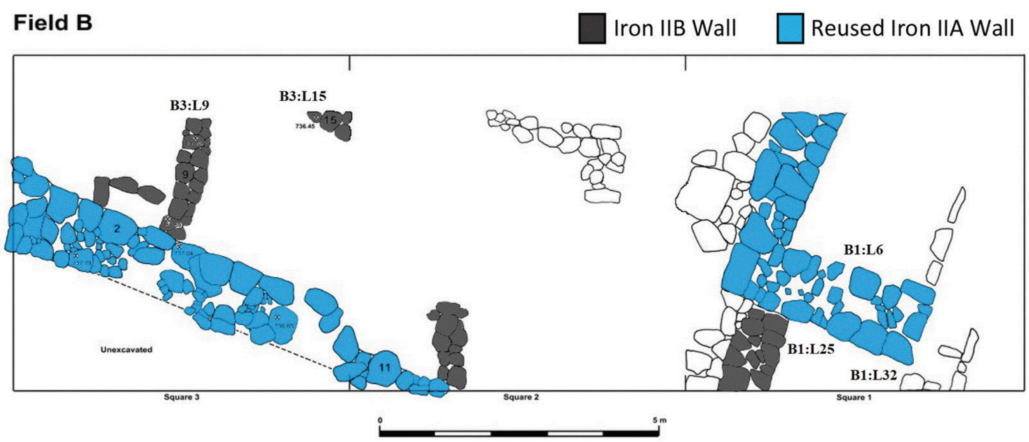
4. Water channels in the temple courtyard (Field A).

temple are two small rectangular rooms (RA07 and RA08). The overall plan suggests a gateway or path to the nearby Hearth Room and the Western High Place. These rooms were originally built during the Iron IIA period, one of which appears to have been reused during the Iron IIB period. The Iron IIB settlers cleaned the room and then placed a plaster floor after rebuilding some sections of the walls.

Further, the Iron IIB deposit from the temple courtyard area produced several sections of water channels (IA26) that still remain partially intact. The aqueduct was found best preserved in the temple courtyard in Field A (Fig. 4). It was about 8 m long, and the inner dimension of the channel was approximately 20 x 30 cm. The walls of the aqueduct were made of small flat slabs of stone with the inner side plastered. Certainly, the water channels were built to allow runoff rainwater from the surface to flow into the cisterns on the acropolis area, including the water cistern found in the western courtyard (Ji and Bates 2014: fig. 23). The aqueducts were ascertained in the soil layer over the temple courtyard surface and cultic architecture such as a large stone platform on the east end of the courtyard and the walls of the rectangular room that produced the bull statue in 2010 (Ji 2012: pl. 46). The stratigraphy and pottery found in the water channels confirm its date of the 8th–7th c. BC.

Field B

Field B, on the southern side of the site, was opened in 2002 with one square (Square B1). During the 2015 season, we reopened Field B with two new squares: Squares B2 and B3 (Fig. 5). The excavations of Field B produced four architectural phases, one of which (Field Phase B3) is best attributed to the Iron IIB period (Ji, Bates, Hawkins, and Schade 2020). Central to Square B1 was a wall (Wall B1:L6) that was oriented toward the northwest. The early phase of this wall was built on bedrock and virgin soil, and the pottery from the associated loci pointed to the Iron IIA–IIB periods for its dating. This wall was abutted by two walls (Walls B1:L25 and B1:L32) from the south, both of which were erected on top of bedrock during the same period. There is a possibility that the first wall was part of the city wall or casemate system given its thickness and solidness (*ca.* 2.5 m thick and preserved up to 3.5 m high). This wall was perhaps originally built during Iron IIA but reused in the Iron IIB era. This second phase of use was associated



5. Architectural remains in Field B.

6. City Wall and Iron IIB deposit in Square B2 (2015).

7. City Wall and Iron IIB walls and floors in Square B3 (2015).

with a cobble floor covering the northern half of the square as well as running through the northern balk.

The city wall was visible above ground to the west of Square B1. Hence, Square B2 was laid out with a portion of this wall protruding above the soil in its southwestern corner. In 2015, a deep probe was dug along the city wall in the southern part of the square, which yielded a hard-packed clay floor (Fig. 6). This beaten earth floor included Iron IIA–IIB pottery. Square B3 was opened to the west of Square B2 (Fig. 7). The city wall, as in Square B2, was exposed transecting the square from its southeastern corner to its western side, where it continues to the west. Further, a smaller wall (Wall B3:L9) was discovered abutting the city wall and running north into the northern balk. The areas on the western and eastern sides of this wall were excavated down to what appeared to be an Iron IIB floor level. On the western side of the space, tabun fragments were found along with krater, jar, bowl, and cooking pot fragments, all dating to the Iron IIA–IIB period. On the eastern side, additional tabun fragments were located in the northern and southwestern corners of the locus, once again along with multiple Iron IIB pottery sherds. This area seems to have served as an area for preparing food. Additionally, another small wall (Wall B3:L15) was discovered transecting the floor in its northeastern corner, and the excavation of the floor revealed that the north-south wall was later than the city wall, probably dated to the Iron IIB period.

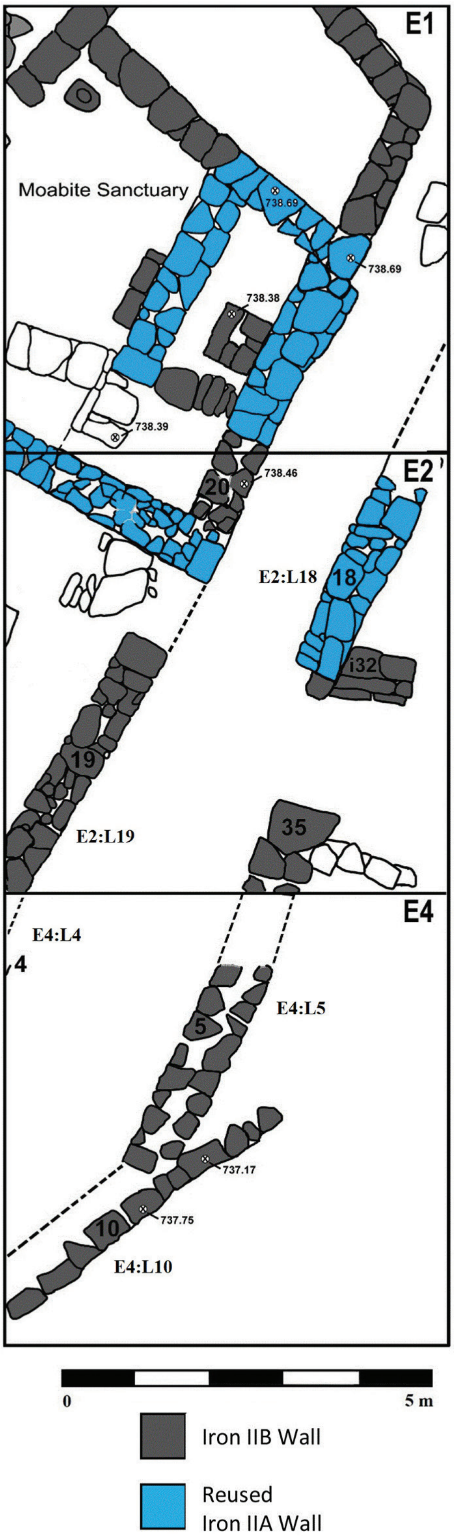
Field E

Field E is located in the eastern part of the acropolis. As said above, the compound that was exposed from Square E1 during the fieldwork of 2010–2014 has been identified as a Moabite shrine (Ji 2018). This result motivated the project team to extend the excavations southward and northward. A total of 24 m represented by Squares E1–E5 were opened during the 2012–2017 field seasons. In 2019 the area was extended to the east by Squares E6–E7.

In relation to the Moabite shrine, Ji (2018) described the stratigraphy of Field E that was broken down into five phases spanning the modern period (Field Phase E1) to the Iron IIA period (Field Phase E5). Between these two phases were one mid-Islamic layer (Field Phase E2) and two Iron IIB phases (Field Phases E3 and E4). The Moabite shrine was attributed to Field Phase E4.

Unlike Field Phase E4, the Phase-E3 stratum in Field E is characterized by domestic activities with small rooms and wall lines. In detail, in Square E2, the excavations revealed two wall lines (Walls E2:L18 and E2:L19; Fig. 8). During the 2012–2015 seasons, five beaten earth floors or hard surfaces were found east of Wall E2:L19, the area corresponding to the southern section of the square (Fig. 9). The presence of a similar floor/hard surface sequence was noted in the northern section of the square as well, concurring with the alley area between Wall E2:L18 and the Moabite sanctuary. Below the earliest floor/hard surfaces were bedrock and a layer of terra rosa soil.

Wall E2:L18 was a long solid wall (3 m long and 70 cm wide) extending to Square E1. Large boulders under Wall E2:L18 served as foundation stones that were placed directly on bedrock. The construction of this wall, along with the earliest floor/hard surface layer, was assigned to Field Phase E5. However, it was continuously used throughout Field Phases E3 and E4. Differently from Wall E2:L18, the construction of Wall E2:L19 associates with Field Phase E4. It is a long wall that divides the square into the eastern and western sections. The wall, oriented northwest for a length of 3 m, ranges from 40 to 60 cm wide and currently stands 40 to 60 cm high.



8. Architectural remains in Squares E1, E2, and E4.

For Wall E2:L19, the builders first dug a foundation trench into the Phase-E5 floors and then erected the wall on bedrock in a northeast-southwest direction. Further, at the southeastern corner of the square was a stack of stone blocks, assignable to Iron IIB, that poked out from the balks. It can be part of a wall or a certain stone installation. Its function and date await future excavations.

Concerning Square E4, the excavations revealed three wall lines. First, Wall E4:L5 was exposed in the northern part of the square and measured 2.5 m long, 80 cm wide, and 50 cm high. It was oriented north-south and continued north into Square E2. Wall E4:L5 was stratigraphically connected with Wall E2:L19 in Square E2. Thus, we provisionally assign Wall E4:L5 to Field Phase E4. Probably to be attributed to Field Phase E3, Wall E4:L10 was the second wall in Square E4, a wall we encountered directly south of Wall E4:L5. This wall extends the full length of the square in the direction of southwest-northeast, and six courses are exposed on its south side. Iron Age II pottery was found near the wall and in earth layers associated with the wall, but excavations ended before the floor could be identified. Lastly, evidence for another wall (Wall E4:L4) came from the northeast corner of the square. It was a two-row, three-course wall with a 20-degree orientation that appeared to be the continuation of Wall E2:L19.

Based on stratigraphy it is now possible to provisionally sequence the building episodes of the Iron IIB walls in Field E. It is apparent that Wall E4:L10 (Field Phase E3) was found on the earth layers sealed against Wall E4:L5 (Field Phase E4) that was contemporaneous with Wall E2:L19 and probably Wall E4:L4. On the other hand, Wall E2:L19 was built on the bedrock, cutting the surface layer on which Wall E2:L18 was constructed. Thus, it is clear that Wall E2:L18 predates Wall E2:L19 and would be attributed to Iron IIA (Field

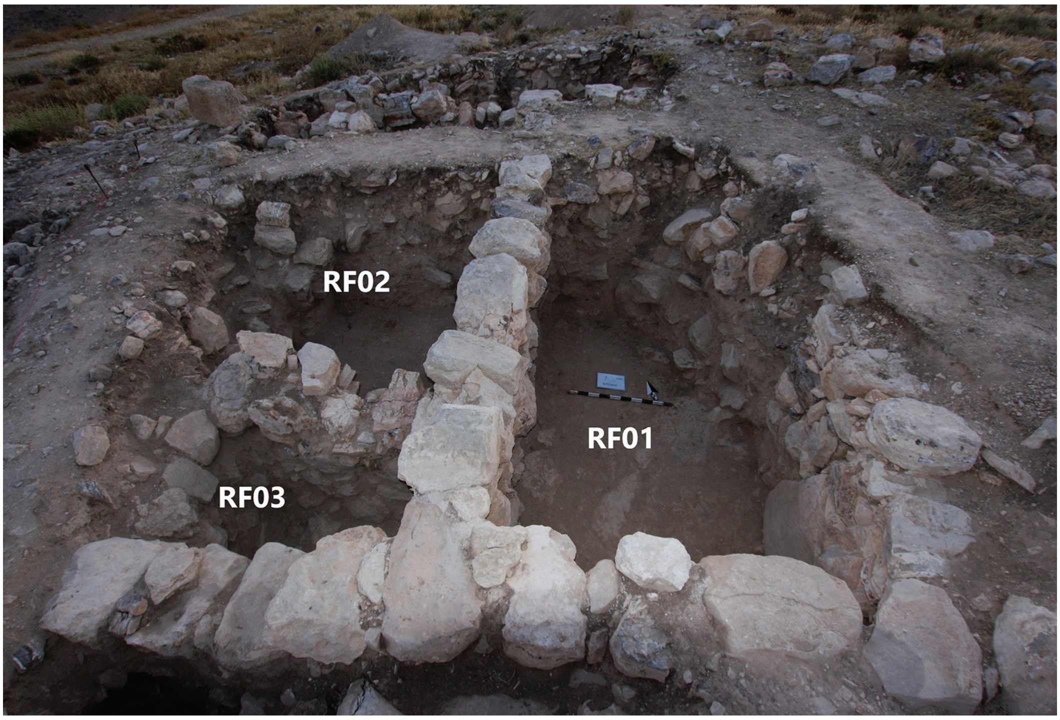
9. Iron IIB walls and floors in Square E2 (2012).

Phase E5). At the northwestern corner of Square E2 are the eastern and western walls of the Moabite shrine in Square E1. These sanctuary walls consist of the lower and upper sections (Ji 2018). The upper section of the shrine walls must be assigned to Early Iron IIB (Field Phase E4), while the lower section is dated to Iron IIA (Field Phase E5).

Field F

Field F is situated on a natural terrace north of the acropolis. Noteworthy from this field is an Iron IIB building with a couple of small rectangular rooms (RF01–RF03) that were exposed in Squares F3 and F4 (Ji and Bates 2014, 2017; Fig. 10). Specifically, in Square F3, the remains of a single-row stone wall are still standing to a height of about 2 m (Fig. 11). The rooms contained two layers of Iron IIB beaten earth floors placed on top of the Iron IIA floor. This Iron IIA floor represents the earliest period in Field F (Field Phase F5), one seemingly contemporaneous with the Iron IIA temple on the acropolis. The Iron IIB floors contained a large number of diagnostic Iron IIB potsherds dated to the 8th–7th c. BC. The Early Iron IIB floor (Field Phase F4) was associated with the building's walls that were comprised of large unhewn boulders. It is as yet unclear, due to limited exposure of the area, whether this early wall was dated to Iron IIA and reused by the subsequent Iron IIB settlers or built concurrently alongside with the Early Iron IIB floor. Meanwhile, the Late Iron IIB period (Field Phase F3) typically produced flimsy walls made up of small to medium-sized stone blocks. A small rectangular platform (IF01) was carefully constructed in the south end of the room (RF03; cf. Ji and Bates 2014: fig. 14). It was most likely used as a storage bin, on which a complete Iron IIB collared-rim storage jar was found *in situ* in 2012 (Ji and Bates 2014:

10. Architectural remains in Field F.



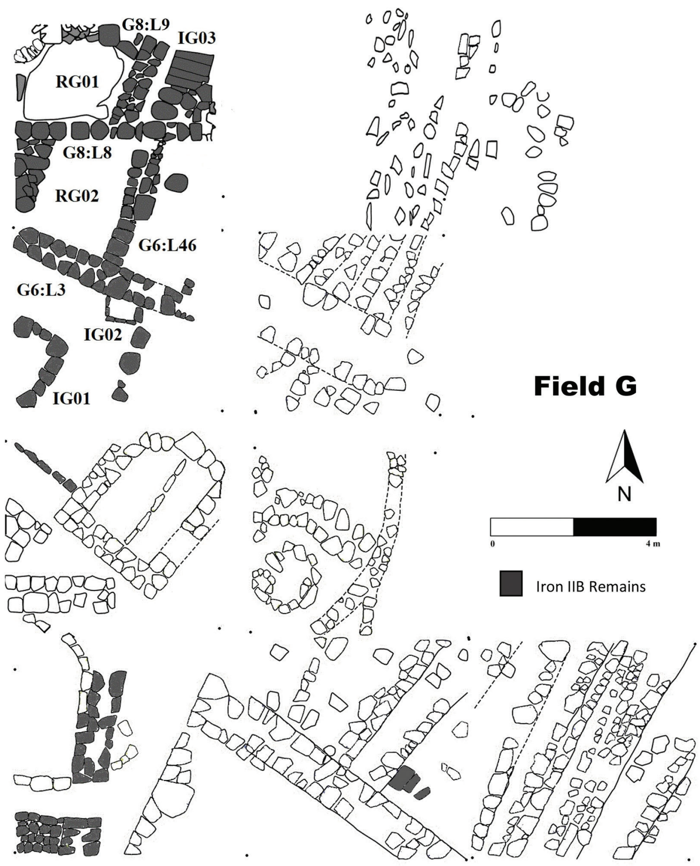
11. Iron IIB walls and floors in Square F3 (2015).

fig. 18). Stratigraphically, this installation is linked with the Late Iron IIB phase floor.

Directly to the north of Square F3 is Square F4, in which another Iron IIB building was unearthed in 2012–2015. Its 30 cm wide walls suggest that it adopted the same building technique that was observed during the late-floor phase in Square F3. Central to this building was a small rectangular room without any installations. But, as in Square F3, the excavations of the room provide the evidence of two Iron IIB usage phases, both represented by beaten earth floors and associated pottery sherds. Excavations of Square F4 has not yet reached the Iron IIA floor level found in Square F3.

Field G

Field G is pertinent to the southeastern slope of the mound. So far, clear Iron IIB evidence (Field Phases G4–G5) has been uncovered from two squares of the field: Square G6 and Square G8 (Fig. 12). Square G6 is characteristic of a major wall (Wall G6:L3) that spans the length of the square, running in a roughly east to west orientation (Fig. 13). It is a two-row wall (*ca.* 1.2 m) with a current height of 1.5 m on average, solidly constructed of medium to large boulders. To the south of this wall, and comprising the majority of the square, a sequence of possible hard surfaces emerged with Iron IIB pottery sherds along with grinding



12. Architectural remains in Field G.

13. Iron IIB installations and walls in Square G6 (2017).

stones on the surfaces.

Excavations at the southwestern corner of the square revealed a rectangular platform (IG01; *ca*. 1.5 x 2.5 m), possibly a storage bin, built using field stones in boulder-and-chink formation with walls that included stone pillars. The platform was raised about 1 m above the Early Iron IIB beaten earth floor (Field Phase G5). In the central section of the square, another rectangular stone installation (IG02) was unearthed. It was formed by three deliberately constructed stone sides, forming a rectangular enclosure (65 x 180 cm). The installation included a flat, rectangular basalt stone partially covering its compacted surface. The southeast corner of this installation was flanked by what appeared to be a possible large lintel, although this could have been part of a series of large monoliths that were intermittently used to construct Iron IIB walls or roofs.

As in Square G6, the remains found in Square G8 are almost exclusively of an Iron IIB date (Fig. 14). This square is mostly characterized by a small room (RG01) that is neatly and well preserved. The northern wall of this room includes two large, vertical ashlar stones creating a doorway into the room. There are two or three stone courses underneath the threshold of the entryway before bedrock is reached. The initial floor is attributed to the Early Iron IIB period (Field Phase G5). It used larger and smaller stones, as well as earth to create a compact surface atop the bedrock. Immediately to the east of this room, there was an impressive staircase (IG03) consisting of at least five large, rectangular flat stones. These stairs are situated within an encasement on their eastern and western sides. We are currently unable to date this installation precisely, but future seasons may attribute it to the Iron IIB period along with the buildings in Square G8.

Along the southern side of Square G8 is Wall G8:L8 (*ca.* 70 cm wide and 2

14. Iron IIB buildings and staircase in Square G8 (2019).

m long) that traverses the entirety of the square. It is perpendicular to Wall G8:L9 and runs in a precisely east-west direction. Further excavations revealed another wall that joins Wall G8:L8 at a right angle. This wall is the continuation of Wall G6:L46 that we uncovered in Square G6 in the 2017 season. A large ashlar stone helped form the foundation of Wall G6:L46. West of this wall is a square room (RG02; *ca.* 2.5 m x 2.5 m) accessed through a door in the wall. Massive amounts of pottery were discovered here on both sides of this wall. The assemblage included Iron IIB kraters, bowls, storage jars, jugs, and a lamp beside a couple of cooking pots attributed to Iron IIA. This area appears to have been used for storage or food preparation and consumption throughout the Early and Late Iron IIB periods.

To summarize, the Iron IIB period is very well represented at ʿAtarūz. It is comprised of two phases. The early phase is dated to the late 9th to the early 8th c. BC. It is certified so far in the Moabite shrine in Field E, the walls and buildings in Fields B, E, and F, and the multiple-room buildings in Field G. The architectural works in Fields B, E, F, and G, except for the sanctuary in Field E, were in continual use during the late phase of Iron IIB without any interruption. Moreover, this phase observed the construction of new walls, buildings, and water channels in the acropolis area. In other words, the evidence unearthed from Fields A and E suggest a steadily expanding settlement from Early Iron IIB to Late Iron IIB at the site.

The end of Iron IIB at ʿAtarūz is as yet obscure in terms of cause and dating, but its ceramic assemblage is broadly dated to the 9th/8th to early 7th c. BC with the appearance of some late forms, usually dated to the Iron IIC period. But these late forms are rather limited in quantity at ʿAtarūz. Further, their debut in the ceramic horizon probably took place as early as the 8th c. BC. The absence or sparseness of some typical Iron IIC forms like offset-rim bowls and black-burnished wares at ʿAtarūz further prevents us from assigning the end of the Iron II settlement to the late 7th–6th c. BC (Ji 2018; see below for the presence of these wares at Mudayna ath-Thamad). At this point, our interim suggestion is that the Iron II occupation at ʿAtarūz terminated during the transition between Iron IIB and IIC or soon after the onset of the Iron IIC period, perhaps in the early 7th c. BC.

Regional Perspective

The following discussion is a brief synthesis of the Iron IIB remains in the regions of ʿAtarūz, the Mādabā Plains, and the Dhībān Plateau. This exploration can help us understand the Iron IIB occupation of ʿAtarūz in a regional context. From the succeeding discussion, we learn that the Iron IIB occupation at ʿAtarūz was one example of many settlements that were widespread in central Jordan during the period. Indeed, it was part of a great settlement intensification in the region, most likely inaugurated by and maintained under the auspices of King Mesha, later kings, and the people of the Moabite kingdom.

To begin with the Mādabā Plains, the ruin of Mādabā contains a large Iron II fortification wall and several associated architectural remains (Harrison *et al.* 2000, 2003; Harrison 2009). The original phase of the fortification (Field B, western Mādabā) was constructed immediately upon bedrock, even though the date of the original wall is unknown. The wall appears to have been rebuilt and reinforced at least once, if not twice, during the Iron II period, bringing the wall to 5 m in width in some areas. A limited probe against the expansion wall reached Iron II levels, which produced a large volume of Iron II pottery. The combination of this pottery corpus and those from the southeastern section of the city (Field A) suggests the presence of a fortified city at Mādabā during the Iron IIB period.

The published ceramic assemblage from Mādabā includes Moabite square cooking pots and painted wares along with several late Iron IIA cooking pots and a variety of Iron II storage jars such as ridged-neck, collared-rim, and neckless forms (*cf.* Harrison *et al.* 2000: fig. 9; Harrison *et al.* 2003: figs. 4–5). The corpus is strikingly similar in typology to those from the Moabite shrine and post-shrine occupation at ʿAtarūz (*cf.* Ji 2018: figs. 8–9, 11). The Mādabā assemblage may include a limited number of later forms datable to Iron IIC, but they already made their debut during the Iron IIB period, which leaves us on shaky ground for convincingly arguing that there was a settlement at Mādabā in the Iron IIC period. Overall, the excavations at Mādabā support the existence of a fortified settlement during the Iron IIB period.

The remains at Jalūl also provide evidence for Iron IIB occupation (Younker *et al.* 2007, 2009; Gregor *et al.* 2011, 2012). It is well represented by buildings in Fields A and F and a paved approach ramp in Field B (de Prestes, 2014). The Iron IIB city was abandoned or destroyed shortly after the 8th c. BC. Iron IIC presents a picture of a flourishing Ammonite town equipped with a large tripartite building (Field A) and an extensive water channel system (Fields G and W), both dated to the 7th c. BC. In addition, as was the case with Jalūl, ample remains of the Iron IIB period were found at Tall Jawa, which continued into the Iron IIC period (Daviau 2003). The floruit of the Jawa settlement is seemingly dated to the late 9th–7th centuries BC.

Rujm ʿAtarūz is a fortress site, roughly 3.5 km east of Khirbat ʿAtarūz, on a medium-sized rocky hill by the road between Libb and Machaerus (Ji 2016). According to the investigations, the fortress was built based on a single plan, enjoying the natural protection provided by the height of the hillock. Its exterior walls were roughly 1.5 m thick. The fortress is estimated to have been *ca.* 17.5 x 18.0 m in size and stood up to at least 3.6 m above the ground. Given the current evidence available, Rujm ʿAtarūz was seemingly constructed as a military outpost in the 9th c. BC and was in continuous use in the 8th –7th centuries BC. During these Iron II eras, the northern part of the fortress might have been utilized as a look-out podium or watchtower, whereas the southern side of the building was used for residence and domestic activities.

Turning to the south, we notice that Dhībān presents a similar version of Iron IIB stratigraphy to that of ʿAtarūz, comprised of two major Iron IIB building phases. Particularly eminent is the discovery of a large palace-like public building at the summit (Area L; Morton 1955, 1989; Routledge 2004). This building, with multiple interior rooms, was built in the mid–late 9th c. BC. It measures larger than 21 x 43 m in size with important walls of up to 1.25 m in thickness. The building witnessed a renovation sometime in the 8th c. BC, which included the construction of a plastered water cistern and drain/conduit. Above the second building phase are the earth deposits with pottery sherds dated to the late 7th c. BC. Once again, as for Mādabā, the published pottery assemblage from the summit area is reminiscent of the Iron IIB corpus from ʿAtarūz (*cf.* Routledge 2004: figs. 8.6–7).

Iron IIB evidence also prevails at Mudayna ath-Thamad in the northeastern Dhībān Plateau. Excavations at the site revealed a small Moabite sanctuary, a well-preserved six-chambered gate, a casemate wall, several pillared buildings, and a textile-related industrial complex along with many incense burners, stone basins, clay loom weights, and hundreds of astragali (Daviau *et al.* 2006, 2008, 2012). A clear illustration of Iron II stratigraphical sequences of Mudayna ath-Thamad is not yet available in the literature, but it is very likely that the city was fortified at the beginning of the 8th (or end of the 9th) c. BC and thrived through the Iron IIB period until it came to an end near the end of the 7th c. BC when the town was attacked. Steiner (2013, 2019) dates the Moabite sanctuary to the 7th c. BC (*cf.* Daviau and Steiner 2000); similarly, she assigns the termination of the settlement to around 600 BC. This dating seems to be in line with the published pottery assemblage (Steiner 2009: figs. 3, 5, 7) that contains typical Moabite square cooking pots, grooved-rim cooking pots, and offset-rimmed black ware normally dated to the 7th–6th c. BC (Ray 2001: 144; Herr 2006; Daviau and Graham 2009; Tappy 2015: pl. 3.2.3:2).

Roughly 3 km west of Mudayna ath-Thamad is an open-air cultic site, Site WT-13 of the Wādī ath-Thamad survey, represented by a perimeter-wall enclosure covering an area of 7 x 14 m (Daviau 2017). The finds include a great number of ceramic statuettes, figurines, architectural models, amulets, miniature vessels, marine shells, and exotic geological samples, including fossils. The WT-13 site is dated to the 8th–7th c. BC.

In addition, Iron IIB saw the erection of a new fort on top of the abandoned Iron I settlement at Aroer (Dearman 1989: 185). The fort is a single unit occupying the area of 50 square meters (Olavarri 1965, 1969). It was circumvallated with a casemate wall that formed a defense structure of great strength. Inside the exterior wall was a residential structure comprised of multiple passages, walls, and rooms. A reservoir was dug in front of the northwest of the fort to store rainwater. Aroer experienced abandonment during the transition from Iron IIB to Iron IIC, probably early in the 7th c. BC (Olavarri 1993).

Finally, Balua was a flourishing town during the Iron IIB–IIC periods (Worschech 1989; Worschech and Ninow

1992). The recent excavations revealed a large Iron IIB house with multiple rooms (Selover 2019). The doors of the house were found preserved with door lintels, which is reminiscent of the large lintel stones found from the Iron IIB houses at ʿAtarūz. The casemate fortification system appears to have been built in the Late Iron I/Early Iron IIA period (Acevedo 2019). But a renovation of the casemate room, adding a partition wall and beaten earth floor, took place during the Iron IIB era. The room was destroyed in a fire. To the west of the casemate wall was a hard-packed earth surface full of Iron IIB pottery. On top of this surface were large amounts of boulder tumble. The fire and rock tumble seem to be associated with the end of the Iron II settlement at Balua. Overall, Balua seems to have been a thriving town during the Iron IIB period, that came to an end during the Iron IIB–IIC transition or the early part of the Iron IIC period.

On the other hand, the arguments for an Iron IIB settlement intensification of the northwestern area of the Mādabā Plains do not all apply. Ḥisbān provides scanty evidence of Iron IIA and Early Iron IIB; the Late Iron IIB period was inhabited, at best, lightly, perhaps by some squatter settlement with no permanent architecture (Ray 2001). The modest Iron IIB era stands in sharp contrast with the Iron IIC occupation (Stratum 16), which was a prosperous town with clear Ammonite signatures. As in Ḥisbān, very little evidence for Iron IIA exists at Umayri (Herr 2018). Iron IIB is slightly better evidenced than Iron IIA as it is represented by pottery sherds and one wall line in Field L. Notwithstanding these finds, Iron IIB is overall very poorly represented at Umayri. Further, Herr (2018) denotes a complete settlement hiatus from the early 7th to late 7th c. BC at the site, after which a new settlement process began to reach its zenith in the 6th c. BC. This Iron IIC occupation should be attributed to the Ammonites.

The disparity of Iron IIB evidence between the Aaruz-Dhībān area and the northern Mādabā Plains gives credence to the view that the Iron IIB settlement intensification in central Jordan was related to the Moabites. The peak of the Moabite dominance would be designated to the late 9th and 8th c. BC. This view is not foreign to the archaeologists working in the region. Harrison and his colleagues (2003: 135), for instance, associated the Iron IIB settlement at Mādabā with Mesha and the Moabites. ʿAtarūz was under the control of the Moabites during the Iron IIB period as well (Ji 2018). According to Ray (2001: 125), the Moabites inhabited Ḥisbān during the Iron IIB period. Olavarri (1993: 93) contended that Mesha was behind the construction of the impressive Iron IIB fort at Aroer. The nature of the Iron IIC settlements at Ḥisbān, Umayri, Jalūl, and Jawa is markedly different from that of the Iron IIB occupations in the region. They were Ammonite (*cf.* Daviau 1997). Ray (2001: 146) dates the transition from Iron IIB to Iron IIC at Ḥisbān to 712–11 BC after Moab defied Sargon II. This would seem to imply the decline of the Moabite hegemony in the region began near the end of the 8th c. BC or no later than the beginning of the 7th c. BC. ʿAtarūz seems to fit this picture well.

Some Moabite towns along the trade route in the east, for example Mudayna ath-Thamad and Balua, would have survived longer, lasting to the end of the 7th c. BC (*cf.* Steiner 2013). The advance of the Ammonites to the northern and eastern Mādabā Plains and their prosperity and trade activities during the 7th–6th c. BC might have contributed to the greater longevity of these eastern towns compared with ʿAtarūz in the west. The sudden emergence of a fortress at Lehun during the Iron IIC period after a long occupational gap at the site can be explained in the same context (*cf.* Homes-Fredericq 1989, 2002). These Iron IIC remains form a rough north-to-south trade line along the desert fringe to the east of Moab's capital and the heartland of the kingdom. ʿAtarūz was far from this region; thus its Iron II settlement perhaps came to an end, along with the decline of the Moabite power in the region, somewhat earlier than those of its counterpart cities in the east or near the Ammonite territory. This perspective also explains the seemingly relative sparsity of Iron IIC evidence at Dhībān and Mādabā. Rujm ʿAtarūz ceased to function around the same time, as well.

Conclusion

The evidence from ʿAtarūz suggests a continuous occupation at the site during Iron IIB, despite the extensive destruction of the city at the end of the Iron IIA period, *ca*. the mid/late 9th c. BC. A high density of material debris accumulated over about two centuries during the period of Iron IIB. A small sanctuary was present on the acropolis area during the Iron IIA–IIB transition. It was identified as a Moabite shrine that was used for about one century or less from the late 9th to the early 8th c. BC. Notwithstanding this discovery, overall, the cultic feature is tenuous, or at least decreasing in association with Iron IIB ʿAtarūz. Other evidence for cultic activities, except for a couple of female figurines from the surface, have not yet been identified. Instead, the Iron IIB period at ʿAtarūz is typical of a residential town whose occupants invested great time and effort in constructing domestic houses and water channels, which implies that they planned to occupy the site for an extended period. For defense, they seem to have largely reused the fortification walls from the Iron IIA period. Their assemblage of material culture, such as new architectural features and Moabite painted ware, can be contended to point to the Iron IIB residents' connection with the Moabites from the south. The finding of an inscribed Moabite altar from the shrine lends additional support to a high degree of association of the Iron IIB inhabitants with the Moabite Kingdom.

The present conclusions concerning the Iron IIB period of ʿAtarūz are derived from the ongoing excavations of rather limited areas in Fields B, F, and G. The continuation of excavations in these areas and their vicinity will enhance our comprehension of the Iron IIB settlement of the site, even possibly correcting some of our views professed in this paper. Further, we are not as yet entirely sure of when the Iron II settlement came to an end at ʿAtarūz. The lack of typical Iron IIC and early Persian pottery found from the Mādabā Plains may posit the early 7th c. BC as the finish/end of the Iron II settlement at ʿAtarūz. Yet, the Iron IIB–IIC ceramic typology and chronology south of the Mādabā Plains are not firmly established. At this point, it might be precarious to date the terminus of the Iron Age II of the ʿAtarūz region based on the data from the north. The land mostly belonged to the Ammonites during this period. We will revisit this issue as excavations continue at ʿAtarūz and other Iron II sites in the region of ancient Moab.

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The Iron Age IIB–C Ammonite Strongholds of Jamʿān and Rujm al-Jāmūs, North-Central Jordan

Introduction

In the last decades an unprecedented urban development in the districts of ʻAmmān, as-Salṭ, al-Balqāʾ, and az-Zarqāʾ has deeply impacted archaeological sites, many of which lay beneath modern buildings. Most recent surveys and excavations—mainly focused on small prehistoric sites, dolmens, cairns, and other multi-period installations for the sake of their preservation and recording their correct location on official maps—achieved the highly commendable task of saving invaluable information and produced fresh archaeological data now incorporated into the MEGA-Jordan database (www.megajordan.org).

In 2015–2017, the Department of Antiquities of Jordan (DoA) carried out rescue interventions and salvage excavations at the Iron Age IIB–C sites of Jamʿān and Rujm al-Jāmūs, in the area of the Governorate of Zarqa, under the direction of Mr. Roumel Gharib, and with the participation of the surveyor Taufik al-Huniti. Two seasons of excavations took place at Jamʿān in 2015 and 2016, and at the end of the rescue archaeological work the main feature of the site, a monumental square tower, was dismantled and rebuilt on the nearby site of Khirbat Zūbyā by the DoA Zarqa Directorate (Nigro and Gharib 2016). In spring 2017, a salvage intervention at the site of Rujm al-Jāmūs was then conducted, and in the following year the state-owned portion of the archaeological area was encircled by an iron fence.

A small team from La Sapienza University of Rome together with personnel of the DoA office of Zarqa studied the architecture and finds (basically pottery and small finds). The two sites have been mapped, carefully surveyed, thoroughly explored, and all related materials have been analyzed with the aim of reconstructing the stratigraphy and architecture of these monuments. Jordanian and Italian

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personnel worked as a team, and this preliminary report is the fruit of their joint work.

Geographical Setting

The site of Jam'ān (32° 05'26.33" N, 35° 57'41.54" E) is located in the subdistrict of Bīrīn, part of the Governorate of Zarqa in the Hashemite Kingdom of Jordan, about 16 km north of 'Ammān. The site lies 0.72 km south of the ancient ruins of Khirbat Zūbyā and 0.5 km east of the village and small tall of Bīrīn (modern dialect corruption of Bīrīn, "the two cisterns", which is actually a distinguishing feature of Jam'ān), just south of the main road running from Wādī Shūmar, a left (western) tributary of the Zarqa River, over the pass into Wādī al-Faṭāyir, and in the underlying Sahl al-Buqay'ah. In antiquity, Wādī Shūmar was a useful shortcut directly connecting the ford across the Zarqa by Junaynah (Sala 2008: 366–7) and al-Batrāwī with the Pass of Bīrīn, 10 km to the east. Jam'ān lays exactly along the pass (elevation 825 m above the sea level) at a clear bend in the ancient road, which leads to the site of Umm ar-Rummānah, 3 km to the west.

The site of Rujm al-Jāmūs (32° 07'53.21" N, 36° 02'45.06" E) is located in the same region of the Upper Wādī az-Zarqā' Valley, immediately west of the site of Jabal ar-Ruḥayl and 5 km to the south-west of Tall al-Bīrah (Sala 2008: 369–71). Rujm al-Jāmūs also lays in a particularly favorable position, exactly along a wide bend of the Zarqa River where a pass dominated the access to the Upper Wādī az-Zarqā' Valley and connected

1. Map of the southern Levant with major sites of the Iron Age II period and the strongholds of Jam'ān and Rujm al-Jāmūs in the Ammon territory.

the latter with the Wādī aḍ-Ḍulayl.

Both passes, overlooked from the fortresses of Jam'ān and Rujm al-Jāmūs, allowed fast and direct access to the southern Jordan Valley and a firm control over the western and southern borders of the Ammonite Kingdom (Fig. 1).

Historical Setting: The Borders of the Ammonite Kingdom

During the Iron Age II (960–586 BC; Nigro 2014), Upper and Middle Wādī az-Zarqā' (Biblical Jabbok) and its tributaries were the core of the Kingdom of Ammon, known in Neo-Assyrian texts as *Bît-Ammani*, whose king Ba'asa took part in the coalition of forces gathered by the king of Soba/Damascus against the invading Neo-Assyrian army at the battle of Qarqar on the Orontes in 853 BC (Lawson Younger 2003).

The earliest document on the Ammonite Kingdom was found in Jabal al-Qal'ah, *i.e.*, the 'Ammān Citadel (Horn 1969; Albright 1970), ancient *Rabbath Ammon* (2 Sam. 12:26, 29). The list of kings of Ammon is known from a series of inscriptions (Puech 1985; Aufrecht 1989; Kletter 1991: n. 12; Stern 2001: 238–40) and statues (Bienkowski 1991: 38–51; Zayadine 1991), from the second half of the 8th c. BC (Nigro and Gharib 2016: table 1), when Ammonite kings Šanibu paid tribute to Tiglath-pileser III (744–727 BC), Zakir and his son Yerah-azar to Sargon II (721–705 BC), Puduilu to Sennacherib (704–681 BC) and Esarhaddon (680–669 BC), and 'Ammi-nadab I to Ashurbanipal (668–631 BC), who also campaigned in the country during his war against the Arabs. Ammon remained a vassal kingdom of Assyria also during the reigns of Ashurbanipal's successors between *ca.* 630 and 610 BC, with the king Ḥiṣṣal'el, and successively Ammi-nadab II, both known from the inscription on the Tall as-Sīrān bottle (Thompson and Zayadine 1974; Bienkowski 1991: 141). With the definitive Assyrian defeat at Harran in 610 BC, and after the accession to the throne of Nebuchadnezzar II (604–562 BC), Ammon also fell under Neo-Babylonian sovereignty (Lipschits 2004: 43–6). The dynasty of 'Ammi-nadab I apparently held power, with his grandson 'Ammi-nadab II, who reigned between *ca.* 610–590 BC, and his successors Ḥanan'el and Ba'alys, who were possibly contemporaries of Gedaliah of Judah (van der Veen 2007; Burnett 2016b: 320).

During this long period, Jam'ān and Rujm al-Jāmūs were part of the defensive strongholds of the Ammonite Kingdom. Towards the mid-6th c. BC, the fortresses were destroyed and their towers abandoned, likely when the Persians replaced the Babylonians as rulers over the country, transforming Ammon into a province of their empire (Stern 2001: 369).

During the Iron Age IIB–C (*ca.* 840–586 BC), which is the approximate date indicated by ceramic finds at Jam'ān and Rujm al-Jāmūs, the area of the Upper Wādī az-Zarqā' was under the control of the king of Ammon, ruling from the capital city of Rabbath Ammon, identified with Jabal al-Qal'ah, the Citadel of present-day 'Ammān (Zayadine *et al.* 1989; Mansour 2002). The "House of Ammon" was protected by means of forts and strongholds erected by crossroads or on hilltops overlooking vast portions of territory, as well as in strategic geomorphological locations like passes and fords, especially on its western and southern boundaries (Gese 1958: 57, 63; Kletter 1991: 43–4 fig. 10; Hübner 1992: 141–50; Stern 2001: 246–7). The orographic step dividing the district within the bend of the Zarqa River, from the valleys of as-Salṭ and al-Balqā' and the mountain range between them and the Jordan, became a natural boundary in antiquity. This boundary was marked by multiple lines (a network or chain) of fortresses and strongholds located in the al-Buqay'ah itself and on the most prominent positions over the highest hill range west of the Zarqa River. A line of fortresses and

2. View of the territory of Kingdom of Ammon with the strategic location of the sites of Jam'ān and Rujm al-Jāmūs.

towers NNW of 'Ammān (Glueck 1939: 246–7) has been interpreted as the western border of the Iron Age IIB–C (840–586 BC) Kingdom of Ammon. The innermost line, in respect to Rabbath Ammon, runs NNE from Khaldā to al-Jubayhah, Khirbat Badrān, continuing further north up to the definitive bend westwards of the Zarqa River. Here it seems plausible that the northern border of Ammon on the Zarqa River was protected by a major fortress on the site of Tall al-Bīrah, which lies 5 km north-east of Rujm al-Jāmūs and 9.5 km north of Jam'ān (Fig. 2).

The network of fortresses surrounding 'Ammān, in which Jam'ān and Rujm al-Jāmūs were included, has been regarded as the north-western border of Ammon during the times of the confrontation with the Israelites (Gese 1958: 57; Fohrer 1961: 66; Landes 1961: 73; Graf-Revcmlow 1963: 136–7), or more convincingly, as the *limes* of the Neo-Assyrian vassal state of *Bît-Ammani* (Kletter 1991: 42–4; Lipschits 2004: 41). This second interpretation appears to be corroborated by finds at these sites.

The Strongholds of Jam'ān and Rujm al-Jāmūs

Scholars traditionally labeled a series of monumental structures made of large limestone boulders punctuating the region south, west, and north of 'Ammān as "Ammonite fortresses".[1] These structures exhibit different features (Glueck 1939: 155), some of them being square (*qaṣrs*) and other round (*rujm*), and they often have diverse chronologies.[2]

[1] These structures are also called "Malfūf buildings", like "cabbage towers" (Kletter 1991; see also MacDonald 1999: 41–2).

[2] Actually, the date of such watchtowers varies considerably from the Iron Age to the Ottoman period, with many possible reuses (Najjar 1999: 103–4). The fortresses that were likely in use during the Iron Age II are: Rujm al-Malfūf North (Yassine 1988: 17), Rujm al-Malfūf South (Thompson 1973: 47–50; Najjar 1999: 105), Rujm al-Ḥinū and Rujm al-Ḥāwī (Clark 1983; McGovern 1983: 136; 1986: 9; 1989: 40-42), Rujm al-Mukhayzin (Thompson 1984, 38), Khaldā (Najjar 1992: 14–20), al-Jubayhah (Muheisen

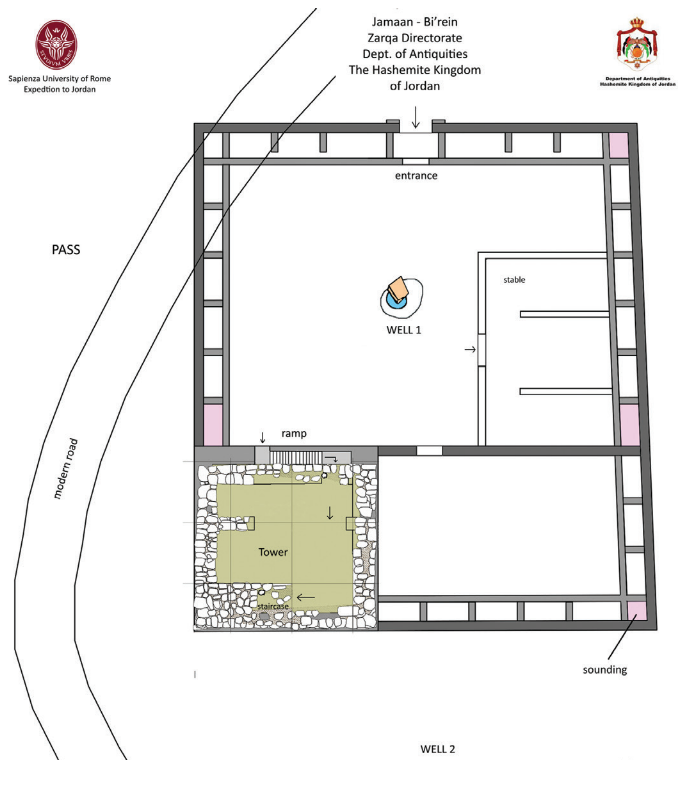
Similar in form, the strongholds of Jam‘ān and Rujm al-Jāmūs consisted of a rectangular enclosure including a raised podium. The fortresses were defended by a double perimeter wall with casemates in between. Structures were built with roughly cut limestone and quartz boulders of average dimensions (0.7–0.8×0.4–0.5 m), usually laid in two rows of superimposed courses set in a conglomerate of mortar tempered with pebbles and small stone chips. The interior portions of the walls were filled with rubble consisting of medium sized irregular stones.

The typology of the buildings is well known in the Iron Age II southern Levant, and it has been called a "citadel" even though this term typically describes palatial complexes and fortresses, which often exhibit strong dimensional variations (Nigro 1994: 203–91, 436–52; Bonfil and Zarzecki-Peleg 2007: 32–3; Lehmann and Killebrew 2010; Ripepi 2012). Jam‘ān and Rujm al-Jāmūs may be reasonably included among the list of fortified sites overlooking the "House of Ammon".

The Architecture

The strongholds of Jam‘ān and Rujm al-Jāmūs are characterized by the presence of specific features: a rectangular enclosure, a podium, a tower, and a water reservoir. The enclosure of Jam‘ān measured 41.56 m on the north-south axis and 37.8 m on the east-west, where almost half of the length was occupied by the square podium located in the corner of the precinct that overlooked the pass (Fig. 3). The enclosure wall

1976), Khirbat Salāmah (Lenzen and McQuitty 1987: 203; 1989: 544), and Khirbat al-Ḥajjār (Thompson 1972: 62; 1977: 29).



3. Plan of the stronghold of Jam‘ān.

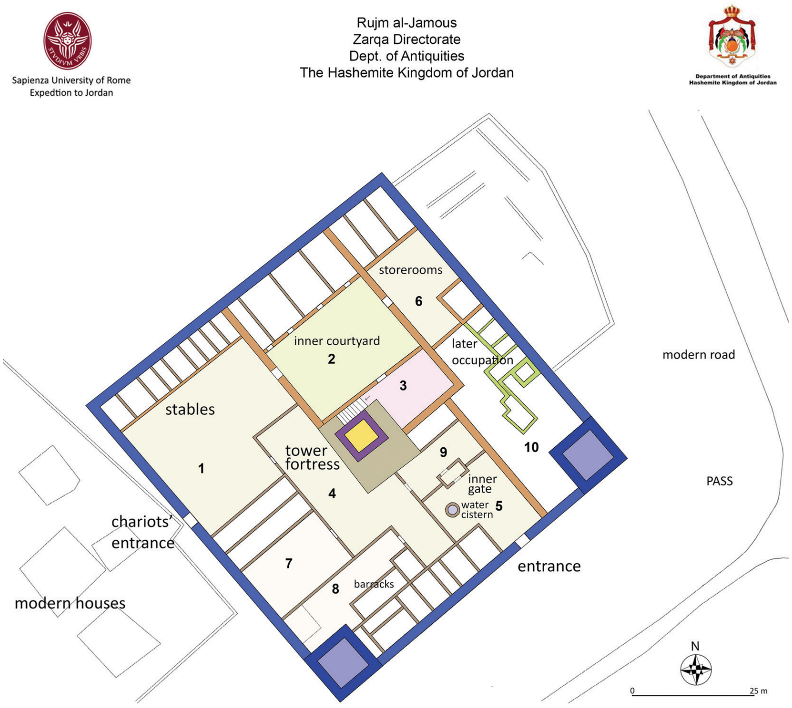
4. View of the eastern side of the enclosure at Jamʿān, seen from the south.

consisted of an exterior structure, around 1.45–1.55 m thick, and a parallel thinner wall (0.8–1.0 m thick) inside, creating two delimiting rectangular rooms that ran around the perimeter of the stronghold. The north-western corner of the enclosure has been destroyed by the modern road that cuts through the site, and the northern side suffered major looting. Nevertheless, it is clear that the gate of the fort was located on the northern side, with an outer passage that was 2.7 m wide and an inner one measuring 2.1 m wide. The eastern side of the enclosure is the best preserved (Fig. 4), and two soundings were excavated inside the casemates down to the earliest floor of the chamber which was built on bedrock. Ten meters inside the entrance, the circular mouth of a cistern is carefully hewn into the bedrock. A drain possibly connected it to a drinking trough for caravans. In the latest stratigraphic phase (Neo-Babylonian period), the eastern part of the entrance courtyard contained a stable. An inner courtyard flanked the tower and occupied the south-eastern quadrant of the fortress. The podium occupied the south-western corner of the enclosure, overlooking the underlying pass and the track climbing it. It was preserved with 6 to 10 super-imposed courses of stones, with some remnants of the walls of the tower standing over it, reaching an overall elevation of 4 m (Fig. 5). The podium measured 14.42×14.56 m, with a base slightly larger than the podium itself, so that a small step jutted off the face of the structure at its bottom. The monumental side-walls of the podium, 1.6–1.8 m thick, were made of large limestone blocks that had slightly battered faces and reached the height of 3.12 m (6 cubits). The outer face of the podium was surprisingly well plastered with a thick layer of mortar and fine clayish light brown lime. Three very regular courses of blocks were standing on the crepidoma, roughly 0.46 m high, and followed by two other courses of roughly intermingled blocks and stones. This detail is possibly the vestige of a reconstruction undertaken at some phase of the building's life. Big boulders reinforced its corners, and on the eastern side, a ramp abutted its corner to give access to the tower on top. The square basement was subdivided inside by three structures, and the inner blind chambers were filled with small stones. Upon this raised podium, a square tower was erected, measuring 12.48×12.48 m (24 cubits). The walls of the tower were made of blocks smaller than those of the podium, laid in three rows, suggesting that this structure

5. View of the north-eastern corner (a), the south-western corner (b), and the eastern side (c) of the podium of Jam'ān, respectively seen from the north-east, the west, and the east.

6. Neo-Assyrian stone door-socket found at the entrance of the tower of Jamʿān.

could reach a height of at least of 9.4 m. The overall height of the building, podium plus tower, was around 12.5 m. The collapsed remains of the tower were quickly excavated, and the inner layout of this structure was partially reconstructed. The entrance was located on the eastern side, where a staircase and a ramp flanked the podium leading to the tower upon it. The entrance was marked by the presence of a door-socket of a distinguished Neo-Assyrian cylindrical elongated type (FIG. 6); a second one, of the same shape and dimensions, was found by the door leading to the staircase made of wood. This allowed access to the upper floor and the roof from the room in the south-western



7. Plan of the stronghold of Rujm al-Jāmūs and sketch drawing of the stronghold (by author Lorenzo Nigro).

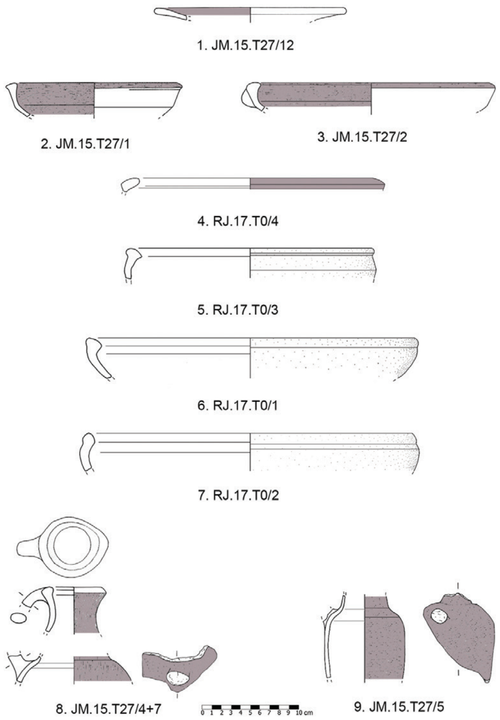
8. General view of Rujm al-Jāmūs from the north-western corner of the enclosure; in the background, the monumental podium of the tower fortress and the site of Jabal ar-Ruḥayyil can be seen from the north-west.

corner of the ground floor. The tower had two storeys: the ground floor was possibly a vaulted hall, while the upper floor had a flat ceiling, which also served as a lookout platform.

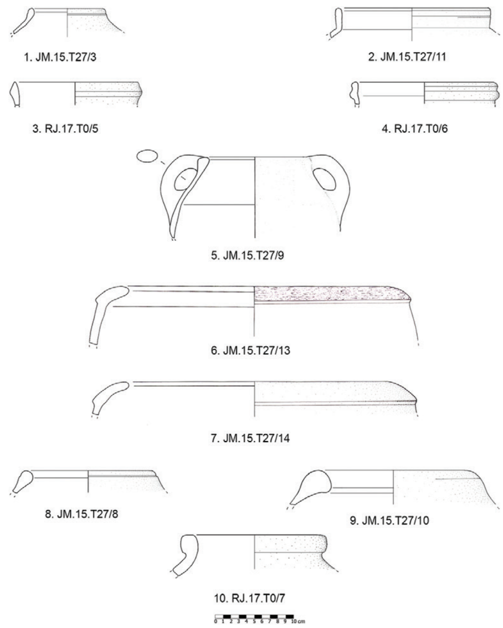
The stronghold of Rujm al-Jāmūs has been carefully mapped and surveyed, and the main features of its architecture can be outlined (Fig. 7). The rectangular enclosures measured 100 m on the north-south axis and about 80 m on the east-west axis. As in the case of Jamʿān, the enclosure wall consisted of an exterior structure 1 m thick and a parallel thinner wall (0.5 m thick), delimiting rectangular rooms or casemates, some of them large and divided by courtyards (Fig. 8). The main entrance was located on the southern side facing the road towards Rabbath Ammon, and a well or cistern was located just inside the entrance. The podium occupied the center of the stronghold and supported an overlying square tower (Fig. 9). The perimeter walls and the side-walls of the podium were made of roughly squared large limestone blocks, some of them reaching the dimension of 2.1 m (4 cubits).

The inner space of the fortress was subdivided into 10 open spaces of different sizes and shapes. The main courtyard (1) was accessible from the west, and was devoted to chariots and horses, as the long rooms on the NE perimeter wall can be interpreted as stables. The second courtyard (2), north of the central tower, is flanked by larger structures possibly hosting chariots, while a further court (6) to the west featured a smith's workshop and was likely devoted to the repair of these military devices (hearths were detected on the ground and in bedrock cavities). From court 2, a passage led to forecourt 3, which was the entrance to the central tower. It was not accessible from the main entrance of the fortress, but from a side entrance. From courtyard 1, one could also access an elongated space (4) leading to court 7, with further storerooms to the side, and court 8, connected to barracks for troops, and one of the two corner towers of the main enclosure. The main entrance

9. View of the south-western side (a), the south-eastern side (b), and the north-eastern side (c) of the podium of Rujm al-Jāmūs, respectively seen from the south, the south-east, and the east.



10. Iron Age IIB–C table ware from Jam'ān (JM) and Rujm al-Jāmūs (RJ).



11. Iron Age IIB–C cooking and storage ware from Jam'ān (JM) and Rujm al-Jāmūs (RJ).

on the SE side gave access to a relatively small court, with the cistern in a corner and a guardhouse leading to court 9, and from this to court 4. This complexity of the interior spaces protected the central tower and underscore the military function of the fortress.

Pottery and Other Finds

A great amount of pottery fragments and meaningful finds have been recovered from the excavation of the destruction layers inside the tower of Jamā'n and on the surface of Rujm al-Jāmūs during survey activities. All these materials date to the latest phases of use of both strongholds, from the mid-7th to the beginning of the 6th c. BC. A brief description of the pottery assemblages from both sites is presented here, together with an analysis of the most remarkable finds retrieved during the salvage excavations in the stronghold of Jam'ān.

Pottery Shapes

Table ware (Fig. 10) includes vessels coated with a dark brownish red slip, sometimes roughly burnished with a wooden tool. A plate (saucer) of coastal tradition (Fig. 10:1), carinated bowls with emboldened or expanded rim (Fig. 10:2–3), a krater with rounded inverted rim (Fig. 10:4) and coated with a highly burnished red slip (Bienkowski 2015: pl. 3.6.1: 11) were found; similar to simple ware carinated bowls with thickened inverted rims (Fig. 10:5–7). These are among the most common open shapes in Late Iron IIC (*ca.* 680–580 BC) Ammonite contexts (Bienkowski 2015: 420 pl. 3.6.1:

12. Duck-shaped red quartzite weight from Jamʿān.

7). Dipper jugs and juglets (Fig. 10:8–9) are also coated with a thick brownish slip (Collins *et al.* 2015: 236; Herr 2015: 285 pl. 2.6.11: 8). Cooking jugs (Fig. 11:1), pots (Fig. 11:2–5), kraters (Fig. 11:6–7), storage jars, and pithoi (Fig. 11:8–10) fit well in the Late Iron IIC ceramic horizon of Ammon (Bienkowski 2015: pl. 3.6.2: 5–6; Herr 2015: 263 pl. 2.6.6: 1), and may reflect some Neo-Assyrian influence, depending on the style of so-called Palace Ware (Bienkowski 2015: 421; Hunt 2015: 146–81).

Finds: Stone Tools, the Duck-Weight, and the Male Statuette from Jamʿān

Excavations at Jamʿān brought to light a rich collection of interesting finds. Among a distinguished set of stone tools of counter weights, grinding tools, and door sockets (Nigro and Gharib 2016: figs. 15–17), two objects are particularly noteworthy finds. A balance weight made of red quartzite, in the shape of a duck with an eroded head (Fig. 12), and the head of a male statuette (Fig. 13).

Duck-weights are common in Neo-Assyrian and Neo-Babylonian contexts, especially palaces, residences, and admin-

13. The head of a fine limestone statuette of a male personage, probably a high official or a military officer, found at Jamʿān.

14. Lateral and rear views of the male statuette found at Jam'ān with its hairstyle clearly visible.

istrative buildings, and are the size of light mina (about 480 g) or heavy or double mina (about 1 kg), while they are usually of reduced size in tombs, transformed into beads (Peyronel 2015: 100–1). The weight from Jam'ān is 345 g, and, with the integrated missing part, it should correspond to 1 light mina (MA.NA) of the Neo-Assyrian weighing system.

The head of a fine limestone statuette portraying a male personage was found in the destruction layer near the approaching ramp of the tower. The sculpture is 13 cm high, roughly carved (partially incised), and its surface also shows some graffiti. It is of quite reduced size and lower stylistic quality with respect to other extant Ammonite sculptures found in 'Ammān or in its surroundings (Abou Assaf 1980; Ornan 1986: 36–9; 'Amr 1990; Burnett 2016a, 2016c). The iconography of the individual is consistent with that of a high official or a military officer (Fig. 14).[3] His eyes and ears are schematically carved, and the eyebrows are disharmonically unified. The individual is beadless and exhibits a distinguished hairstyle that is a neat separation of radial braids. This iconography may recall some Arab of Madianite hairstyle, as it is similar to the Arabs riding camels visible on the reliefs from Room L in Assurbanipal's North Palace at Niniveh which depict the war against the Arab Queen Adiâ (Dolce 1995: 36–7 fig. 6; Nigro 1995: fig. 126; Matthiae 1996: 186 fig. 9.6).

Conclusions

Thanks to the commitment of the DoA Zarqa Directorate, the sites of Jam'ān and Rujm al-Jāmūs, previously (and almost completely) neglected by archaeologists, were documented and their historical-archaeological roles in the Iron Age have come to light. After the rescue interventions between 2015 and 2017, it became clear

[3] The statue from Jam'ān can hardly be associated with royal statuary or cult statues. In Ammonite statuary, the element characterizing the gods is the atef crown (Mallowan and Herrmann 1974: 106; Negbi 1976: 31; Abou Assaf 1980: 78; Daviau and Dion 1994; Burnett 2009, 2016a: 58–65, 2016c: 30–1). Ammonite kings' statues are characterized by the presence of a headband or diadem, as shown by the statue of Yerah-azar (Abou Assaf 1980: pl. VI; Burnett 2016c: 64–5).

that Jamʿān and Rujm al-Jāmūs were two strongholds along the northern border of the great Ammonite Kingdom during the 9th to 6th c. BC.

The chronological setting of these sites has been confirmed by the analysis of material culture conducted in cooperation with the La Sapienza University team of the Expedition to Palestine and Jordan. Ceramic fragments going back to a century or more before Iron IIB were found, but the majority of the pottery belongs to the so-called "Ammonite" Late Iron IIC horizon, where Neo-Assyrian, and also Neo-Babylonian, influences are noticeable, both in shapes and in the dark red-brownish burnished surface treatment of vessels (Gilboa and Sharon 2016: fig. 4:2). The Neo-Assyrian influences are also evident in the male statuette and the duck-weight, which further support the interpretation of the strongholds being devoted not only to territorial control and defensive purposes, but also to administrative functions. All of these elements fit well with the historical interpretation of these buildings as strongholds erected in the 9th c. BC to protect the northern border of Ammon, and part of the defensive and administrative system of the Kingdom of Ammon that was still in place during the Neo-Assyrian and Neo-Babylonian occupations.

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Wādī Khunayzīrah Astonishing Discoveries of 2018: Unknown Tombs from the Early Bronze Age and Nabataean Periods

Introduction

Until recently, very little has been known about the antiquities of Wādī Khunayzīrah. During Burton MacDonald's survey of the area in 1985–1986, site number 108, Rujm Khunayzīrah, was singled out due to interest in the Iron Age II and recommended for excavations, but none had ever taken place. However, from February to March 2018, rescue excavations were conducted by the Department of Antiquities staff from the Southern Ghawrs office. Some astonishing finds were revealed, namely well-built tombs with remarkable grave goods dating to the Early Bronze Age and Nabataean periods.

Wādī Khunayzīrah is located in the Southern Ghawrs, at the south-eastern end of the Dead Sea (36R 732623.84 3420578.99), cut across by the main Aqaba highway (Route 65; Fig. 1). The northern side was selected by the Jordan Valley Authority to be dammed in order to divert water into a large water reservoir (*birkah*) to irrigate local lands for agriculture. Before these works began, the Department of Antiquities was contacted to investigate whether there were any antiquities, and consequently rescue excavations were conducted there.

Two parts were designated as Area A and Area B (100×100 m each) respectively. Within each of these, five 4x4 m squares were plotted and excavated. In addition, a survey just east of the two squares identified ten archaeological sites (Fig. 2).

Early Bronze Age Tombs

Near Rujm Khunayzīrah (Site 10) in Area B, a tomb was identified and excavated (Fig. 3). On a section of the east side, only 1 m beneath the

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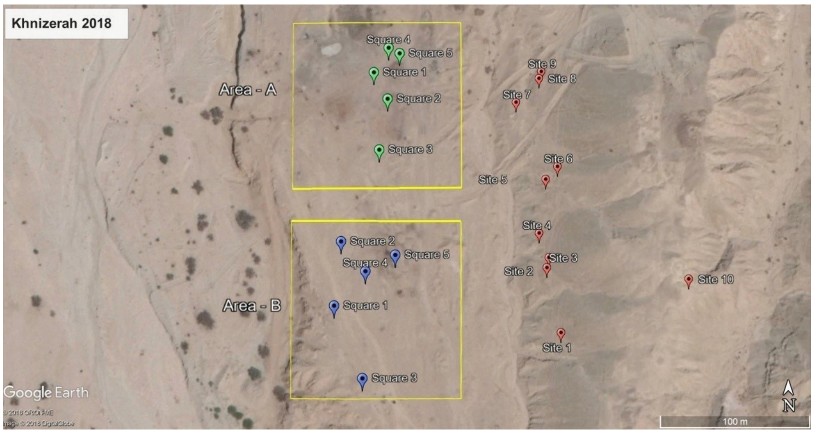
1. Location of Wādī Khunayzīrah cut across by the Aqaba highway (Route 65).



2. Location of areas and sites investigated and excavated.

3. Tomb in Area B before excavation.

4. Stone-lined grave in Area B after excavation.

5. An adobe-made structure, probably a tomb.

6. A structure made of stones, probably a tomb.

ground, is a small semi-globular-shaped grave lined on the west side by stones. It was used to bury a child (Fig. 4). Associated with this grave was a rectangular adobe-made structure and another rectangular structure made of stones. Both of these were probably tombs (Figs. 5–6).

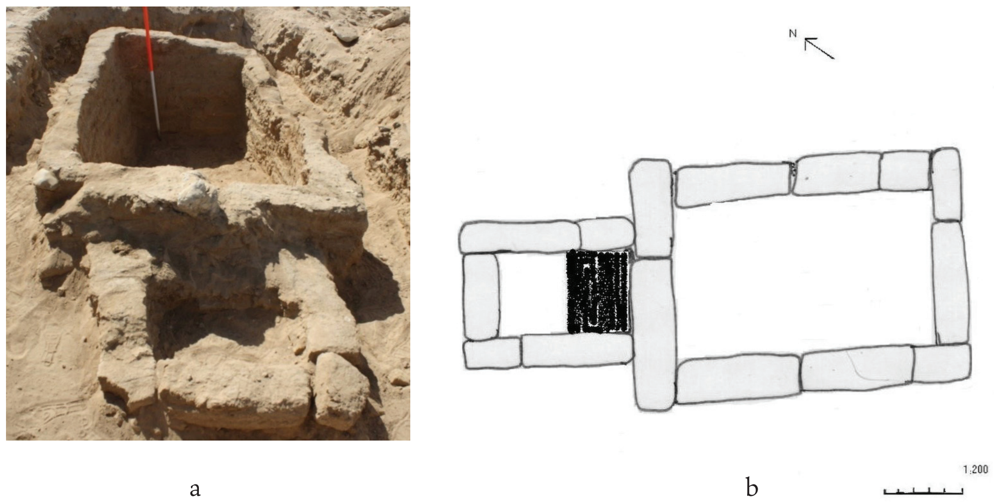
A third structure was also excavated, which formed part of a double chambered adobe-built tomb similar to one found at Early Bronze Age II Numayrah (Figs. 7–8). This structure, plus the pottery finds, help date the burials to the same period.

Two types of pottery forms were recovered from Area B: closed-form pots (Fig. 9) and open-form earthenware vessels (Fig. 10). Of particular interest was a pot found in a stone bowl (Fig. 11). Several copper-alloy pins were also found, which may have been associated with clothing.

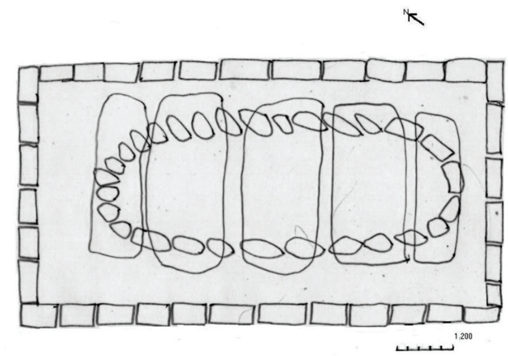
In conclusion, the tombs excavated in Area B of Khunayzīrah were shallow (perhaps due to soil erosion), rectangular, and built of adobe bricks, but their funerary architecture is not well known. Human bones were well preserved and collected. Pottery vessels helped to date the burials to the Early Bronze Age II period.

Nabataean Burials

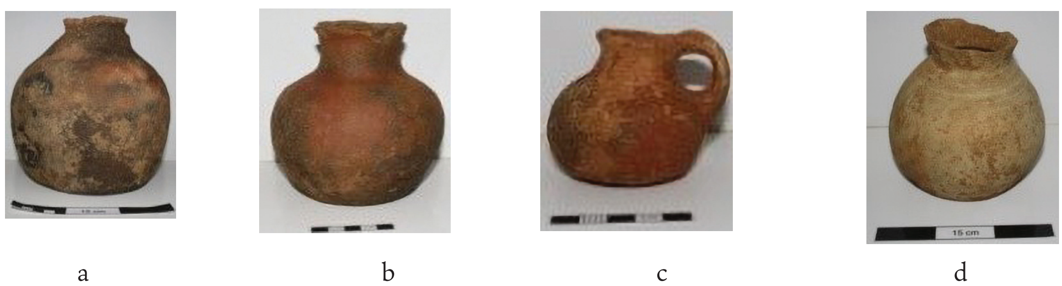
Area A was located further to the west (Fig. 2). The burials there were at a much deeper level, over 2 m down, in well-preserved shaft tombs undercut to the east and covered by adobe bricks and stones similar to those found by Politis at Khirbat Qāzūn in Ghawr al-Mazraʿah



7. a–b) Double-chambered tomb similar to one found at Numayrah (M. Alzahran).



8. Plan of Early Bronze Age II tomb structure found at Numayrah, made of stone within an adobe brick enclosure (M. Alzahran).



9. a) Flat-based medium-sized jar, white grits, firing (KHZ. 2018 Area B Sq.5), b) flaring jar neck (KHZ. 2018 Area B Sq.5), c) small jug with loop handle, painted in red (KHZ. 2018 Area B Sq.5), d) rounded jar (KHZ. 2018 Area B Sq.4).

a b c d

10. a) Bowl-shaped oil lamp (KHZ. 2018 Area B Sq.4), b) bowl with vestigial ledge handle (KHZ. 2018 Area B Sq.4), c) bowl (KHZ. 2018 Area B Sq.5), d) cup-shaped oil lamp (KHZ. 2018 Area B Sq.5).

11. Pot found in stone bowl from Area B dating to the Early Bronze Age II period (KHZ. 2018 Area B Sq.5).

a

b

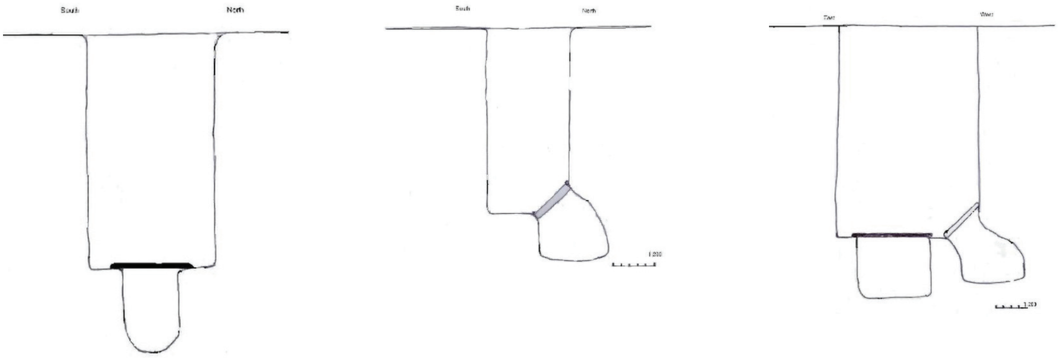
12. a, b) 12. Shaft graves excavated in Area A of Khunayzīrah sealed with adobe bricks.

(Figs. 12, 13a–b; Politis 2019: 434–6). The bodies were similarly wrapped in textiles or leather body-bags. Although few objects were found in the graves themselves, pottery dating to the 1st to 2nd c. AD (Fig. 14) and jewellery (Fig. 15) in their shafts and in the vicinity helped to date the burials to Nabataean–Late Roman times.

As is visible in a section of one shaft (Fig. 13c), one grave is carved into the north side of the shaft with a body wrapped in a textile, and another is carved in the middle of the shaft with the deceased placed in a wooden coffin (Fig. 18). Both of the graves were oriented east-west. Pottery found in these graves dates to the Late Roman period. Other organic finds included a well-preserved pair of leather sandals (Fig. 17).

Conclusions

Both Area A and B burials represent unique finds at Wādī Khunayzīrah which were not known before. The extent of Early Bronze Age occupation is not as



a b c

13. Sections of deep shaft graves excavated in Area A of Khunayzīrah sealed with adobe bricks (M. Alzahran).

14. Two-handled ribbed red cooking pot, Late Roman/Early Byzantine (KHZ. 2018 Area A Sq.6).

15. Pair of lunate-shaped gold earrings, *ca.* 1st to 2nd c. AD (KHZ. 2018 Area A Sq.6).

16. Fragmented wooden coffin from shaft tomb, *ca.* 1st to 2nd c. AD (KHZ. 2018 Area A Sq.6).

17. Leather sandals, *ca.* 1st to 2nd c. AD (KHZ. 2018 Area A Sq.6).

surprising, but still quite important considering the southerly limit. Nabataean presence should also not be unexpected as Wādī Khunayzīrah was within their territory. But, the fact that the burials have survived for centuries undisturbed makes them invaluable. Therefore, the preservation of the site is imperative and further archaeological investigations and excavations should be conducted there in order to put these discoveries in their proper cultural and regional contexts. The Iron Age was not represented in the areas investigated, but it also needs to be examined in order to better understand Iron Age Rujm Khunayzīrah, which was located nearby.

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Rethinking Monument 468(the Burg-Berge Monument) on the Ad-Dayr/Ad-Deir Plateau, Petra, Jordan

Abstract

In June of 2018, the Ad-Dayr/Ad-Deir Monument and Plateau Project (AMPP) completed the first comprehensive GPS pedestrian survey of the Ad-Dayr/Ad-Deir Plateau linked with low altitude UAV-drone imagery. Special attention was given to Monument 468 (the Burg-Berge Monument) due to its proximity to the Ad-Dayr/Ad-Deir 'Monastery' Complex as well as this massive building's prominent position above the Great Circle Pool now being restored by AMPP. While Monument 468 has previously been briefly discussed in earlier German scholarship, with portions of it drawn by the famous artist David Roberts, there has never been a modern comprehensive study of the site despite its monumental size and precarious positioning on one of the highest peaks to the west of the Ad-Dayr/Ad-Deir façade. Significantly, Monument 468 may have been one of the Nabataean's greatest engineering feats, given its challenging position high on a rocky mountain saddle that gave it birds-eye views of both the Ad-Dayr/Ad-Deir Monument to the east as well as the Wādī ʿArabah escarpments and rift to the south, west, and north. Additionally, this massive multi-tiered building was supported by unique Nabataean substructural engineering as well as rock-cut caves that kept it supplied with water via a large underground cistern complex. This paper discusses the findings of the GPS mapping of Monument 468 and provides never before available on-site information concerning the functions, design, and potential purposes of one of the most important building structures in ancient Petra. This discussion will attempt to answer the question; was such a challenging engineering product the result of a 'culture in crisis,' or a civilization with other agendas?

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1. UAV/Drone (Orthomosaic) aerial image of the central region of the Ad-Dayr/Ad-Deir Plateau with the Ad-Dayr/Ad-Deir Monument in the center-right of the image including its courtyard. The Great Circle Pool lies to the west (left) and above the courtyard, thus topographically protecting the Ad-Dayr/Ad-Deir Monument from flood erosion, with Jebal At-Tanbour and the Burg-Berge Monument above all to the immediate southwest or center left in this photo (AMPP 2014).

Introduction: The Strategic Importance of the Burg-Berge Monument

Over 700 meters above ancient Petra's urban center and to the northwest looms the Ad-Dayr/Ad-Deir Plateau—one of the most militarily strategic and defensible locations in Petra other than the earlier Edomite and Nabataean sites on the massif of Umm al-Biyāra (Fig. 1). Despite its strategic importance, the Ad-Dayr/Ad-Deir Plateau has never been studied with this strategic aspect in mind within the regional contexts of Nabataean Petra. Additionally, situated almost in the very center of the Ad-Dayr/Ad-Deir Plateau is a high rugged mountain topped with the remains of one of the Nabataeans' most impressive engineering feats—the Burg-Berge Monument, one element of which is known as Room 468 (Fig. 2).[1] The mountain itself is shaped like

[1] This number was assigned to the large east facing rock-cut room on the Burg-Berge's lower terrace by Rudolf Ernst Brünnow and Alfred Domaszewski (1904: I 337) and reflects their on-the-ground

2. The Burg-Berge Monument on Jebel At-Tanbour including Room 468 looking from east to west with the excavations and restoration of the Great Circle Pool in the left foreground and excavations of the Ad-Dayr/Ad-Deir Monument's Northwest Temenos Slot Entrance in the very lower left corner of the photo (AMPP 2016).

a long-necked stringed instrument somewhat similar to a lyre or *oud* and called in Persian a *Setar* or *Dotar,* and in Turkish and Arabic a *Tambur*, thus the local name for this mountain escarpment is Jabal At-Tanbour.

Only three possible accesses to the Ad-Dayr/Ad-Deir Plateau itself, all through extremely challenging topographies, made this mountain plateau the ideal location for a Nabataean strategic stronghold and probable palace hidden and protected from Petra's more vulnerable urban center. From the top of the Burg-Berge Monument, whose elevation made communication possible with Jabal an-Nabī Hārūn to the southwest via fire signals, Nabataean defenders could monitor all traffic coming from the south, north, or west up or down the Wādī ʿArabah, as well as defend themselves against invaders who might have penetrated the lower city or the Bayḍa/Beidha Plain to the north. Access to the Ad-Dayr/Ad-Deir Plateau from the southwest is today almost impassable due to the rugged volcanic ridges and vertical cliffs on this side of the Plateau. Even finding the correct passages upward to the Ad-Dayr/Ad-Deir Plateau would have been problematic for invaders unfamiliar with Petra. Once found, the steep, rock-cut stairwells with numerous switchbacks (existing on both the Petra urban access upward from the southeast as well as within the Bayḍa/Beidha track

survey of Petra in 1897/98. Volume 1 of this three volume publication was the first official survey, study and cataloguing of the rock cut structures of Petra, including over 800+ buildings and miscellaneous other archaeological elements.

from the northwest), would have placed any invader at a distinct disadvantage and vulnerable to costly attacks from above, all along these two very narrow winding and steep routes. The only other possible access from the southeast via a branch of the Wādī Siyagh is also almost impassible due to sheer cliffs and an especially steep ascent that would have been challenging to any large company of combatants, and thus also easily defended by local inhabitants. In antiquity, the upper portion of this passage also hosted numerous Nabataean farming terraces and outposts whose residents could have also carefully monitored this ascent pathway.[2] Additionally, in antiquity a visitor to the Ad-Dayr/Ad-Deir Plateau did not use the same path up from the center of the ancient city of Petra that tourists utilize for their final ascent to the courtyard of the Ad-Dayr/Ad-Deir Monument today. In antiquity, this access was blocked at the top and controlled by a *temenos* wall that surrounded and protected the courtyard of the Ad-Dayr/Ad-Deir Monument on the south and southeast. Most of this colonnaded wall has now fallen into the *wādī* to the southeast, however, a few column drums exist on the platform floor on the southeast as visitors approach the Monument today.

The ancient access to the Ad-Dayr/Ad-Deir Plateau from Petra's urban center actually began about 100 m below the modern trail, and turned northwest up a beautifully carved rock-cut processional staircase that ended in a bridge that spanned the Wādī Ad-Dayr/Ad-Deir just to the southeast of the Ad-Dayr/Ad-Deir Monument courtyard. This bridge acted as the only easy access over this steep ravine, with the *wādī* itself serving somewhat like a moat and drawbridge with the entrance to the bridge carefully guarded. A wide-mouthed cave that probably served as a guardhouse still exists on the lost bridge's eastern access at the end of the ancient processional way coming up from Petra's urban center. The footings for this bridge on either side of the *wādī* can still be seen just southeast of the modern café and store owned by the Dak-il-Allah family.

If Petra were compared to a medieval castle, the Ad-Dayr/Ad-Deir Plateau was the higher defensible inner court with the mountain upon which the Burg-Berge Monument sat on Jabal At-Tanbour acting as the center, or castle keep—the place of potential last defense. In traditional Nabataean fashion, however, these brilliant ancient engineers utilized the natural topography of the Ad-Dayr/Ad-Deir Plateau for their castle walls whenever and wherever possible, rather than expend excess resources on curtain fortress walls when nature's walls and *wādī* moats were already available. This allowed the Nabataeans to focus more time, resources, and energy on developing complex water control and storage systems to supply the Ad-Dayr/Ad-Deir Plateau with almost unlimited water sources in multiple locations, and in multiple cistern types, in case of a siege, or for other daily needs. In addition to these strategic advantages, the Ad-Dayr/Deir Plateau is always about ten degrees cooler than the lower city in the summer, and also favored with a daily afternoon breeze that usually begins after the heat of midday.

Thus, it is not surprising that the ancient Nabataeans chose the heights of At-Tanbour on the Ad-Dayr/Ad-Deir Plateau as the location for the amazing structure that we now call the Burg-Berge Monument, a building complex which also encompasses Room 468. This unique building is the focus of this article, which is the first scholarly work to extensively discuss and accurately map the surface remains of the Burg-Berge Monument in detail utilizing aerial drone imagery at a very low height (300 m), linked with on-the-ground GPS survey

[2] Pedestrian and GPS survey was completed in this region by AMPP in 2017 and 2018.

equipment that is accurate to within 30 cm, as well as computer generated mapping and photogrammetry imaging made possible by PIX4D software.

The Discovery of the Ad-Dayr/Ad-Deir Plateau and the Burg-Berge Monument by Explorers and Scholars

Despite the Burge-Berge's impressive architectural remains perched precariously on a high mountain escarpment, it has never received adequate scholarly attention, mapping, publication, and discussion, nor much needed conservation. The first European explorer credited with rediscovering and identifying Petra in August of 1812, Johann Ludwig Burckhardt, was not able to travel beyond the urban center of the ancient city.[3] Additionally, his time in Petra was very short due to his concerns of being discovered as a non-Muslim Western traveler (1822: 421–31).[4]

In 1818, William John Bankes, traveling with the explorers Charles Irby and James Mangles, saw the Ad-Dayr/Ad-Deir Monument through a spyglass as the group visited the heights of Jabal an-Nabī Harūn to the southwest, but this expedition could not find a pathway to actually visit the Ad-Dayr/Ad-Deir Plateau (de Laborde 1830: 85). From their southern vantage point, they could not have clearly recognized the ruins on the At-Tambour heights later known as the Burg-Berge Monument. Another early European explorer by the name of Strangwais visited Petra in 1826 but did not publish his findings (de Laborde 1830: 85). In 1828, the 19-year-old Marquis Léon de Laborde and the 29 year old Louis Linant de Bellefonds (acting as draftsman) explored and mapped portions of Petra including aspects of the Ad-Dayr/Ad-Deir Plateau (1830: 187–8) which de Laborde published in 1830 in *Pétra Retrouvée: Voyage de l'Arabie Petrée*. Laborde and Linant are thus credited with being the first Westerners to set foot on the Ad-Dayr/Ad-Deir Plateau in 1828, and to note the ruins on Jabal At-Tanbour that Alois Musil, who is discussed below, would later call the Burg-Berge Monument. However, the sketch maps of Laborde and Linant are not detailed, comprehensive, nor often very accurate given the kinds of conditions and equipment that they had to work with in this remote location. On the Ad-Dayr/Ad-Deir Plateau, for example, they completely ignored the Great Circle lying between the Ad-Dayr/Ad-Deir Monument and the Burg-Berge Monument, a very visible archaeological site that has a very noticeable diameter (60 m+). In 1836, John Lloyd Stephens, an American lawyer, traveled to Petra after meeting Linant in Cairo. Stephens published his impressions of the ancient site in 1838 in *Incidents of Travel in Egypt, Arabia, Petraea, and the Holy Land*, but without much discussion of what would later be called the Burg-Berge Monument on the Ad-Dayr/Ad-Deir Plateau (Stephens 1970: xxxii–xxxiv). However, Stephens would later become one of the most important discoverers of ancient Mayan societies and ruins in Central America.

On March 6, 1839, the Scottish stage set painter, David Roberts, sketched and utilized a new invention, the *camera lucida*, to capture images of the Ad-Dayr/Ad-Deir Monument and portions of the Lower Terrace Porch of what would later be called the Burg-Berge Monument. These initial

[3] It is important to note, however, that Burckhardt's notes were gathered and published after his death and thus without his personal edits or input. All indications are, however, that he was not able to explore areas of Petra beyond the main access from the south coming from the Wādī ʿArabah that then turns northeastward onto the ancient main *cardo* and exits to the east through the Sīq to Wādī Mūsā.

[4] Burckhardt had spent years perfecting his Arabic as well as his clothing disguises due to the previous murder of European explorer Ulrich Jasper Seetzen in 1809. Seetzen was also attempting to discover and identify ancient sites noted in Reland's work (1714) that included the first modern reference to the lost city of Petra.

3. David Roberts' lithograph of the Ad-Dayr/Ad-Deir Monument which he visited in 1839. In this image all distances are conflated and the Bedouin pictured are standing on the remains of the Burg-Berge's colonnaded Lower Terrace. The Great Circle has dropped out of this image and all the vistas surrounding the Ad-Dayr/Deir Monument are incorrect (from Roberts 1846: III pl. 90).

sketches and proto-photographs provided the backdrops for Roberts' later lithographs of the site published in six volumes in *The Holy Land, Syria, Idumea, Arabia, Egypt, and Nubia* in 1846–1849 (Fig. 3).[5] While these lithographs are valuable visual historical documents, we must remind ourselves that Roberts was only able to reside in Petra approximately two days due to local Bedouin hostilities toward Roberts' expedition. His later lithographs are done from memory, quick sketches, and the shadow outlines of edifices captured by the *camera lucida* that were then later trolleyed together with the eye of a former stage set artist who emphasized the dramatic, but often ignored other archaeological evidences in his works, and even distorted accurate distances between architectural remains for visual effect. However, after Robert's publications and stunning visual lithographic images became known, numerous Western visitors began to attempt the arduous and dangerous trip to Petra. Some of these included Formy (visited in 1840), E. Robinson and E. Smith (published in 1841), and Harriet Martineau (visited in 1848) who was the first person to notice the Great Circle lying between the Ad-Dayr/Ad-Deir Monument and the Burg-Berge Monument (Stanley 1866: 47–

[5] For the Ad-Dayr/Ad-Deir Monument and a portion of the colonnaded porch of the Burg-Berge Monument, see Roberts 1846: III pl. 90.

92). These intrepid travelers were followed by over 33 other explorers including Sir Arthur Penrhyn Stanley who published his journeys in 1866. A number of these travelers mention the ruins on Jabal At-Tanbour, but do not name it nor understand its architectural elements or functions.

The first Western explorer credited with naming the archaeological ruins situated on the apex of Jabal At-Tanbour was the Moravian (Czechoslovakian) explorer and priest Alois Musil who reached the Ad-Dayr/Ad-Deir Plateau and Petra in 1896 (Brünnow and Domaszewski 1904: xi, 338). At this time, Moravia was part of Germany and before and during World War I, Alois Musil served Germany in the Near East as the counterpart to their English adversary and British spy, T.E. Lawrence. Musil's explorations, discoveries, and exploits were so famous that his portrait currently appears on Czech currency. Before the First World War, the orientalist, explorer, and later spy, Musil, subsequently gave lectures in Vienna in 1899, 1901, and 1902 concerning his discoveries (which included Qaṣr 'Amra in Jordan), and named the archaeological remains on Jabal At-Tanbour on the Ad-Dayr/Ad-Deir Plateau the 'Burg-Berge Monument.' However, Musil did not include it, nor the Great Circle, in his two volume publication of maps, *Arabia Petraea, Vols. I & II, Edom*, which appeared in 1907 and 1908.[6] In German, 'burg-berge' has multiple meanings including, 'palace,' 'castle,' and 'fortress mountain' which all seem to suit the archaeological surface remains of At-Tanbour quite adequately as the buildings on its summit may have served all of these functions in Nabataean contexts over time. After World War I, Musil eventually taught at Charles University in Prague. In an ironic twist of history, in 2016, AMPP and Brigham Young University geology specialists co-partnered with Czech geologists from Charles University who specialized in sandstone in order to properly clean the second story of the Ad-Dayr/Ad-Deir Monument of erosion debris and foliage, and to assess its geologic condition for conservation efforts. At that time, we did not realize the historic connection of Charles University to Alois Musil and to Musil's early explorations of the Ad-Dayr/Ad-Deir Plateau and the Burg-Berge Monument. The research for this paper thus uncovered this delightful historic link that brings Musil's explorations full circle and underscores his connections to this great Czechoslovakian university.

By the late 1800s/early 1900s, and especially after World War I, the exploration and mapping of the Petra Region began to be more systematic. In 1897–1898, the German-American orientalist and philologist Rudolf Ernst Brünnow (who eventually taught at Princeton University) teamed up with the Austrian-Polish Scholar Albert Domaszewski (who eventually taught at the University of Heidelberg) to explore and map the major edifices of Petra. Published in 1904, *Die Provincia Arabia* was the first systematic study of the Petra Region that endeavored to map and number major building and tomb structures as well as other significant archaeological elements. In all, Brünnow and Domasewski identified over 800 edifices and elements, and their numbering system is still referred to today by scholars studying Nabataean tombs and rock-cut structures. For example, the Ad-Dayr/Ad-Deir Monument is Tomb No. 462 in their numbering system. Brünnow and Domasewski credit Alois Musil with naming the Burg-Berge Monument even though Musil's publications were not available until 1908, fully four years after the release of *Die Provincia Arabia* (Brünnow and Domasewski 1904: xi, 338). We must therefore assume that being in the German and Austrian circle of scholars, Brünnow and Domasewski must have heard some of Musil's lectures given in Vienna in 1899, 1901, and 1902 and/or

[6] See Musil 1907 and 1908: I 139–50 figs. 103–118, 148.

been in correspondence with him. Despite their more systematic approach to mapping Petra and the Ad-Dayr/Ad-Deir Plateau, the maps created by Brünnow and Domasewski are still very problematic. While they note both the Ad-Dayr/Ad-Deir Monument and the basic location of the Burg-Berge ruins, they call the Burg-Berge, 'the Ad-Dayr,' (probably misidentifying the Ad-Dayr/Ad-Deir Mountain rather than this mountain's local name of At-Tanbour versus Jabal Ad-Dayr/Ad-Deir to the east), and inaccurately place and/or misidentify many of the other archaeological elements and geological formations on the Plateau including the Great Circle (Brünnow and Domaszewski 1904: Taf. XIV.S.336). Again, we must be sympathetic to the constraints these early explorers were under given the traveling conditions, issues of personal safety, and types of surveying equipment that were available to them in portable form under the worst of geological and environmental conditions.

The next important scholar to publish information on the Burg-Berge Monument from on-site observations was the German Lutheran theologian and pioneer in Aramaic Studies, Gustav Dalman. His work, *Petra und Seine Felsheiligtümer*, was published in 1908, and cites both the previous explorations of Alois Musil as well as Brünnow and Domaszewski (Dalman 1908: 263, 271, 278–7). Dalman was the first to suggest that the large rock-cut cultic room (Room 468) of the Burg-Berge Monument may be cardinally oriented in relation to the sun during certain times of the year, and thus allowed for the illumination of the shrine at the very back of the structure on these celestial occasions (Dalman 1908: 207, 212). This theory, however, seems questionable given the fact that the entire front of Room 468 was surrounded by a very large columned terrace that was roofed in antiquity. Both the roofing of the terrace as well as the heights of the mountain of the Jabal Ad-Dayr/Ad-Deir to the Burg-Berge's east would have made any cardinal alignment with the sun, solstices, and the interior shrine of Room 468 problematic, if not impossible, at the Lower Terrace level. However, it must be noted that our AMPP project has not yet tested Dalman's hypothesis during the winter solstice. The extreme height of the rock-cut entrance to Room 468, whose upper doorway section may have been higher than the Lower Terrace roof structure and open to both wind and light, might be of significance with relation to Dalman's claim. The entrance opening is higher and larger than any ancient doors could have enclosed. The question thus remains, why did the Nabataeans carve such a high entrance to Room 468 if it could not be enclosed, especially if the room was related to burials and/or had additional cultic significance? Was the height of the doorway related to the position of sunlight entering the room, or did such a high door act as a breeze collector to cool both the room and the terrace in front of it, becoming a Nabataean rock-cut version of a Persian *iwan*? More research needs to be conducted at the site in order to answer these questions.

After Dalman's work of 1908, it was not until 1991 that the Jordanian scholars Fawzi Zayadine and Suleyman Farajat published a brief description of the Ad-Dayr/Ad-Deir Monument as part of an initial Jordanian survey of the Ad-Dayr/Ad-Deir Plateau, but with no significant attention to the Burg-Berge Monument (Zayadine and Farajat 1991: 282–4). The Burg-Berge Monument remained largely ignored and unnoticed within Nabataean scholarship for almost 75 years until another German scholar, Manfred Lindner, began to publish more research on the Ad-Dayr/Ad-Deir Plateau with specific descriptions of the Burg-Berge Monument (Lindner *et al.* 1984: 163–70; Lindner 2001: 393–4). Lindner relied heavily upon the previous publications of Brünnow and Domaszewski as well as Musil.

Lindner's works often contain inaccuracies both in the naming history of the Burg-Berge Monument as well as in his maps and sketches of the archaeological remains on the Ad-Dayr/Ad-Deir Plateau, including the Monument itself. He did, however, note, photograph, and sketch some of the basic elements of the Burg-Berge Monument, including the foundations or supports for two small mysterious *tholoi*-like structures above the second terrace, as well as noting the mosaic floor on the apex of the mountain. Lindner also initially utilized other sources to attempt to date the Burg-Berge based on column capital styles and suggested that elements of the building were associated with the late 1st c. BC (Lindner *et al.* 1984: 168). However, Lindner later incorrectly followed F. Zayadine in associating the earliest horned Nabataean capital with the era of the Nabataean king Rabbel II (*ca.* AD 75–106; Zayadine 1980: 244; Lindner *et al.* 1984: 168). Thus, in his initial analysis, Lindner stated:

> *The 'Burgberg' opposite the rock temple (The Ad-Deir Monument) shows no definite traces of a fortification or a castle. There are, however, impressive signs of its former role as a splendid sanctuary* (Lindner *et al.* 1984: 180).

Given this statement, it is obvious that Lindner did not look at the Burg-Berge Monument in a regional context with relation to topography and relative location. In 2001, however, Lindner revisited an assessment of the Burg-Berg Monument in a second article published in *ADAJ* (Lindner 2001: 393–4). The two *tholoi*-like structures were again discussed, and Lindner labels at least one as a '*monopteros*,' *i.e.*, a *tholos* without sidewalls. By AD 2000, however, fully one-half of one of these small circular structures had already disappeared, but Lindner dated the remaining *tholos* to the Herodian Perod (*ca.* 74/73 BC to 4 BC).[7] In his very final assessment Lindner states:

> *It seems to me that ad-Dayr and the structure of the 'Burgberg,' including the results of previous examinations (Dalman, 1908, 1912; Lindner, 1984; Zayadine and Farajat, 1991) should be reassessed as a highly important ensemble. The top of the 'Burgberg' deserves thorough investigation, excavation, and consolidation, not only for scientific purposes but also for furthering the tourist trade. The on-going destruction of the 'Burgberg' top opposite the impressive façade of ad-Dayr should not be tolerated* (Lindner 2001: 394).

Lindner's appeals for the importance and tragic condition of the Burg-Berge Monument remained unheeded as the development of Petra for tourism from the late 1970s through today has focused mainly on the excavation of ancient buildings in the city's urban center, *i.e.*, the clearance of the Siq, the excavation of portions of the Temple of the Winged Lions, the Roman-era Theater, the Byzantine churches, and the so-called Great Temple and adjacent Garden Pool Areas. Thus, the Burg-Berge has remained basically ignored by scholarship and abandoned to deterioration and vandalism until the Ad-Dayr/Ad-Deir Monument and Plateau Project began its mapping on the Plateau with a special focus on the Burg-Berge Monument in 2017 and 2018. Within our mapping system, the Burg-Berge is recorded as Element 129

[7] It should be noted, however, that these dates reflect the birth and death dates of Herod the Great. The Herodian building period could not have begun until Herod the Great, as an adult, solidified his political power over Judea after 41 BC.

and Element 130, as well as Element 459 with sub-elements noted as either 130.1 or 459.1 respectively depending on their location and survey date. The sub-elements associated with Elements 129 and 130 in our survey designate archaeological elements around the lower base of Jabal At-Tanbour that were mapped in 2013. Sub-elements associated with Element 459 (459.1, 459.2, etc.) document all visible archaeological remains on the upper mountain and building site itself that were mapped in 2017 and 2018. In order to understand some of the complexities of this massive edifice as well as its importance within Nabataean engineering, we must begin our description of this amazing building from its substructures, and then climb upward via its only access on the northeastern side of the mountain and onto its numerous terraces to the final apex of the mountain of At-Tanbour.

Substructures of the Burg-Berge Monument

One can only approach the Burg-Berge Monument with the intent of a pseudo-easy ascent from the northeast side. Without modern climbing ropes and equipment, the Burg-Berge is relatively inaccessible from any other direction due to massive sheer cliff walls, and thus we assume that the modern access to the First Lower Terrace of the Burg-Berge follows somewhat the same route of the ancient Nabataean stairs. Upon approaching the base of the mountain from this side, two structural elements are quickly observed. First, beneath Jabal At-Tanbour and the Burg-Berge Monument lies a massive dog-leg-shaped cistern now filled with erosion debris and garbage (to the visitor's lower left as one begins the ascent). This is AMPP Element 129 that was surveyed in 2013.[8] This cistern measures 12.90 m on its South Wall, by 5.47 m on its North Wall by 10.31 m on the North dog-leg wall, by 13.52 m on the East. The other sides of this rock cut cistern are now penetrated by eroded openings in its rock wall surfaces. Without archaeological excavation, it is impossible to accurately estimate this cistern's original water containment volume, but given the ongoing AMPP excavations of Cliff Cistern B across the valley to the northeast under the skirts of Jabal Ad-Dayr/Ad-Deir, we can make a guestimate. Given the known dimensions of Cistern B after excavation, we estimate that at capacity it could have held 500–550 m^3 of water. Significantly, given its horizontal dimensions, the massive cistern carved at the base of Jabal At-Tanbour and under the Burg-Berge Monument may be just over two times the size of Cistern B, if depths are similar. This was thus a huge cistern complex serving the Burg-Berge with a potential holding capacity of 1,000 to 1,100 m^3 of water.

Additionally, extremely large rock cut water channels feeding into this cistern, as well as another probable unexposed cistern on the southeastern underbelly of the mountain, can still be identified by the careful observer. As a visitor climbs the lower rock wall substructure levels up to the first and largest terrace of the Burg-Berge, one large vertical rock-cut channel can be seen to the left coming straight down from the upper mountain and toward the cistern noted previously (this is AMPP Element 459.36). Another rock-cut channel, wide enough to walk in, runs from below the Upper First Terrace of the Burg-Berge Monument and winds around the east and southeastern cliff face beneath the terrace itself to a probable second cistern complex at the base of the eastern and southeastern side of the mountain. This cistern complex has been completely filled in with erosion

[8] All AMPP archaeological element numbers for the Ad-Dayr/Ad-Deir Plateau are recorded as part of the MEGA (Middle Eastern Geo-Database for Antiquities) System that includes comprehensive descriptions of each element as well as its conservation status.

and could not be measured during our survey in 2013. It should also be noted that the lower skirts of Jabal At-Tanbour also host numerous cultic niches. In addition, many of the column drums and column capitals from the First Lower Terrance of the Burg-Berge Monument have fallen and rolled down the Eastern Cliff face of Jabal At-Tanbour and are now located in the *wādī* to the east which is subject to intense flash floods during the winter and early spring rainy seasons. Our survey team attempted to measure and document as many of these architectural elements as possible in this *wādī* for future retrieval, but many more may lie beneath the present surface and have been buried by water erosion over time as well as many that may have been washed further down the *wādī* and are now also buried (Fig. 4).

Secondly, above these cistern complexes and on the east face of Jabal At-Tanbour, the amazing engineered supports for the First Lower Terrace of the Burg-Berge Monument can be seen. Utilizing both natural crevices in the cliff face as well as man-made cuttings, the Nabataeans inserted limestone support blocks to create massive piers to support the built structures above (Fig. 5). The natural bedrock of the cliff on either side of each crevice gave the piers extra strength and countered the downward pressures of the weight of the large colonnaded terrace above by disbursing these pressures throughout the bedrock cliff face itself. The Nabataean use of natural geological features as integral

4. Column drums from the Burg-Berge Monument that have fallen into the wādī to the east and southeast of Jebel At-Tanbour. These probably originated from the Lower Terrace (AMPP 2019).

5. The east face of Jebel At-Tanbour where Nabataean engineers utilized faults and vertical crevices in the mountain in which to construct built stone support piers for the Lower Colonnaded Terrace of the Burg-Berge Monument (AMPP 2018).

parts of their engineering programs is not unique to the Burg-Berge Monument. When excavating the remains of a Nabataean water control system in the West Temenos Slot Entrance to the Ad-Dayr/Ad-Deir Monument Courtyard, it became clear to the AMPP team that the Nabataeans inserted the base support blocks for this dam into rock notches in the natural cliff sides of the dam on the water side of the structure. The pressure of the water thus pushed the support stones into the natural cliff face and increased the holding capacity of the dam itself by disbursing these pressures into the natural bedrock sidewalls. When carefully observing other extant Nabataean dam structures throughout the Petra Park, it is interesting to note how often these brilliant ancient engineers utilized this same technique to control potentially powerful and damaging flash flooding, and in turn were able to collect and store massive amounts of seasonal rain water and snow melt. This is a technological water engineering system that needs to be restored and maintained not only to create fresh water resources for the Park and region, but to also control the damaging flood erosion that destroys much within the Park each year.

The current ascent to the Lower First Terrace of the Burg-Berge Monument lies adjacent to the base of the Northeastern side of Jabal At-Tanbour, and is a scramble over fallen architectural debris. The support walls of the Lower First Terrace are situated to the left of the climber and dog-leg to the east over the bedrock of the mountain itself, with the lowest wall coursings of the terrace exhibiting the typical Hellenistic masonry block pattern of header-stretcher-header. The second visible coursing is laid with off-center stretchers, and the third visible coursing returns to the Hellenistic wall pattern. Coursings above these initially visible lower ones utilize a more sporadic pattern of headers and stretchers characterized by other similar Nabataean walled structures, such as those seen in the walls of the possible cultic center of the High Place of Sacrifice. Given the ashlar patterns noted above, the Burg-Berge may have been started in the Late Hellenistic Period (*ca*. 100 BC or before) with its upper terrace walls completed by the end of the 1st c. AD when more sporadic stone ashlar placements became popularized from the mid-1st c. BC onward.

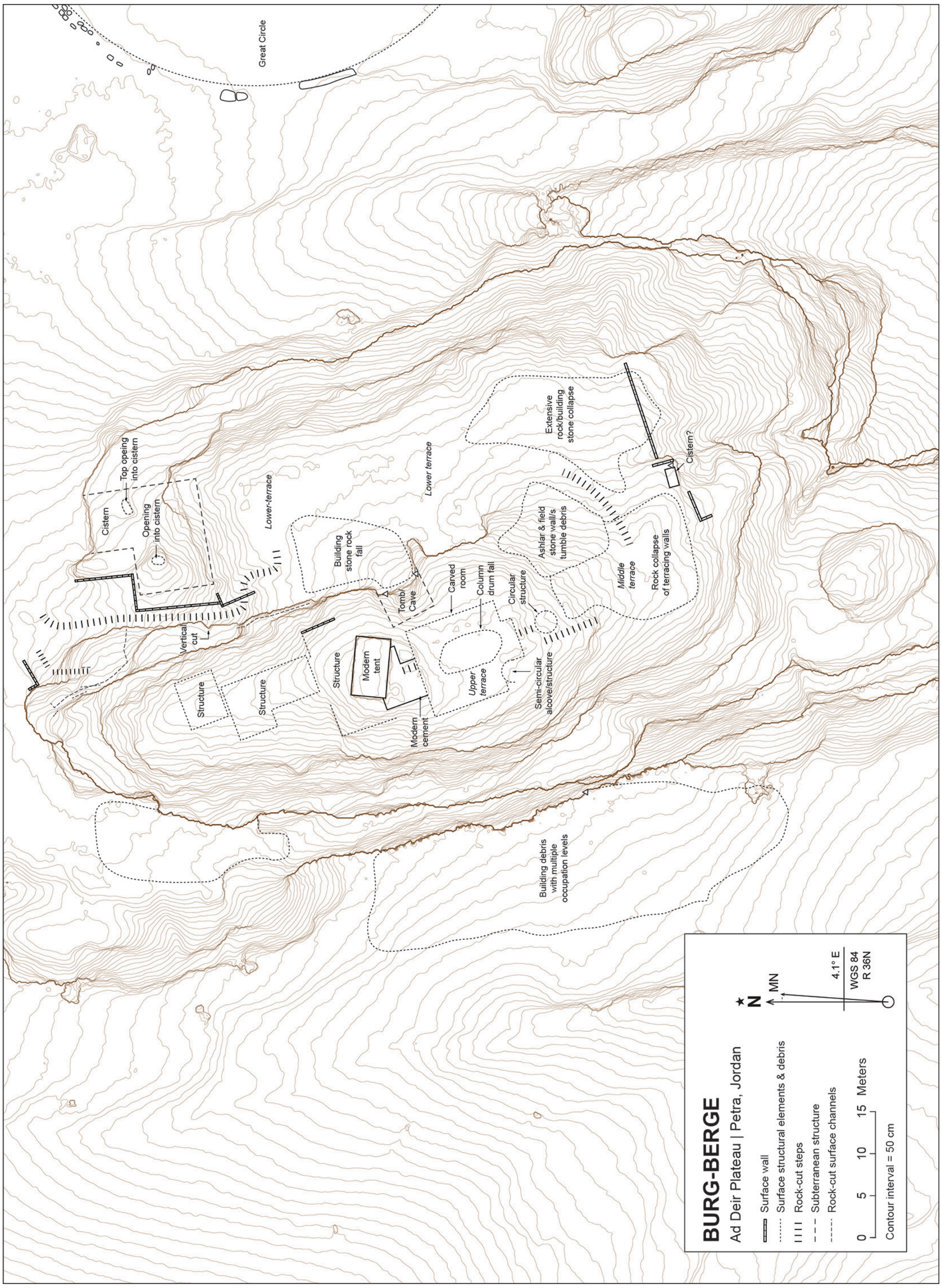
These last remaining in-situ terrace support walls to the viewer's left (as one climbs up to the Lower First Terrace) also support the last vestiges of the northeast corner of the beautifully laid ashlar limestone terrace floor. On this last remaining corner also sits one of the last of ten in-situ column bases for the Lower First Terrace colonnade. This corner edge is currently hanging over the cliff edge and will soon be destroyed by ongoing neglect and yearly erosion forces. Other damaged parallel foundations for additional terrace support walls resting on bedrock just to the northwest are also evident, but were too dangerous to measure or map with GPS given their crumbling position on the northwest cliff edge.

The Lower First Terrace (AMPP Element 459.29)

The Lower First Terrace of the Burg-Berge Monument was its largest and most visible structure in antiquity with an estimated original length of almost 55 m from northwest to southeast along the first terrace ridge of the east face of Jabal At-Tanbour. Its current extant remains along this building line are 46.063 m in length with the majority of its colonnade and some of its support flooring fallen to the *wādī* below on the east (see Figs. 3–6). The total width of the Lower First Terrace was approximately 15 m depending on where one measures given the current fallen building debris. Given current visible remains, this Lower First Terrace supported three rows of columns with the longest colonnade on the eastern edge of the cliff overlooking the Great Circle Pool and the Ad-Dayr/Ad-Deir Monument (Fig. 6). Currently 10 column bases for this colonnade can still be found along the outer line of the terrace (Fig. 6). Lindner and colleagues (1984: 167 fig. 3) record 11 bases with three of these inclusive of column clusters, especially on either end of the colonnade, and in the last three column supports on the northwest. Two additional rows of columns, located closer together, adorned the Lower Terrace just to the northwest and were located in front of the large rock-cut room known as Room 468 (Figs. 6–8a–c).

The arrangement of the columns brings up questions as to the actual structural nature of the colonnade or colonnades on the Lower Terrace of the Monument. The distance between the outer eastern colonnade and the next closest potential colonnade to its west is a little less than 10 m, which is quite a distance to span for ancient stone roofing systems in Petra. How was this accomplished? Cedar beams were seemingly more practical than stone for such an endeavor given the lack of any known support structures between these two extant column rows. But was the roof flat or pitched given that weather events on the Ad-Dayr/Ad-Deir Plateau can include both heavy rain and snow in the winter and early spring? Was the roof tiled with kiln baked clay tiles or covered with some other material such as bronze or copper as was seemingly done for the roofing of Qaṣr al-bint Pharaon in the center of the ancient city?[9] These

[9] Excavations of the foundations of Qaṣr al-bint Pharaon were undertaken by the author in 1978 under the direction of Dr. Phillip Hammond for the subsequent UNESCO restoration efforts of the temple. At the bottom of our test trench on the east side of the temple we discovered a roofing plate of bronze with a high copper content.


Great Circle
Cistern
Top opeing into cistern
Opening into cistern
Lower-terrace
Lower terrace
Building stone rock fall
Extensive rock/building stone collapse
Cistern?
Ashlar & field stone wall/s tumble debris
Middle terrace
Rock collapse of terracing walls
Tomb/ Cave
Carved room
Column drum fall
Circular structure
Vertical cut
Structure
Structure
Structure
Modern tent
Upper terrace
Semi-circular alcove/structure
Modern cement
Building debris with multiple occupation levels
BURG-BERGE
Ad Deir Plateau | Petra, Jordan
Surface wall
Surface structural elements & debris
Rock-cut steps
Subterranean structure
Rock-cut surface channels
0 5 10 15 Meters
Contour interval = 50 cm
N
MN
4.1° E
WGS 84
R 36N

6. (Opposite page.) AMPP topographic map of the Burg-Berge Monument with all major extant surface elements labeled and outlined. The map was generated from a photogrammetric model created from aerial imagery captured by a UAV flown over the Plateau. The features were verified using a pedestrian survey and GPS mapping. While the major archaeological elements can be seen on this aerial view, it is also difficult to get a 3-D perspective of the height relationships between the multiple and complex terrace structures of the Monument. The First Lower Terrace can be seen to the lower right with the visible remnants of its three colonnades noted with current column drum and base placements (AMPP: S. Ure 2019).

7. Room 468 on the west side of the First Lower Terrace of the Burg-Berge Monument with its back wall cultic niche and monumental doorway (AMPP: J. Newbold 2018).

questions cannot be answered without scientific archaeological excavations of the site and careful restoration, however some surface remains may give us clues as will be noted below. Additionally, did the second set of columns, which lie closer together on the west, run the full length of the Lower Terrace or just a short distance on either side of Room 468 as part of an entrance? How did this colonnade tie into the larger roofing structures of the Lower Terrace itself, and how did it relate to the very high rock-cut doorway for Room 468? Again, without scientific archaeological excavation, these questions cannot be answered entirely by only extant surface remains that are covered by building collapses of the Lower Terrace and the structures above it that fell down the upper mountainside to this area on the east side of Jabal At-Tanbour. The current visible remains of all existing column bases, however, suggest an alignment between the placements of the outer eastern colonnade with the two inner ones (Fig. 6). The diameters of all existing columns range from 55/56 cm in diameter to 59/60 cm with the largest diameter being 61 cm. Distances between the columns averaged to about 2.90 m on the inner colonnades with a slightly wider distance variance between the columns on the furthest eastern terrace overlooking the drop into the *wādī*. This slight variation may have been due to the geological nature of the cliff edge that supported the terrace floor and the subsequent outer colonnade alignment.

The Lower Terrace is also the home of the huge rock-cut room known as Room 468 in Brünnow and Domasewski's

a

b

8. a) Close-up of the back wall cultic niche in Room 468 of the Burg-Berge Monument (AMPP: C. Finlayson 2018).

b) The carved figure on the left side corner of the second fascia of the cultic niche of Room 468 (AMPP: C. Finlayson 2018).

c) The carved figure on the right side corner of the second fascia of the cultic niche of Room 468 (AMPP: C. Finlayson 2018).

c

survey number system (AMPP Element 459.23; see Figs. 6–8a–c). The questions associated with the gigantic size of the rock-cut doorway to this room have already been noted. It is this enormous rock-cut entrance that is visible from just about any location on the southeastern side of the entire Ad-Dayr/Ad-Deir Plateau, thus, it was the first visual marker that drew early explorers to Jabal At-Tanbour. This rock-cut room faces east toward the Eastern Cliffs of Jabal Ad-Dayr/Ad-Deir and the Ad-Dayr/Ad-Deir Monument, with the Great Circle Pool lying below it just beyond a *wādī* at the eastern base of Jabal At-Tanbour (see Fig. 2). When filled with seasonal water, the Great Circle Pool must have been a beautiful reflective surface between the Burg-Berge Monument and the façade of the Ad-Dayr/Ad-Deir Monument. Room 468 measures roughly 5 m x 6 m in size horizontally, however, the floor is unevenly filled with erosion debris and goat dung. Without archaeological excavation, it cannot be determined if the room originally functioned as a tomb, a memorial chapel, a triclinium, or even possibly all three functions all at once, or individually over time. Remnants of column drums at the front of the room hint at its once grand entrance decoration that was somehow associated with the western most colonnade on the Lower Terrace. In the far back wall (within its own carved rectangular alcove) is hewn a very large pedimented cultic niche in the shape of the façade of a Classical temple (Fig. 8a–c). The outer side columns of the niche are chamfered (*i.e.,* square in shape) and rest on column plinth bases that are undecorated. The lower first third of each of the square outer columns is also undecorated. The upper two-thirds of the columns on both sides of the niche are carved with multiple squares (six on each column) that stand out due to the relief carving around each. Additionally, each of these outer columns is topped by a Nabataean horned capital that supports an upper architrave divided into two fasciae. Significantly, more than one fascia is characteristic of both the Ionic and Corinthian Classical Orders, architectural paradigms that the Nabataeans loved to play with while inventing their own capital styles and design combinations. The playful characteristics of Nabataean architectural design and embellishments thus make secure dating of these elements problematic if stylistic analysis is the only methodological approach utilized to create a chronology.[10] At either corner of the uppermost fascia are carved single figures with their upper torsos contained within a square cut frame. The top of the fascia also hosts a line of dentition that separates the fascia from the upper triangular pediment. This dentition molding is repeated in the upper triangle of the pediment itself. At the top of this pediment, situated at its apex, is a rectangular-shaped platform with a flared bottom that may have contained or supported another decorative element that is now missing. Additional acroteria figures may have sat on the upper corners of the pediment but are now gone.

The identities of the two anthropomorphic figures in the upper fascia of this niche are highly debated by modern scholars with relationship to their gender and potential mythological associations in Nabataean contexts. Each holds a single cornucopia (the left figure with the cornucopia over its right shoulder, and the right figure with the cornucopia over its left shoulder if the viewer is facing the niche; Fig. 8b–c). At first glance, the damaged nature of the niche makes it difficult to determine if the figures are females with breast lines, or males with overdeveloped chest muscles. The shoulders and torso of the figure on the viewer's left (Fig. 8b) are fully covered by a modified Greek-style himation that seemingly drapes over both shoulders and the chest, rather than just over the left shoulder as in the Classical Greek style for males, thus possibly indicating that the figure on the left fascia is female. Similar himation-like garments are also seen in the funerary portraits of Palmyra, Syria representing an Arab-Aramaean ethnic group similar to the Nabataeans, and one also subject to the synthesis of clothing styles that developed in the East since the Persian period when aspects of East Greek and Persian clothing styles were merged even before the conquests of Alexander the Great. Significantly, both figures in the second fascia of AMPP Element 459.23 have been defaced by iconoclasts over time, but their sculptural remnants indicate that both had long hair possibly rolled into shoulder-length curls with elaborate headdresses.

[10] J. Mckenzie's (1990) attempts to date Nabataean structures utilizing stylistic analysis by comparing some with tombs at Mad'in Salah was only based on a relatively few tombs close to the center of urban Petra, and did not rely on an adequate number of examples, nor tomb types from all regions of Petra in order to establish a reliable dating system based on architectural styles. A new categorization has currently been developed by one of my graduate students, Josie Newbold, who has visited and data-based over 300 Nabataean rock-cut structures ranging over the entire area of Petra (Newbold 2020).

Although Robert Wenning has suggested that both sculptural figures represent male tychai (*i.e.,* male figures of good fortune), I disagree for the following reasons.[11] Close on-site examination and the magnification of the photos taken of these figures suggest that both were intended to be female. The figure on the viewer's left has already been discussed, and a magnification of this figure's photo clearly indicates a breast protrusion under the woman's garment just to the right of the figure's right hand—the hand that clutches the base of her cornucopia. The figure on the viewer's right is more complicated. This figure has the himation draped over its left shoulder, but instead of the chest being bare as in the Greek male style, this figure is wearing a tunic/thob or chiton underneath the himation, with the right breast clearly discerned creating a protrusion underneath the chiton (though it is slightly defaced). This figure also possibly hosts a decorative band around her right arm (commonly also seen in female Palmyrene funerary portraits) and the figure may be clutching a grain sheaf or sheaves along with the base of a cornucopia in the left hand. In fairness, however, it should be mentioned that in the East, Greek style clothing was often modified and lost its gendered associations, with both males and females often wearing items of clothing or clothing styles that breached earlier Classical Greek cultural gendered paradigms. For example, at Palmyra both women and men wore a himation-like garment over both shoulders, and women often wore male Persian style riding pants and boots under their long tunic style dresses, or thobs, in funerary portraiture (Finlayson 2004). Possibly more important than gender identity with relation to the Nabataean figures under discussion is the fact that both figures also hold a cornucopia, a Hellenized symbol that was commonly associated with female figures of fertility, abundance, and nourishment, especially in the Eastern Mediterranean region. The association with nourishment is especially important to highlight if the cultic niche (in which these Nabataean figures were carved) was perceived by its patrons to be associated with the continual nourishment of a deceased loved one/or ones in the Afterlife.[12] While there are exceptions to the exclusive gendered usage of the cornucopia with female figures (including goddesses and spirits of fortune especially in Greek and Roman art and artifacts), male spirits or deities holding the cornucopia, or associated with it, are very rare (see n. 12). Of those male exceptions, Dionysus, Serapis, and Hades are pertinent to note given the potential for this cultic niche to be associated with the honored dead of the shrine's patron, and the roles of these deities and their possible Nabataean avatars with relation to the Afterlife and rejuvenation. Additionally, cornucopiae were popularized

[11] Personal discussion with Dr. Robert Wenning at the Florence Conference in January 2019.

[12] One of the Greek myths of the origin of the cornucopia is linked with the nourishment of the infant god Zeus by the divine caretakers who kept him hidden from his father Cronos in a cave on Mt. Ida on Crete. Some sources say that when the powerful god-child Zeus inadvertently broke off one of the horns of the milk-giver Amaltheia (a goat goddess), the horn obtained the power to provide for unending nourishment. For a summary of these myths, and Amaltheia commemorated by Zeus as the constellation Capricorn, see Graves 1988: 39–40. By the Roman period, the cornucopia was predominantly associated with female goddesses and spirits of Fortune, Harvest, and Prosperity or Abundance of Spirituality. There were only a few male personifications that were also at times associated with the cornucopia in art. These included Dionysus, Plutus (god of riches and the son of the grain goddess Demeter), Hades (who in the mystery cults of the age was associated as a benefactor of agriculture and mineral and spiritual wealth), and the Greco-Egyptian Priapus who was associated with fecundity (Cooper 1978: 43). Significantly, the constellation Capricorn (the Goat) was symbolic of life-giving principles and could also be represented by the dolphin as well as associations with the winter solstice (Cooper 1978: 43, 198–200).

throughout the Hellenized Near East as symbols of prosperity and fecundity by both the Ptolemies and the Seleucids as well as copied and utilized by local kingdoms on both sides of the Jordan River including the Hasmoneans, and eventually even Herod the Great.[13] The cornucopia or double cornucopiae also symbolized the promise of nourishment to the populace by a ruling body, and became a popular symbol of Eastern dynasts including the Nabataean kings. The cornucopia, via its mythological origins in the Hellenized world, also associated rulers with the divine kingship of Zeus and/or local pagan avatars.[14] Given the figures carved on the niche within Room 468 discussed above, it is thus significant to note that the first use of the single cornucopia in the iconography of Nabataean coinage occurred with the reign of the Nabataean king, Malichus I (*r.* 59–30 BC) with the double cornucopiae introduced on Nabataean coinage by Obodas III (*r.* 30–9 BC), the progenitors of Aretas IV Philopatris (9/8 BC to AD 39/40; Meshorer 1975: 88–93 pl. 2). We can thus tentatively assume, given the horned capitals of the niche and the use of the cornucopia by both figural elements, that the niche may date to *ca.* 59–30 BC, but no later than AD 106 with the Roman annexation of Petra to the Roman Empire.

The second smaller niche carved within the larger outer one also hosts two square columns topped by Nabataean horned capitals (Fig. 8a–c). The architrave hosts two fasciae capped with horizontal molding. The upper-most fascia is decorated with a pseudo-Greek Doric decoration of metopes and triglyphs. Each metope hosts a circle carved in relief with a total of six extant circles. The inner niche or aedicule may have hosted either a figural sculpture or an aniconic betyl, but neither of these potential sculptural options have survived. The entire shrine is heavily damaged and continues to be defaced by extensive modern graffiti.

As a visitor leaves this Lower Terrace and turns upward to the right to ascend the only access to the southern stairs of the Burg-Berge Monument, the foundations and walls of numerous rooms perched on the southern-most terrace and cliff of Jabal At-Tanbour to the right and left on the Middle Terrace are still visible (see Fig. 6). These appear to have been rooms meant for habitation with finely constructed ashlar walls. This type of solid wall construction on this particular side of the mountain makes perfect sense given the weather patterns that move across the heights of Jabal At-Tanbour and the Burg-Berge Monument. Most major storms arrive from the south up the Wādī ʿArabah from the Red Sea, thus situating these massive walled rooms on the southern side of the Monument provided needed protection for the colonnaded Lower Terrace and the building's residents, as well as cooling breezes through probable south facing windows in the summer. Remains of collapsed wall structures are everywhere and include large amounts of red terracotta coarse ware roofing tiles that may indicate that the whole monument was roofed in such a manner. This also indicates that the roofing supports may have been cedar timbers rather than stone beams. Among this debris, the AMPP survey team

[13] See Marshak 2015: 68–72 for examples and discussion of the cornucopia or double cornucopiae in Hellenistic and Early Roman coinage of dynasts in the East including Cleopatra Thea and John Hyrcanus I with the impact of dynastic iconography on the Idumaean Herod the Great and Nabataean king Obodas III. See also Marshak 2015: 126–36 for the cornucopiae in Herod the Great's coinage and a history of this symbol's use in Ptolemaic contexts; also Marshak 2015: 165–73 for Roman influences on Herodian coinage.

[14] See Marshak 2015: 38–42 for the concept of divine kingship in the Hellenistic and Early Roman Period and its associations with Zeus, as well as other types of iconography utilized by the Seleucids (*i.e.,* the anchor reflecting a birthmark on the thigh of Seleucus I that enhanced Seleucid claims of a divine heritage and descent from Apollo Didymus).

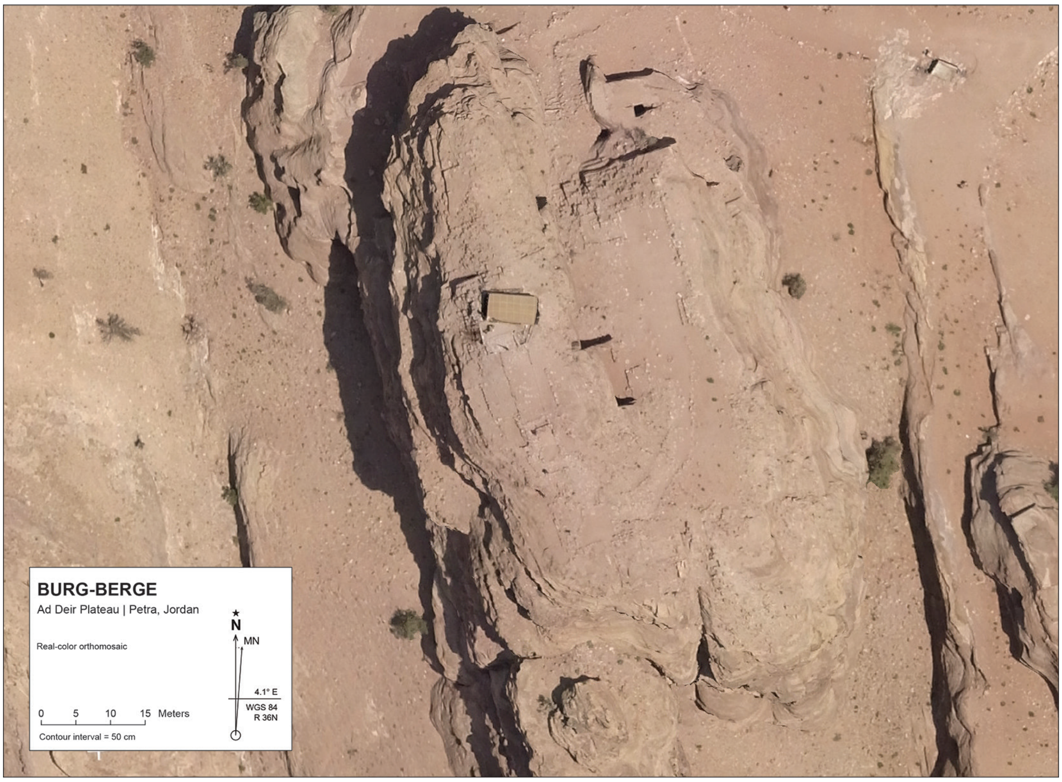
also observed a molded plaster wall piece with extant sea green and earth red paint potentially indicating the painted plaster decorations of some of the building elements within these structures. An especially large building collapse on the southeast side of this level of the mountain may indicate that an additional terrace existed anciently on the southeast flank of the mid-section of the Burg-Berge Monument (AMPP Element 459.21). Large ashlars and fieldstone from previously built upper walls on the south-west side of the mountain have also fallen downward and can also be seen on this flank of the building site. Many of these remnants of stone walls have tumbled down the southwest and west side of the Burg-Berge Monument and are resting within the debris on the narrow plateau below. AMPP also included these archaeological elements where observable in their GPS database of all archaeological elements on the Ad-Dayr/Ad-Deir Plateau.

Finely laid and rock-cut stairs eventually bring the visitor upward to just below the Upper Terrace Portico where the remains of two mysterious circular structures reside (see Fig. 6). The most complete small circular structure sits at the juncture of two stairwells that dog-leg to the east and then to the north and upward to the Upper Terrace Portico (AMPP Element 459.18; see Fig. 6). This small circular structure has a diameter of roughly 3.12 m and at its outer base contains the remnants of three J-shaped engaged column bases or footing supports. The second, and less complete, circular structure (now really only a semi-circle due to erosion damage) sits slightly to the northwest of the first and below the western side of the Upper Terrace Portico support wall (AMPP Element 459.6) (See Fig. 6). Its diameter is roughly 2.73 m. If one looks at the AMPP GPS mapping of the Burg-Berge Monument (Fig. 6) it is evident that both circular structures are located exactly parallel to each other on the southwestern side of the mountain and are facing toward the Wādī ʿArabah and Jabal an-Nabī Harūn (both observed by Lindner *et al.* 1984: 168–9; Lindner 1986: 91 Abb. 3). Significantly, AMPP Element 469.6 is lined with thin, fired, red terracotta tiles, some of which are embedded with melted iron fragments. Thus, one possible solution to the uses of these small circular structures, especially given their location on a high mountain plateau and facing south by southwest toward Jabal an-Nabi Harūn, might be that they are the remains of ground level base supports for fire signals and/or beacons.[15] In antiquity, these structures were usually about the height of a man and capable of holding up to five lit torches at a time. Other possible fire containers requiring base supports might have consisted of an iron tripod with an upper cauldron. These possible uses need to be tested via archaeological excavation and further study of these structures.

The Upper Terrace Portico

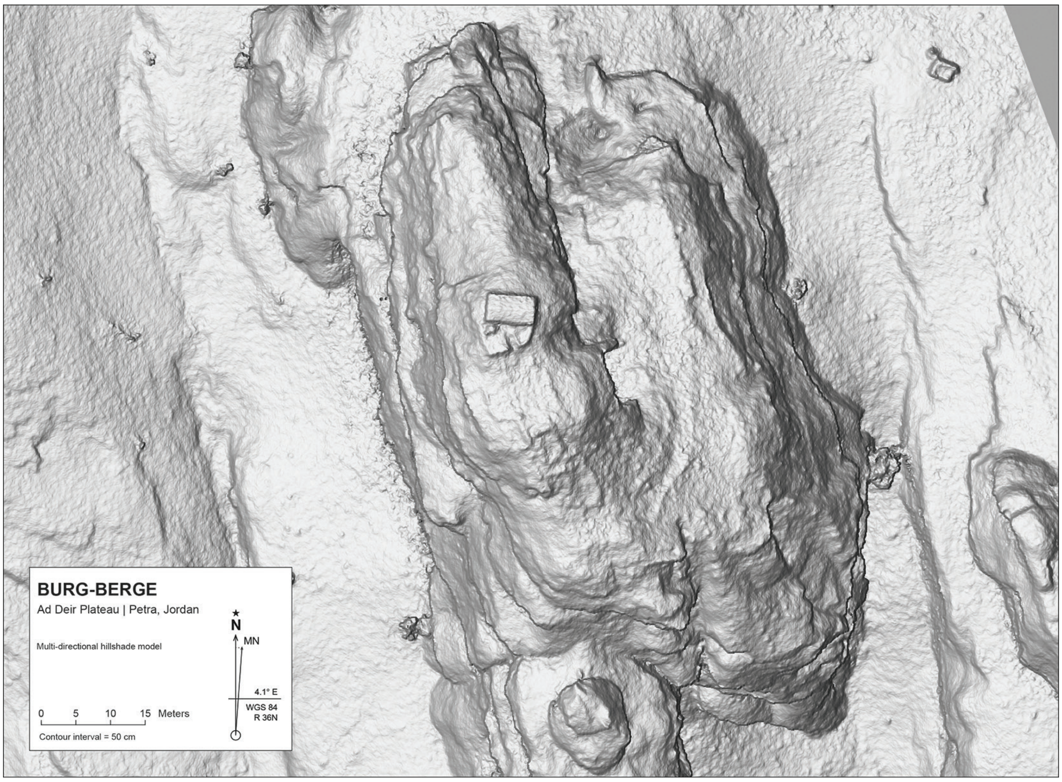
The dog-legged shaped stairs noted above move the visitor upward and slightly to the northwest in order to access what must have been a very beautiful columned portico just below the very apex of the mountain's top (AMPP Element 459.4; Figs. 6 and 9). This Upper Terrace Portico measures 12.55 m x 9.50 m in size and its carefully constructed stone floor is strewn with the collapse of multiple column drums that are clustered toward the center of the

[15] See Polybius *Histories* 10.45–7 for ancient examples and descriptions of communication systems utilizing fire beacons between strategically chosen mountains in antiquity. According to Hellenistic Greek tradition, the inventors of such a long distance signaling system (up to 100 km between beacons) were Kleoxenos and Dimokleitos in the 3rd c. BC. However, in Aeschyles' *Agamemnon*, the playwright notes that Pallamedes used fire beacons to announce the fall of Troy to the city of Mycenae on Crete. If this is accurate and not just a much later Classical gloss, such means of long distance signaling can be traced to at least the Bronze Age.



9. Aerial view of the Northern Section of the Burg-Berge Monument on Jebel At-Tanbour looking from south to north. The colonnaded portico with rows of collapsed columns can be seen just below the roof the Bedouin tent at the apex of the mountain. Room 468 is to the lower right of the tent on the First Lower Terrace (the cliff face was carved back to create the porch entrance to the cultic niche). Numerous building walls and wall collapses can be seen in all areas including the eastern most colonnade line on the edge of the First Lower Terrace just above the mountain's Eastern cliff face. The wādīs on both the east and the west contain much of the architectural remains that have fallen off the building over time (AMPP: S. Ure 2019).

terrace itself. There seem to have been two parallel rows of columns with four to five columns on each side, but the erosion fill in this area may cover further architectural evidences critical for fully understanding the design of this space. All the columns seem to have fallen from northwest to southeast indicating that their collapse was probably due to an earthquake event originating close to the Dead Sea. A number of significant earthquake events are noted in antiquity to have affected the Petra region even before the infamous earthquake of May 19, AD 363 that is credited with damaging large areas of the city, as well as its water infrastructure. For example, Josephus noted a very major tectonic event in 31 BC (the same year as the Battle of Actium) that originated from around the Dead Sea Region and impacted large areas of Judea as well as the regions close to the Dead Sea itself (Josephus *Antiquities of the Jews* 15.5.2–5). Thus, this earthquake event would have also impacted Petra. However, without further archaeological excavation of the Burg-Berge, it is impossible to determine if



10. Multi-directional Hillshade Model generated from the photogrammetric imagery captured by the 2013 UAV flight over the Ad-Dayr/Ad-Deir Plateau (AMPP: S. Ure 2019).

the 31 BC earthquake was the event which destroyed this portico, or if it fell during one of the numerous earthquakes that struck the Near East both in AD 363 and during the Christian Byzantine Period.[16]

[16] For a discussion of the 31 BC earthquake as well as others that subsequently affected the region, see Amiran 1996; Zohar *et al.* 2017. The 31 BC earthquake is believed to have struck in early spring and was a 6.7 magnitude event, the same magnitude as the later AD 363 earthquake that destroyed much of Petra at that later time. This may also help explain the Nabataean reluctance to assist Cleopatra VII with her escape from Octavian/Augustus (*i.e.,* their weakened situation made them reluctant to engage either side of the war).

The Uppermost Structure of the Burg-Berge Monument

Five or six steps up and to the northwest of the Upper Terrace Portico takes the visitor to the very last Uppermost Structure of the Burg-Berge Monument, some of whose remains are now covered by a Bedul Bedouin Tent utilized as a tourist view area, *i.e.*, 'Top of the World Café' (Figs. 6, 9, and 10). This very top tier of the mountain once contained a monumental building structure situated on a NW to SE building line with amazing views of the Wādī ʿArabah both to the north and south but especially to the northwest. The current Bedouin tent is situated with its longest backside wall facing almost directly north, and with this tent wall running from west to east. The shorter sidewalls of the tent run north to south. An AMPP Multidirectional Hillshade Model (Fig. 10) generated from our aerial drone flight gives us a better understanding of the size and shape of the ancient building that rests under the present Bedouin tent structure. The visible wall line structure of the ancient building was approximately (10 m x 5 m) in size with an opening to the southeast and a possible altar structure at the front of the building to the southwest. Multiple small Classical size tesserae as well as larger Byzantine era floor tesserae litter the area. While the Bedouin tent is an unwanted intrusion on this archaeological site, it is currently serving the purpose of preserving a large area of the tessellated floor of the ancient building/s underneath from weather erosion. Additionally, the Bedouin have also added modern concrete floor and terrace support structures to the area that overlay the ancient building. However, much of the probable multiple levels of the ancient historic flooring of this mountain top edifice are still being destroyed in areas not covered by the modern tent due to yearly seasonal water erosion and visitor foot traffic.

Below and slightly to the north and northwest of the Uppermost Structure of the Burg-Berge Monument are indications of other building remains strung along the northernmost ridge line of Jabal At-Tanbour, but the access to them is extremely steep and precarious from the northeast side of the apex of the mountain (Figs. 9–10). Some of the outlines of these buildings could be picked up by both the aerial photographs and the resulting Multidirectional Hillshade Model derived from them, but without excavation and clearance, not much could be discerned about their style and purposes other than they were also seemingly associated with multiple tesserae remains (Figs. 9–10).

Summary and Analysis

It is obvious from the above detailed survey and mapping of the Burg-Berge Monument that this building represents one of the most important engineering feats of the ancient Nabataeans in Petra, and greatly deserves excavation clearances and conservation efforts. The building seems to have been multi-functional over time with surface remains potentially indicating that it was begun before 59 BC and utilized into at least the Byzantine period in some fashion. Ancient coins retrieved by AMPP from the Ad-Dayr/Ad-Deir Plateau indicate that the use of the strategic heights and ruins of the Burg-Berge Monument may also have been revitalized in the Byzantine period during the reign of Constantius II during his campaigns in the East against the Persians.[17] Various elements of the building's remains indicate that it was appropriately named by Alois Musil as the Burg-Berge, a 'palace, castle, fortress,' but it also included at least one cultic element represented by Room 468 that may have served as either a triclinium, a burial site, or other type of Nabataean memorial structure (or all three functions over time) given its present remains. Only archaeological excavation and restoration of

[17] During each spring/summer excavation season, AMPP usually has five sites open—three on the Great Circle on the southwestern side of the most culturally dense area of the Plateau, one at Eastern Cistern B across the Plateau to the northeast, and one in the North Temenos Slot Entrance to the Ad-Dayr/Ad-Deir Monument's courtyard which is also on the eastern side of the Plateau. The excavations are thus recovering ancient coins from both the eastern and western sides of the most densely concentrated archaeological sites on the Plateau itself. Over 800 ancient coins have been retrieved from these sites with the majority coming from the erosion wash area in the North Temenos Slot, however, of the few Byzantine era coins retrieved from all sites, all of these coins have come from the period of Constantius II (AD 337–361) who was in constant warfare in the East with the Sassanians. It is thus postulated that the Ad-Dayr/Ad-Deir Plateau was again utilized during this era given its strategic military advantages.

this room may reveal its true identity and dating sequence but it may represent a cultic use that predates later areas of the structures around it.

With relation to the overall building chronology of the Burg-Berge itself, it is of interest to note this structure's similarity with the fortress palaces of Herod the Great (*r.* 37/36 BC to 4 BC), especially those at Masada and Machaerus that are so geographically close in proximity to Petra. According to Josephus, Herod's desert palaces were often built over previous strategic installations constructed by the Hasmonean king of Judea, Alexander Jannaeus (*r.* 103–76 BC) whose rule was characterized by continuous conflicts, some of which embroiled the Nabataeans, especially under the rule of their kings Obodas I (*r.* 96–85 BC) and Aretas III (*r.* 87–62 BC; Josephus *Wars of the Jews* 1.8.9; Marshak 2015: 117–24 fn. 8). Thus, it is logical to postulate that the first Nabataean strategic buildings on Jebel At-Tanbour may have been the result of Nabataean concerns for the more intensified threats from their Judaean Hasmonean neighbors who were also closely linked to Ptolemaic Egyptian support at this time. It is possible that Room 468 already existed (given its high

a

b

11. a) The Burg-Berge Monument and Room 468 on Jebel At-Tanbour with clearances of the Great Circle Pool below it looking from the east to the west.

b) The escarpment of the two Masada palaces built by Herod the Great between 37 and 31 BC. According to Josephus, Herod's structures were built over earlier Hasmonean fortifications built by Alexander Jannaeus earlier in the 1st c. BC (Photo: Dr. Robert Cargill, University of Iowa).

doorway that seems out of scale with the rest of the Burg-Berge building complex), and thus, the additional 1st c. BC building programs were built around it. It is also significant to note that Herod the Great (b. 74/73 BC) may have spent some of his youth at Petra. His mother, Cypros, was a Nabataean of possible noble connections in Petra, and his father, Antipater/Antipas (d. 43 BC), was an Idumaean—the Hellenistic name for Edomite, the earlier biblical-era inhabitants of southern Jordan and Petra itself (Josephus *Antiquities* 4.1.3–4, 4.7.3; Marshak 2015: 110–1). During the turbulent eras in which Herod's father was politically embroiled with the Hasmonean rulers of Judea and their squabbles over kingship (which also often included Nabataean involvements), the young Herod may have been sent to Petra under the protection of his mother's family, however, we do know that he is also documented as having visited the city at least twice in adulthood.[18]

With relation to the construction of strategic desert palace fortresses, it is important to emphasize that these were very turbulent times. Not only was Judea racked with battles over multiple claimants to the throne as well as the position of high priest, but this was also the era of Rome's initial military presence in the Levant (Pompey 64/63 BC) and the final decline of the Ptolemaic and Seleucid Dynasties in the Near East. The eventual assassination of Julius Caesar in Rome plunged the emerging Roman Empire into another civil war with the last Ptolemaic dynast, Cleopatra VII and her lover/husband Mark Antony's bid for power in the East drawing all the Levant into the carnage including Judea and Nabataea. This conflict culminated in the Battle of Actium (31 BC) and eventually Octavian/Augustus' conquest of Egypt and solidification of the remains of Ptolemaic and Seleucid political spheres under Roman control. It is thus a very strong possibility, given Herod's family connections to Petra, that the building of Nabataean strategic structures such as the Burg-Berge Monument, especially during the early 1st c. BC wars with the Hasmoneans, were the initial inspirations for Herod's later mountain fortresses on either side of the Dead Sea, many of which were built over previous Hasmonean remains.[19]

When one compares images of the site of the Burg-Berge Monument in Petra with that of Masada in modern-day Israel or Machaerus in Jordan, for example, the similarities of topographical setting and architectural elements in terracing down steep escarpment slopes are very striking (Figs. 11a–b). It is also possible that Herod the Great may have utilized Nabataean engineers in his desert palace building projects, especially with relation to the development of water systems. Most scholars agree that Masada was built between *ca.* 37–33 BC, after Herod solidified his power in *ca.* 37/36 BC. Alternatively, Josephus notes that a Hasmonean structure, built by Alexander Jannaeus (*r.* Judaea 103–76 BC) earlier in the first century BC, lay under Herod's additions, however archaeologists have not been able to confirm this fact (Josephus *Wars of the Jews* 1.8.9; Marshak 2015: 117–24 fn. 8). The palace fortress at Machaerus to the north of Petra and on the Jordan side of the Dead Sea may also have had an earlier Hasmonean structure built by Alexander Jannaeus in 90 BC that was later remodeled by Herod the Great in *ca.* 30 BC. Therefore, one hypothesis to be tested is that the Burg-Berge at Petra was begun during the beginning of the 1st c. BC at about the same time that Alexander Jannaeus was also fortifying desert palace retreats—

[18] The close relationship of Herod's father, Antipater, with the kings of Petra (see Josephus *Wars of the Jews* 1.4.1; *Antiquities* 14.13.8–9) as well as the origins of Herod's mother, suggest that Herod the Great was not unfamiliar with Petra itself, the Nabataean capital city.

[19] For a discussion of Herod the Great's desert fortresses, see Marshak 2015.

retreats that also played strategic military as well as caravan route control roles. So let us look at the relevant rulers listed on the most commonly accepted Nabataean king list to try to discuss more deeply the Nabataean rulers most likely to have been involved in the Burg-Berge's birth as well as its subsequent development:

Rabbel I	? (some say late 2nd c. BC, but see below)
Aretas II	*ca.* 103–96 BC
Obodas I	*ca.* 96–86/85 BC
Rabbel I	? 85/84 BC (some say as early as 2nd c. BC, some say the successor to Aretas II?)
Aretas III	86/84–62/60/59 BC
Obodas II?	62/61–60/59 BC
Malichus I	59–30 BC
Obodas III	30–9 BC
Aretas IV	9/8 BC to AD 39/40
Malichus II	AD 40–70
Rabbel II	AD 70–106

The very existence and aspects of the rule of Rabbel I and Aretas II are controversial. The rule of Obodas I may be more critical to this discussion. After his death, the Nabataean king Obodas I (*r. ca.* 96–86/85 BC) was deified by his people, probably due to his numerous victories over the Hasmonean rulers of Judea and especially his victory at a battle in 93 BC on the Golan Heights. Obodas I was a special enemy of the Hasmonean Judean king, Alexander Jannaeus, whom he trapped near Gadara (Umm Qays) and attacked with camel cavalry, thus leveraging the return of areas east of the Dead Sea to the Nabataeans. Obodas I was also victorious over the Seleucid ruler, Antiochus XII Dionysus, thus saving Petra and Nabataea from direct Seleucid rule. Given the military needs of these times, it is thus likely that the Ad-Dayr/Ad-Deir Plateau and Jabal At-Tanbour were strategically important, and that the Burg-Berge fortress/palace may have been begun by either Aretas II or more likely Obsodas I as a reaction to the rise of more threatening Hasmonean incursions in southern Jordan. It may thus also be possible that Room 468 within the Burg-Berge complex is a memorial chapel and possible triclinium associated with Obodas I since his actual burial is linked with a site in the Negev renamed Avdat, and not a currently known burial site in Petra.

As previously mentioned, the existence and regnal dates for Rabbel I are still debated, but if his dates of 85/84 BC are accepted, he did not rule long enough to impact structures on the Ad-Dayr/Ad-Deir Plateau. Aretas III (*r.* 86/84–62/60/59 BC or some sources say *r*. 87–62 BC) was the probable sibling of Obodas I and ruled for approximately 24 or 25 years, thus long enough to continue the fortifications and embellishments of the structures on the Ad-Dayr/Ad-Deir Plateau, potentially including the Burg-Berge Monument. Room 468 as a cultic room to the memory of his brother, the deified Obodas I, thus would have been important to this Nabataean king as well as any possible larger memorial structures on the Plateau itself including that of the Ad-Dayr/Ad-Deir Monument and the Great Circle Pool which may have been begun under his reign given his familial association with Obodas I. Certainly, Aretas III had both the motives and the wealth to do so. During his reign, Nabataea extended beyond southern Jordan and encompassed also most of what is northern Jordan, southern Syria including the Hauran, and parts of modern-day northern Saudi Arabia, thus reaching Nabataea's greatest size geographically. However, this expansion put the Nabataeans into direct conflict with Hasmonean aspirations for a Greater Judea. In addition, Aretas III plucked the ancient trade center of Damascus from the weakened Seleucids in *ca*. 85 BC and took over its mints and famous metal foundries as well as administered trade ventures emanating from this city to as far as possibly modern-day Afghanistan and India. Aretas III is thus famous for striking the first identifiable Nabataean silver coinage from Damascus that is Hellenistic in style and iconography, as well as labeled in Greek rather than Nabataean. It is at this point that the adoption of Hellenistic iconography within Nabataean coinage begins and it may have been the point at which the fasciae of the cultic niche in Room 468 may have been embellished with its figures, each holding a cornucopia. Additionally, AMPP excavations of the Great Circle Pool now point to the existence and use of the pool before the great earthquake of 31 BC. If the façade of the Ad-Dayr/Ad-Deir Monument was begun by Aretas III, the Great Circle must have been begun at the same time given the topography of the Ad-Dayr/Ad-Deir Plateau and the necessary role of the Great Circle Pool to protect both the façade and courtyard of the Ad-Dayr/Ad-Deir Monument from seasonal flash flooding and destruction. Indeed, we now think that the bedrock floor and inner ring wall was damaged by the 31 BC earthquake given a fracture that exists in these locations on the southwest side of the pool as well as other archaeological artifacts found in context.

By *ca.* 67 BC, Aretas III also became embroiled in the conflicts surrounding the Hasmonean succession for king and high priest in Judea when Aristobulus II began a rebellion against his older brother Hyrcanus II in Jerusalem and Judea. Hyrcanus fled to Petra and in exchange for the promise of the return of certain towns to the Nabataeans, Hyrcanus received support from Aretas III. Significantly, Hyrcanus' chief advisor was Antipater the Idumaean, who was the father of Herod the Great and marriage partner of a woman from Petra, Herod's mother. Political machinations by Aristobulus, however, brought the newly powerful Romans in the Near East into the fray resulting eventually in the defeat of Aretas III who subsequently retained his rule, but became a vassal king of the expanding Roman Empire in a similar manner to the rise of the Herodians in Judea following the ascent of Antipater and his sons including Herod the Great. This event may have made Nabataean rulers more cautious about becoming engaged in the ongoing political intrigues of Antipas' son, Herod.

The existence and dates of Obodas II (? *r.* 62/61 to 60/59 BC) have been debated by modern scholars. In any case, his rule may have been too brief to make any great impact on the structures on the Ad-Dayr/Ad-Deir Plateau including the Burg-Berge Monument. His successor, Malichus I (59–30 BC), may have been more critically active at the site. Some scholars have speculated that he was a cousin of Herod the Great given Herod's Nabataean mother and Herod's flight to Petra in 40 BC following the rise of the Hasmonean claimant, Antigonus II Mattathias, who had imprisoned Herod's brother, Phaseal. Malichus I, however, did not support Herod's plea for support, which caused Herod to seek support from Cleopatra VII. When her second lover/husband, Mark Antony, began to confiscate properties traditionally controlled by Herod and the Nabataeans to turn them over to Cleopatra, relationships declined between Cleopatra's Egypt and both Judea and Nabataea with the result that neither entity heeded Cleopatra's demands for assistance following her defeat at the Battle of Actium in 31 BC, and Octavian/Augustus' subsequent invasion of Egypt. In fact, the Nabataeans under Malichus I burned Cleopatra's boats stationed on the Red Sea and thus destroyed any avenue for her escape to the East (Dio Cassius 51.6.2–7). Given the political instabilities of the times, it is logical to assume that the Ad-Dayr/Ad-Deir Plateau and the Burg-Berge Monument remained important strategic locations for the residents of Petra, particularly the Nabataean royal family.

Little is known about the personality of the Nabataean king Obodas III (*r*. 30–9 BC) beyond his need to deal with an attempted Roman conquest of Nabataea and takeover of the caravan routes. Towards the end of his reign, the controversial political figure, Syllaeus, emerges as a minister to the king and powerful political player. He is often credited with outsmarting the Roman expedition sent out in *ca*.25/24 BC by the prefect of Egypt, Aelius Gallus, by leading them in the desert until many died from thirst and disease. Syllaeus may have also attempted to usurp the Nabataean throne as he is shown on the obverse of Nabataean coinage along with the reverse hosting Aretas IV, the young boy successor to his father, Obodas III. Indeed, it may have been Aretas IV's probable mother (some scholars say wife), Hulda, who actively maneuvered her son into sole power in Nabataea despite Syllaeus' political agendas. Syllaeus is also reported to have alienated Herod the Great after falling in love with Herod's sister. Eventually, Syllaeus' political machinations found him in Rome where he was finally executed.

This now brings us to Aretas IV (*r*. 9/8 BC to AD 39/40) whose presence and energized activity on the Ad-Dayr/Ad-Deir Plateau has been confirmed by AMPP excavations not only on the Great Circle but also via the over 800 ancient coins recovered from all five AMPP sites related to the excavation and restoration of Nabataean structures whose original purpose was to protect the Ad-Dayr/Ad-Deir Monument. Over 88% of the coins retrieved from all five excavation sites currently being worked on by AMPP are the mints of Aretas IV. While this is not unusual for Nabataean sites, it is unusual to find complete series of the mints of this king from in-situ excavations. Indeed, we have a few of the known mints hosting Syllaeus and a very young Aretas IV, as well as all of those mints of a later and older Aretas IV with the exception of coins that he minted with his mother (or first wife) Hulda. In particular, we have numerous batches of Aretas IV on the obverse as a cuirassed solder and with his wife Shuqailat on the reverse as priestess—possibly high priestess. Additionally, pottery remains confirm an increased activity on the Plateau under Aretas IV.

The above may be explained by the fact that Aretas IV was often at war with Judea. His daughter was married to Herod's son, Herod Antipas, who subsequently spurned her in order to illegally cohabit and eventually marry his brother's wife, Herodias. This is the famous event that brought John the Baptist's condemnation of the royal Herodian couple, probably not only on moral grounds, but also on political ones, since it destroyed the marriage alliance between Nabataea and Judea that was critical in keeping absolute Roman power at arm's length in both kingdoms. Aretas' daughter fled to her father rather than be murdered in the infamous Herodian court, and Aretas IV subsequently launched a major attack against Herod Antipas who then had to call in Roman assistance. This was the beginning of the end for the sovereign powers of both the Judeaen and Nabataean kings, and the second major step in the eventual formal annexation of Nabataea by Rome in AD 106 by Trajan.

Given the events noted above, it is not at all surprising that the Ad-Dayr/Ad-Deir Plateau and the Burg-Berg Monument became increasingly important to the strategic plans of Aretas IV. The Plateau may have even served as a storage area for his coinage during wartime given its secure position in contrast to the more vulnerable urban center of the city of Petra below. Significantly, use of the Plateau seemingly declines with Aretas' successors, Malichus II (AD 40–70) and Rabbel II (AD 70–106), with only a few of their coins extant from AMPP excavations. Following the Roman annexation of Nabataea in AD

106 and the probable disempowerment of the Nabataean royal family under direct Roman rule, the use of the Ad-Dayr/Ad-Deir Plateau and the Burg-Berge Monument seemingly declines significantly. It is logical to assume that the Burg-Berge Monument may have been abandoned or occupied by numerous settlers at this time given the disappearance of royal patrons to maintain its water systems and structural integrity. As previously mentioned, archaeological evidence at this point seems to indicate that the Ad-Dayr/Ad-Deir Plateau does not receive noticeable later Early Christian or Byzantine occupation until the reign of Constantius II and his campaigns against the Sassanians.

The Burg-Berge Monument thus hints to us that it was built by a Nabataean culture with an established and effective kingship of the early 1st c. BC that was very much aware of the political dangers surrounding it, especially those posed by their neighbors in Hasmonean Judea, and at times even Ptolemaic Egypt and Seleucid Greater Syria. However, the Nabataeans also mixed their preparations for crisis with the construction of strategic desert palaces that also enhanced personal comfort and safety by mastering the exploitation of their local geology and seasonal weather patterns to manipulate and control the power of water and geology in desert environments. This paper thus presents a number of hypotheses to be tested given a careful mapping of current surface remains including a proposed chronology. The first hypothesis is that the Nabataean Burg-Burge Monument was initiated during the beginning of the 1st c. BC. Second, that this monument (and its possible sister strategic palaces) combined with similar structures, especially those built by Alexander Jannaeus in the early 1st c. BC, were the inspirations for the later desert palaces and strategic structures of Herod the Great given his father's connections to Petra and Herod's ongoing family connections (via his mother) and personal visits to Petra itself. Third, the height of the Nabataean strategic use of the Burg-Berge occurs during the reign of Aretas IV given his particularly hostile relationship with Judaea due to the adulterous actions of Herod Antipas that particularly impacted Aretas IV's daughter and destroyed an important political alliance between Judaea and Nabataea that would have dire political consequences for both nations.

Thus, given its importance in the histories of both Arab/Aramaean Nabataea and Idumaean Judea, the Burg-Berge Monument desperately requires immediate consolidation and conservation efforts. This incredible building has much to teach us. It reveals a Nabataean culture concerned with the regional political crises surrounding it, as well as a civilization that could also still maintain sites of cultic importance and creature comforts in one of the most challenging natural and political environments in the history of the Near East.

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The Nabataean Crocodile Shrine near al-Bayḍā

Introduction

During the 2017 excavations at Umm Hamtha located on the southern edge of the Baʿja massif, just a few kilometers north of al-Bayḍā (Fig. 1), Ayman Amarin, a member of the Sela work crew, brought to my attention a cultic niche with a depiction of a crocodile stretched vertically across the niche. It was located just north of al-Bayḍā inside a cave in the Raqqabta Abu Thabet area, to the west of the entrance to Siq Umm al-Ḥīrān on the Namala Road (Figs. 2–4). According to Ayman, after the discovery, the crocodile was chiseled off the cultic niche (Fig. 5). The photo Ayman provided appears to justify his claim. The relief seems to have been executed with some precision. The depiction of a crocodile in a cultic niche is unique as far as I can determine. In 1997, Robert Wenning and the late H. Merklein launched the "Petra Niche Project" which has already documented 840 votive niches in the eastern half of Petra alone, two-thirds of which were previously unrecorded, with an estimated total of over 1,200 for the Petra region (Wenning 2013: 343–50). The vast majority are aniconic, with only a few figurative or anthropomorphic representations (*e.g.*, Isis, Dhusharā-bust), but there also are eagles depicted in cultic niches in a valley just below Jabal al-Khubtha at Petra (Lindner 2003: 155–64). In addition to the enigmatic snake monument near Rās Sulaymān/Wādī ath-Thughra, there are snakes associated with votive niches at al-Qanṭara, along the stairs leading up to Umm al-Bīyarā, and at Jabal al-Barra, perhaps serving a protective-apotropaic function and possibly reflecting a Nabataean snake cult (Wenning 2012: 246–50; *cf.* 2019: 562). The crocodile at Raqqabat Abu Thabet may now be added to these other depictions of birds and animals that appear with cultic niches.

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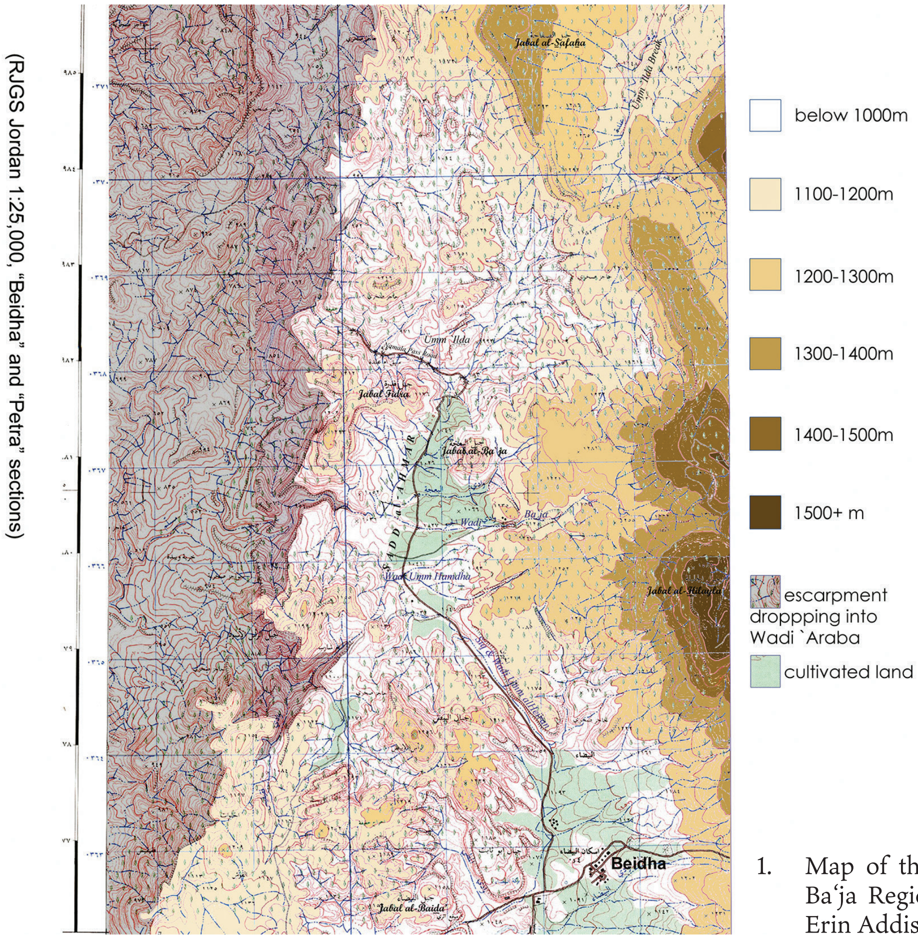


1. Map of the al-Bayḍā-Ba'ja Region (map by Erin Addison).

2. Raqqabta Abu Thabet, view to west. The cave with the shrine is located in the middle of the photo between the two mounds (photo by D.F. Graf).

3. Cave with shrine at Raqqabta Abu Thabet (photo by D.F. Graf).

4. Crocodile relief at Raqqabta Abu Thabet (photo by Ayman Amarin).

5. Shrine after relief was damaged (photo by D.F. Graf).

Terminology

The interpretation of the fairly common aniconic representations of Nabataean deities is traditionally connected with a statement in Philo of Byblos that the Greek *baitulia*, or "betyls," were designated by the god Ouranos as "animated stones" (*lithoi empsuchoi*) which fell from the heavens and possessed magical or divine powers (*FGrH* 790 F 2, 23). But no such myth, explicit or implicit, is known to have existed in the Nabataean realm (*cf.* Wenning 2001: 80), and the tangled web of Philo of Byblos' *Phoenician History* remains controversial. *Phoenician History* was produced during the Hadrianic period and was allegedly based on the earlier writings of the Phoenician priest Sanchuniathon. Sanchuniathon lived before the Homeric age, and his works are primarily preserved in Eusebius' *Praeparatio Evangelica* dating to the 4th c. AD. The authenticity of Sanchuniathon was infused with some credibility by the discoveries of mythological texts at Ugarit and Boghazköi (1400–1200 BC), but the subsequent comparative critical analysis of these texts with Philo reveals that they conflict and are in tension with his fragmentary texts (Barr 1974: 59). As a result, the mixed and muddled tradition of Philo has been aptly called a *farrago*—a "confused mixture." With earlier elements, there are fragments that suggest some of Philo's sources date after the Persian period (Lipiński 1983: 305–10), and that he represents, or follows in, the Hellenistic tradition of Manethos' *Aegyptiaca* and Berossus' *Babylonica* (Ogden 1978: 122–6; Edwards 1991: 219). The distortions and anachronisms in Philo's garbled account makes it a precarious guide for understanding religious phenomena in Nabataea. In sum, the terminology of "betyl" is both misleading and artificial.

In fact, no Semitic text ever refers to the representations of deities in cultic niches as "betyls." The standard precise terminology in Nabataean Aramaic texts for the monumental stones displayed in the cultic niches is "stele" (*nṣybt', nṣyb', nṣb',* and *mṣb'*), designating an "erected or raised votive stone, idol or statue" (Hoftijzer and Jongeling 1995: 749–51; *cf.* Monferrer-Sala and Ferrer 2017: 64, 68).[1] At al-Khubtha in Petra, the monuments in the niche are designated as "the stelae (*nṣyby*) of al-ʿUzzā and the Lord of the House (Temple)" (*RES* 1088, *'lh nṣyby 'l'z'wmr' byt'*). At Qaṭṭār al-Dayr at Petra, another text mentions "the stele which is at Boṣra" (Milik 1958: 246–7, *mṣb' dy Bṣr'*). Finally, a third text at ʿAyn Shallaley in Wādī Ramm designates the cultic stone as the "stele of the goddess Allat" (Milik 1958: 247, *nṣbty 'lt 'lht'*). There is not the slightest indication in any of these Nabataean texts (or elsewhere in Semitic texts) that the depictions in stone possessed divine or supernatural powers (see the catalogue of Wenning 2008: 613–5). Furthermore, it seems best to take the "aniconic" and "iconic" not as representations in opposition reflecting evolutionary stages, *i.e.*, the primitive versus the more "advanced" anthropomorphic (Patrich 1990; *cf.* Parlasca 1993: 279–81), but as complementary forms of representation attempting to evoke the divine (Gordon 1979: 11–3; Donohue 1997: 31–45; Basile 2002: 255–8; Gaifman 2012: 9–26).

Even in the presumed biblical antecedent (Genesis 28:10–2; *cf.* 35:6–8), the "pillar" is designated as a *maṣṣebah* (35:7) and the "place" where the gate to heaven and God appeared in a dream is given the name of *byt-'l* or Bethel (Genesis 28:16–7; 35: 7), as frequently observed (from Moore 1903: 206–8 to Gaifman 2008: 45–50; *contra* Zuntz 1947: 169–219). The Greek *baetyl/ baitulos* is clearly of Semitic origin, but rather than the corrupted interpretation of Philo, the original "House of God" should

[1] See also Philo of Byblos *FGrH* 790 F6 = Stephanos of Byzantium s.v. Nisibis: "Philo says *nisibis* means 'stelae.'"

be understood as the aniconic stone block/pillar/shape representing and embodying the god. In fact, many of the cultic niches are framed with the pillars of a house (called a *aediculum,* "little house"), lending credence to the niche representing a "house of god," or, as has been suggested, "windows," functioning "as a passage to the outer world with the gods as protecting guides" (Drijvers 1990: 76). But the representations of the deity represented inside the cultic niche are always designated in Nabataean Aramaic as a "stele." For this reason, I have chosen to reject the controversial term of "betyl" in favor of the more customary and neutral word "shrine."

The Interpretation of the Crocodile

Just as troublesome as the terminology is the meaning of the crocodile image. In the Augustan era, the crocodile was clearly a symbol of Egypt. After Octavian's victory at Actium, he issued coins in 28/27 BC with the legend AEGYPTO CAPTA above a crocodile (Fig. 6; *RIC* I² 275a, 544–5 = *BMCRE* 650). In similar fashion, at Nemausus (Nîmes in France), where veterans of the campaign were settled, the military colony became the location of an important imperial mint and immediately began issuing coins with the legend COL(*onia*) NEM(*aus*) above a crocodile chained to a palm tree (*RIC* I² 155–7), known popularly as the "As de Nîmes" (Puech *et al.* 2014: 58–66). In addition, reflecting Augustan political propaganda, *terra sigillata* were produced in fairly large quantities depicting a nude Cleopatra holding a victory palm while engaged in debauchery with a crocodile. The pottery circulated broadly in legionary camps and elsewhere (Paunier 2005: 349–55). But this hostile demagoguery is designed for a particular political objective, lacking currency in other more popular contexts, and far afield from Petra in Arabia.

6. Coin of Nemausus (Nimes), 27 BC: Obverse: Augustus and Agrippa; Reverse: Crocodile and palm beneath legend COL NEM.

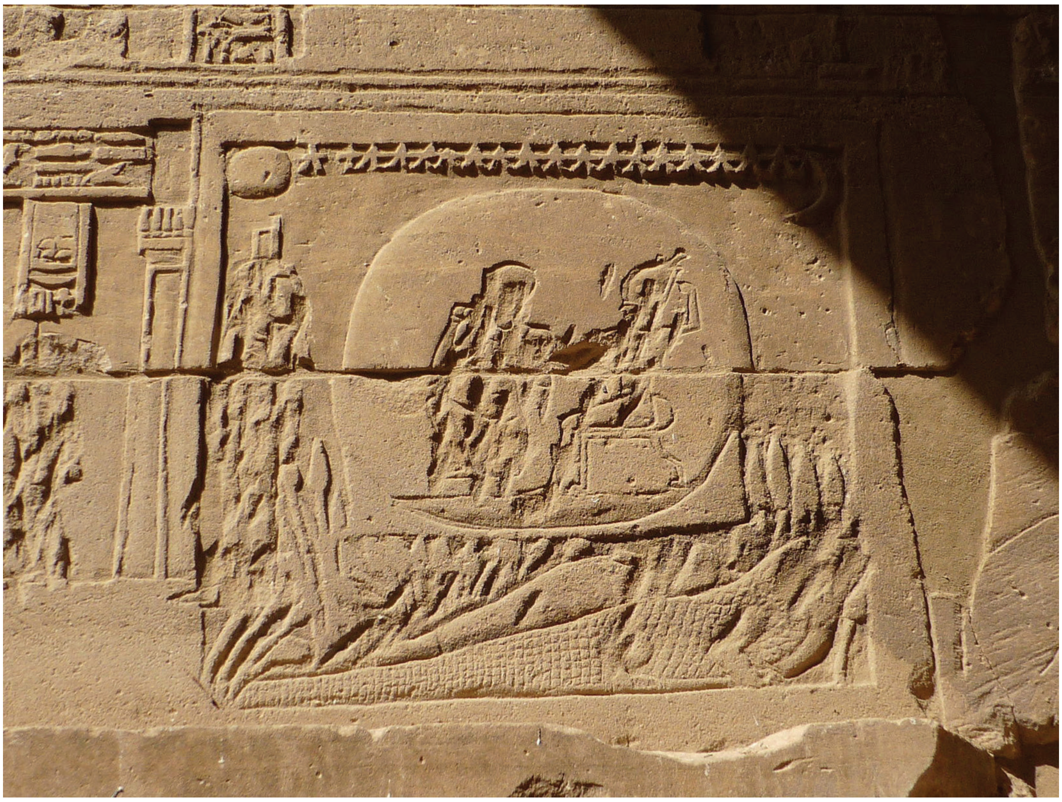
Internally, within Egypt, the crocodile metaphor is linked to the cult of Sobek (Greek *Souchos*)—the crocodile god *par excellence* (Brovarski 1984: 995–1031). The center of the worship of Sobek was the Fayum capital at Shedet, known in Ptolemaic times as Arsinoe and in Roman times Krokodilopolis. This fertile land with its marshes was an ideal habitat for crocodiles (Brovarski 1981: 792–801). The priests of the cult produced what is called the "Book of the Fayum," which identified Lake Moeris as the primordial ocean and listed the various local cult centers of Sobek. At Tebtunis in the Fayum, thousands of votive crocodile mummies attest the popularity of the cult, the dedications perhaps reflecting that the Fayum was the location of large-scale crocodile breeding enterprises (Molcho 2014: 181–93). Sobek was a syncretistic god, with the cult assimilating at an early stage the features of Re, Hapi ("Lord of the Nile"), Osiris, Horus, and others at an early stage. The pharaohs of the Middle Kingdom and Second Intermediate Period chose Sobek as their personal god and divine patron, and made his name part of their royal name. These relations raised the status of Sobek to a state god and established him as a symbol of power and part of royal ideology (Koenen 1981: 801–11). As such, Sobek became a primeval deity, a manifestation of Re on earth, as well as Osiris, the living god and son of Re, known as the "king of Shedet," accompanied by his spouse Isis and son Sobek-Horus (*cf.*

Tallet 2012: 139–63). Horus, the royal and state deity, was known in the Fayum as "Horus of Shedat," *i.e.* "residing in Shebat." The so-called *cippi* amulets of Horus are of apotropaic character and depict him with his feet firmly placed on a crocodile (Seele 1947: 43–52; Bakry 1967: 15–8). *Cippi* amulets were circulated widely through the Near East and are attested as far as Iran (Draycott 2011: 123–33). The cult of Sobek of the Fayum also extended throughout the whole Nile region. The magnificent temple of Kom Ombo, built by the Ptolemies on the foundations of the smaller pharaonic temple, gradually became the most important temple of Sobek in Upper Egypt (Gutbub 1982: 675–83: Brovarski 1984: 1010–1). In a relief at Dendera from the reign of the emperor Claudius, Horus of Edfu is depicted being reconciled with Sobek of the Fayum (Cauville 2007: 29–39), a late reflection of the union that was consummated much earlier in the Middle Kingdom (Brovarski 1984: 1008). With Sobek's assimilation to Hapi, the "Lord of the Nile," the crocodile god also became the god of water and marshes, with power over the inundation, bringing forth the flood, fertility, and rebirth to the land of the Nile (Koemoth 2010: 258–89). Since there was a well-established Arab community in the Fayum in the early Hellenistic period (Graf 2018a), it is entirely possible that a migrant Arab from the Petra region had adopted adherence to the cult of Sobek and honored his new Egyptian god in the crocodile relief in the shrine at Raqqabta Abu Thabet, but even more attractive possibilities need to be explored.

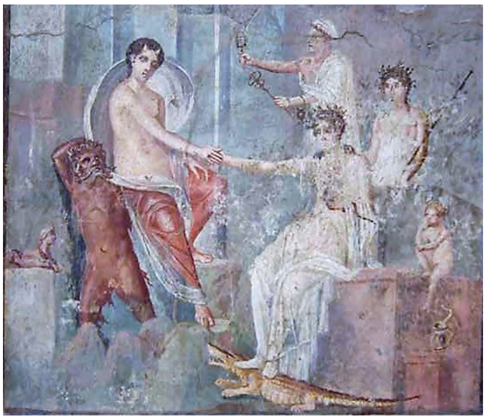
7. Relief with goddess Isis (left) and Sobek, the crocodile-headed god (right).

Isis and the Crocodile

The union of Sobek and Isis is a product of the myth of their combined effort to unite the dismembered limbs of Osiris, Isis' deceased husband. As a result, Sobek became a healer and a protective deity (Zecchi 2010: 3). The connection between Sobek and Isis is reflected in reliefs of the pair together (Fig. 7), and in some instance, Sobek even supports the coffin of Osiris (Fig. 8; *e.g.*, in the reliefs of the Temple of Isis at Philae: Vassilika 1989: pls. 1–44). In similar fashion, in the Temple of Isis at Pompeii, there is a fresco (likely originally painted in the Second Pompeian Style) on the southern wall of the *Ekklesiasterion* that depicts the Greek goddess Io, identified by the horns on her head, carried by a personification of the Nile and being received by Isis in her sanctuary at Canopos near Alexandria (Fig. 9). In this scene, Isis is seated with a cobra wrapped around her left arm and a crocodile at her feet. A small Harpocrates sits below Isis on an urn with water. Above Isis there is a priestess with a sistrum, a ritual rattle, and a priest who shakes a sistrum and a caduceus, a herald's staff and a symbol of Hermanubis (Moorman 2007: 151–3). On the lower left there is a small statue of a sphinx, and in the background a great altar with horns, disclosing that the scene is in the sanctuary where worshippers of Isis gathered for ritual banquets (Museo Archeologico Nazionale,



8. Relief from Temple of Isis at Philae. A crocodile with Osiris mummy on his back with Isis (left) and a solar disk above (Wikipedia Commons 2009).



9. Pompeii. Fresco of Isis receiving Io from the temple of Isis at Pompeii (permission of the Ministero dei Beni e delle Attività Culturali e del Turismo - Museo Archeologico Nazionale di Napoli).

Naples inv. 9558).[2] After the earthquake of AD 62, the freedman Numerius rebuilt the Temple of Isis (*ILS* 6367), evidently restoring the paintings in the Fourth Style (Nappo 1998: 89–91), including the Io-Isis fresco (Tinh 1990: 781–2, 794).

The fresco in the Temple of Isis at Pompeii is not the only fresco scene in which the crocodile is associated with Isis in the port city. For example, in the *Casa de Centenario*, an Isiac procession is depicted with two women carrying a crocodile on their left shoulders and is probably of Alexandrian inspiration (Fig. 10; De Vos

[2] For a discussion of the fresco, see Tinh 1964: 81–2, 128 no. 15 pl. XVI, 2; *cf.* Merkelbach 1965: 14. See also Grenier 1994: 22–6 on *Oxyrhynchus Papyrus* 1380 and Moormann 2007: 137–54 in general.

10. Pompeii, Casa de Centenario, woman carrying a crocodile on her left shoulder in an Isiaic procession (De Vos 1980: 38 fig. 15).

1980: 35–47 fig. 15). By the Augustan era, Isis was a normal feature even of the imperial landscape at Rome. On the Palatine, the houses of Augustus and Livia—as well as in the Villa Farnesina nearby in Rome that is associated traditionally with Augustus' associate, Agrippa—contain wall paintings that feature Isis in her various roles (De Vos 1991: 121–7; 1984: 59–71). In Augustus' Palatine House, the fresco in Room 15 on the upper floor reflects the Isis cult and many Egyptian symbols, such as obelisks and lotus flowers. The new style of room 15 was painted between 30 and 28 BC, probably by an Alexandrian artist (Carettoni 1983: 67–92 Taf. 18–22). In the adjacent House of Livia, there is a painting of Io/Isis (*ca.* 30 BC with Augustus symbolically offering Isis the land of Nubia: Takács 1995: 100). In the Villa of Livia at Prima Porta, there is also a depiction of Isis (Cubiculo B, right wall: Di Mino 1994: 208–13; 1998: pl. 76). In the nearby Villa della Farnesina in Rome, there is a representation of Zeus Ammon and Isis (Di Mino 1994: 215–35; 1998: pls. 24, 75). In the *Aula Isiaca* discovered beneath the Flavian Palace (Iacopi 1997), the paintings of the late Second and early Third Pompeian Style include a female figure with the Isaic headdress or sistrum identified as a priestess of Isis surrounded with Nilotic scenes (Aerae 2015: 88–91). This "Egyptomania" in the decoration of the Augustan Palatine represents a distinct cultural change that appears to have its roots in Ptolemaic Alexandria, which was perhaps perceived as the "primeval paradise" (Aerae 2015: 93), divorced from religious and political motivations (see Dio Cassius 53.2.4 with Orlin 2008: 251–3; Malaise 2011: 185–99). But within the Nabataean realm, the cult of Isis was a vital and real force.

Isis at Petra

As we have seen, the cult of Isis penetrated Petra by at least by the late 1st c. BC (Merklein and Wenning 1998; Healey 2001: 137–140; Vaelske 2013: 351–61), but maybe even earlier, given the intimate connections with Ptolemaic Egypt (Graf 2006). This was certainly the case elsewhere in the Levant. The onomasticon of the 4th c. BC Idumaean ostraca in Palestine has numerous Arab names, with several theophoric "servant names" with the Egyptian deity for Isis.[3] A Nabataean inscription also mentions the goddess Isis at Sīʿ in the Ḥaurān in the year

[3] For Isis, see ʿBD-SY (A14: 3) and ʿBD-ʾS (A215.1), and even several for Osiris, ʿBD-ʾWSYR' (EN 96. JA 86.A215.1 and more) Porten and Yardeni 2014: 244; texts cited in Yardeni 2016: 652 for both names, includingEphʿal and Naveh 1996: nos. 96, 98, 182. Note that ʿbdys also appears at Beersheeba: Naveh 1979: nos. 37, 45.

108/7 BC (Milik 2003, 269–74, correcting his date of 104/3 BC). At Petra, the signs of the adoption of the cult are later, attested first in a dedication to Isis at el-Mreriyye in Wādī es-Siyyagh in a relief of the goddess dated to 25 BC (Milik and Starcky 1975, 120–4 = Bricault 2005: 513 no. 404/0501; Merklein and Wenning 2001; *cf.* Janif 2004). The possible presence of Osiris in the relief at el-Mreriyye has led to the suggestion that the mysteries of Osiris were celebrated at Petra and that Isis herself had a small temple at the Nabataean capital (Bricault 1992: 39, 45). Significant monuments and evidence of the worship of Isis have been found scattered across Petra (recently summarized by Wenning 2016: 519–24). The concentration of Isis statuettes at the Temple of the Winged Lions at Petra shows the popularity of the cult (Roche 1987: 218). There also are some 20 or more terracotta and stone figurines, primarily from domestic contexts, scattered throughout the civic center (El-Khouri 2002: 11, 52–4), demonstrating the widespread popularity of the cult at Petra. A much later Greek inscription of AD 257 mentions a priest of Isis at Petra, who must have had precursors (Milik and Starcky 1975: 123 = Bricault 2005: 514 no. 404/0502).

This penetration of Isis into Petra is supported by sculptures of Osiris, Harpocrates, Sarapis, sphinxes, and Dionysus found at the Nabataean capital (Wenning 2019: 562). Nevertheless, in spite of abundant evidence for the cult of Isis at Petra, the Nabataean onomasticon reveals only few anthroponyms with the name of the goddess Isis in theophoric personal names (*ʿAbd-Isis,ʿbd-ʾsy*). As far as I can determine, there are only four such cases: 1) the gorge of el-Jerra (Dalman 1912: n. 87 = RES 1431; reading by Littmann 1914: 275), 2) the path to the so-called "Obodas chapel" (Dalman 1912: no. 3 = RES 1382; reading by Lidzbarski 1915: 276–7), 3) cistern D. 523 at Jabal al-Mʿīysrah West (Dalman 1912: no. 93 = RES 1435 = Littmann 1914: 276), and 4) the Wādī Shuʿb Qays (Milik and Starcky 1975: 122). Their scarcity is somewhat surprising given the prevalence and pervasiveness of the Isis cult at Petra.

A similar absence exists for the presence of the Isis cult elsewhere in Nabataea, suggesting the evidence at Petra is an isolated phenomenon. Elsewhere, the evidence for the Isis cult appears to be later and fragmentary. At Gerasa in the Decapolis, statues of Sarapis and Isis were dedicated in AD 142/3 (Bricault 2005: 512 no. 404/0401) and an inscribed bust of Sarapis decorated with Isis crowns and headdresses is attested from Umm al-Jimāl in the 2nd or 3rd c. AD (Weber 2006: 82 no. 61). In contrast, in Palestine to the west, the evidence is much earlier. The wall paintings at Tomb I at Marisa have been interpreted as having Dionysiac and Egyptian overtones (Jacobson 2007: 46–9) and the reference to a Dionysiac festival at Jerusalem in 2 Macc. 6:7, regarded traditionally as suspicious, has been recently determined to be authentic (Amitay 2017: 265–70). There is also inscribed Isis-type pottery at Samaria-Sebaste of the late Hellenistic period (Magness 2001: 158–65; Bricault 2005: 510 no. 403/0501; *cf*. Bricault 1999). For the Augustan period, there is a dedication to Sarapis and Dionysos at Nysa-Scythopolis (Bricault 2005: 509 no. 403/0301; Belayche 2017: 12–5). This evidence for Palestine and Arabia is just a reflection of the widespread popularity of the Isis cult across the Mediterranean in the Hellenistic and Roman periods (Bricault 2001: see Map I for the diffusion across the Mediterranean world; for the epigraphic evidence: Bricault 2005; for the numismatic evidence: Bricault 2008). The substantial and extensive evidence of Isis at Petra and elsewhere is then not merely a local phenomenon (*pace* Alpass 2010: 107), but rather a phenomenon of large-scale proportions generated by Ptolemaic influence and the attraction of the Isis cult.

In similar fashion, the Nabataean queens are represented as the Tyche (fortune deity) of their realm, with a raised open palm, and a headdress decorated in the front with an Isis ornament. The same Isis iconographic elements are reflected in the representation of the goddess al-ʿUzza (Zayadine 1981: 117; 1991: 283–306; *cf.* Schwentzel 2005: 162; Kropp 2013a: 242–43). The Isis headdress appears first with Queen Huldu in the reign of Aretas IV in AD 15 and later with Queen Shuqilat in AD 27 (Hoover and Barkay 2010: 204; Schwentzel 2010: 241–3; *cf.* Kropp 2013a: 26). It continues with the later queens of Rabbel II, Gamilat, and Hagiru (Kropp 2013b; Schwentzel 2014: 156–58; Barkay 2016: 19, 22). These depictions suggest the numismatic images of Nabataean kings and queens have been infused with the divine symbols of Dionysos and Isis. The influence of Ptolemaic royal portraiture in Nabataean coinage is rather explicit, but not unusual for the period.

These royal portraits are a reflection of the Ptolemaic dynasty, where the queens identified themselves with Isis. Arsinoe II Philadelphos in the 3rd c. BC identified herself with a host of female deities, including Isis, Aphrodite, and Hathor (Müller 2009: 280–99; Caneva 2012: 12; *cf.* Quaegebeur 1978). But by the reign of Cleopatra III (161–101 BC), Isis is predominant (Smith 1991: 208–9; Van Nuffelen 1999: 179). The latter queen even represented herself as the "Sacred foal of Isis, the Great Mother of the gods," a clear attestation that the Ptolemaic queen identified herself with Isis (Fraser 1972: 221 n. 249; *cf.* Colin 1994: 272–83; Plantzos 2011: 395). By the 1st c. BC, the ruling king and queen were now thoroughly divinized, the *Königspaar* (Colin 1994: 293), and incorporated into the Egyptian cult "during their lifetime" (Quaegebuhr 1989: 107). This culminates with Antony and Cleopatra, identifying themselves as the *Neos Dionysos* and the *Nea Isis* (Fraser 1972: I 245–6; Quaegebeur 1998: 53; *cf.* Roller 2010: 114–7). Cleopatra VII was not only the representative of Isis in Egypt, but the protector and preserver of her cult from the beginning of her reign (Bernand 1992: no. 21, dated to 51 BC). It is precisely this time that the Nabataean dynasts begin portraying themselves as Dionysos and Isis.

The attestation of *thiasoi* and symposia at Petra confirm the reality of this iconography. At Wādī al-Amti, just northeast of Siq al-Bared at al-Bayḍ**ā**, 9 km north of Petra, a Nabataean inscription mentions "Ganamu, the *rab marzeḥ,* and his son Wa'ilu," i.e., the symposiarch of a *marzeḥ* (Zayadine 1976: 139–42; 1986: 465–74). At we have seen, al-Bayḍā was the center of wine production, and Wādī al-Amti is adjacent to an elaborately decorated building discovered in 2006 with a colonnaded hall and triclinium dating to the reign of Malichus I (59/58–30 BC). It has been identified as a "Dionysiac" banquet hall, based on the Dionysian-like styled human-headed capitals associated with the structure (Bikai *et al.* 2008: 465–507). The nearby "Painted House" at al-Bayḍā depicting grapes and vines (McKenzie 1990: 114–5), perhaps with an Isis figure, has recently been interpreted as a banquet complex and Isis sanctuary (Twaissi *et al.* 2010: 31–42 fig. 10). Both ritual areas are located at the center of the numerous winepresses in the al-Bayḍā-Baʿja region, which I have designated "Dionysiac lands" of the Nabataean dynasty, perhaps comprising their royal vineyards (Graf 2018a; *cf.* Schmid 2017; Bellwald 2020). This would be an appropriate setting for an adherent of the Dionysos-Isis cult to create a votive shrine with a sculpted crocodile at nearby Raqqabta Abu Thabet symbolizing his devotion to the Egyptian gods. Without epigraphic support associated with the shrine, there is no absolute certainty for this proposal, but I hope the case presented is at least reasonable if not plausible.

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Building a Capital: New Evidence for Construction Techniques in Petra

Introduction

Approaching ancient building processes has always been associated with difficulties.[1] Usually, ancient buildings are preserved only as ruins and associated construction processes are no longer traceable. Therefore, one must search for small traces which provide evidence for certain construction processes, like construction lines, mason marks, or tool marks on single architectural blocks. In Petra, only the Qaṣr al-Bint (Zayadine *et al.* 2003) is preserved to such an extent that information on the construction of the building itself can be obtained from the extant remains. All other structures investigated so far could only be documented in their much more ruinous condition. Walls are only preserved up to a relatively low height, so that further information on the uprising wall structure, doorways and entrances, further storys, and the upper end of the buildings with entablature and roof can only be obtained from the collapsed building components. Investigations on the large buildings in the city center, not only the Qaṣr al-Bint but also the Great Temple (Joukowsky 1998; 2007; 2017a), the Temple of the Winged Lions (Hammond 1996) as well as the Nabataean-Roman villas on az-Zanṭūr (Bignasca 1996; Schmid and Kolb 2000; Kolb 2007; 2012) have provided a lot of information about

[1] In the course of the research on Nabataean capitals for my dissertation project 'Architecture and Architectural Decoration in Petra (Jordan)—Studies on the freestanding Nabataean architecture and their models', more than 250 capitals in and around Petra were examined in detail. Special credit goes to the North-Eastern Petra Project and its directors, for giving me the opportunity to conduct the study on this topic, and the American Center of Oriental Research (ACOR; now the American Center of Research) which gave me the permission to study the capitals of the Temple of the Winged Lions and to use them for comparison. All measurements used here, as far as they are not provided with an additional reference, originate from this research.

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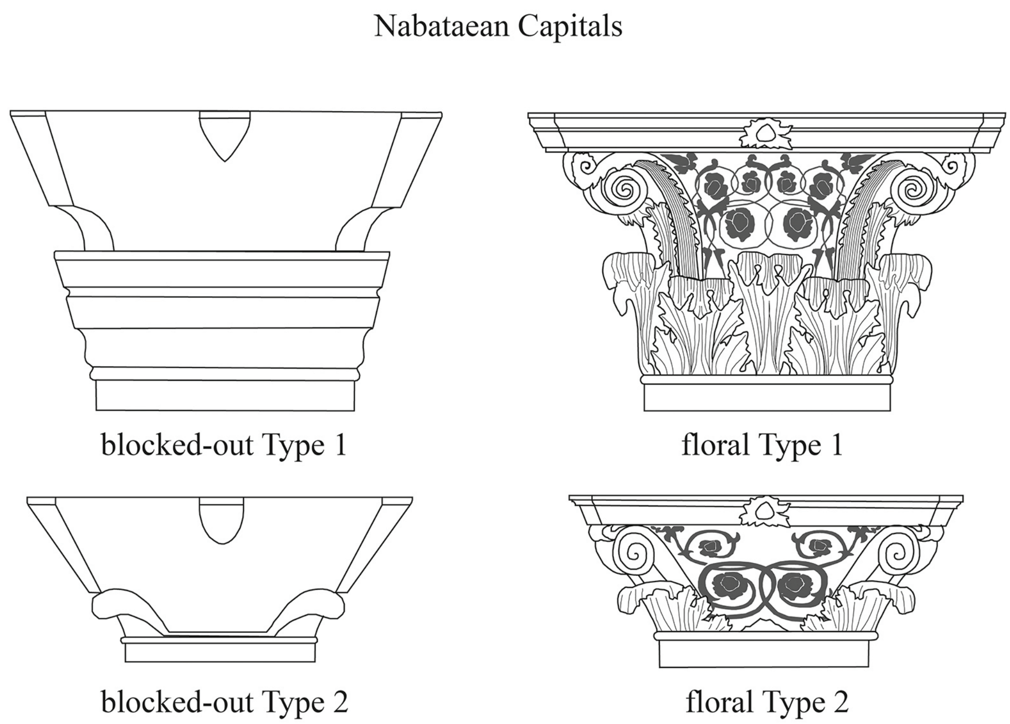


1. Nabataean blocked-out and floral capitals (by M. Dehner).

the construction of walls, floors, and the general layout of individual buildings. Furthermore, the investigations led to the identification of the Egyptian long cubit as the main unit of measurements which was used, at least, for the construction of the Qaṣr al-Bint (Zayadine *et al.* 2003: 77–80). This hypothesis has not been confirmed on other buildings yet. A comprehensive study on construction techniques in Petra was presented by Rababeh (2005) who gave an overlook mainly on the construction of columns, walls, floors, and roofs as well as the building material and quarries it was obtained from. A study of the quarrying work, material, and tools and the work carried out by the stonemasons in Petra is provided by Bessac (2007).

As mentioned above, the analysis of individual structural elements in particular provides indications of certain construction techniques. The following study is based on observations on capitals located in the area of the North-Eastern Petra Project, subsequently referred to as the NEPP, and the Temple of the Winged Lions, which have also been confirmed on other capitals in Petra. The Nabataean capital of Type 1 (Fig. 1) will be examined more closely, especially marks on them which can be interpreted as construction lines. The evaluation of the findings, in turn, makes it possible to shed more light on general developments concerning construction processes in Petra and to underscore the dependence on the construction material.

The Nabataean Capital in Petra

The Nabataean capital, in its blocked-out version as well as the sculpted floral one, has a unique appearance. As several scholars have already pointed out, the two different forms are interrelated (McKenzie 1990: 116; Patrich 1996: 203–7; Netzer

2003: 162; Grawehr 2017: 105). The blocked-out version is to be seen here as a simplified form of the floral one, whereas the floral Nabataean capital in its principal appearance is related to the Corinthian capital (Ronczewski 1932; Schlumberger 1933). Both capital forms were an integral part of the architectural decoration of freestanding buildings (Dehner 2020). At least three different types of Nabataean capitals can be identified (McKenzie 1990: 190; Patrich 1996: 197–200).

Both capital forms appear to be made of roughly the same dimensions with a lower diameter varying between 0.62 to 0.70 m. This can be seen in the examples of blocked-out capitals from the Roman Theater (Hammond 1965: 45), in the city's 'Central Area' (Parr 1957: 10–1), and in Structure 2 of the NEPP (Schmid *et al.* 2012: 91–3; Fiema *et al.* 2016: 750–2; Dehner 2020) as well as the floral Nabataean capital with examples in the Dionysian Hall (Bikai *et al.* 2008: 480–2 figs. 14, 16), on az-Zanṭūr IV (Kolb *et al.* 1999: 265) and in the Bâtiment B (Fournet 2017: 48 fig. B.10). Also, findings in Bâtiment B (Fournet 2017: 46–9 figs. 3, 5) and in the Nabataean/Roman Villa az-Zanṭūr IV (Kolb and Keller 2000: 358) prove the use of both forms in the same building. In terms of size, the capitals of the monumental temples in the city center were an exception. Especially on the entrances and building façades, floral capitals of much bigger dimensions were used regularly, as can be seen on the Qaṣr al-Bint (Zayadine *et al.* 2003: 160–1 figs. 26–27), the Great Temple (Hussein 2017: 123–6; Schluntz 1998: 226), and the Temple of the Winged Lions (Kanellopoulos 2004: 228).

Construction of the Nabataean Capital

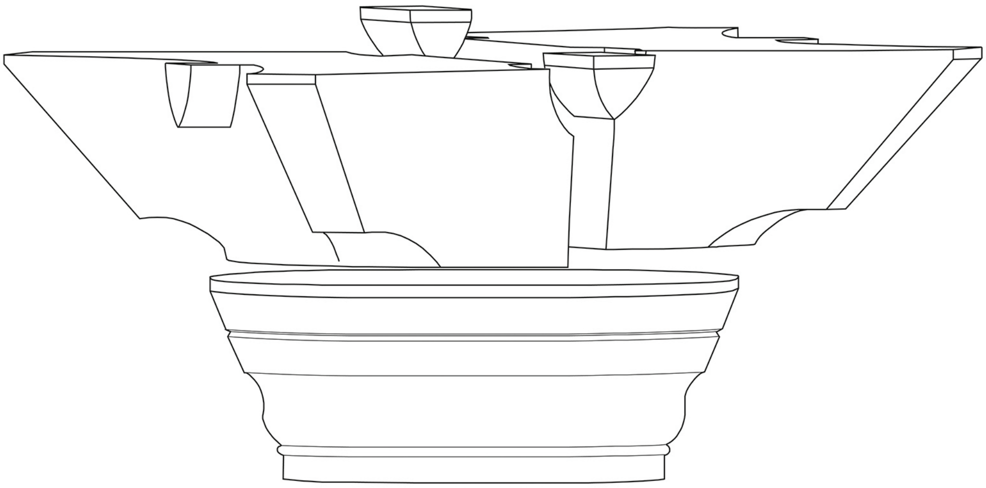
The two capital forms do not only show similarities in their dimensions, but also in their general construction. Based on findings in Structure 2 of the NEPP area, the group of Nabataean blocked-out capitals was examined in more detail (Dehner 2020). The evidence shows a large number of half-capitals representing the upper segment of a Nabataean blocked-out capital of Type 1 with a height of 0.30 to 0.32 m (Fig. 2). In addition, there are several fragments of the lower segment with a lower diameter of 0.62 to 0.68 m (Fig. 3) which, however, consists of a complete drum with the outer faces being decorated with a sequence of moldings. The finds indicate that these capitals were composed by combining separately worked upper and lower elements of about the same height to form a single capital. Additionally, examples of a smaller capital order with a lower diameter of 0.25 to 0.30 m (Fig. 4), this time made out of one block, proves the use of blocked-out Type 1 capitals in more than one area of the same building. The upper and lower segments show the same height in both the smaller and larger capitals. All capitals in the NEPP area were made of sandstone.

Looking at other examples of Nabataean capitals of freestanding buildings in the city center, it becomes apparent that this is not a singular phenomenon which is specific for the buildings in the NEPP area. Moreover, all examples of blocked-out and floral Type 1 capitals, once they reach a certain size, show a subdivision into separately carved upper and lower elements of about the same height. Additionally, the upper elements were always worked as half-capitals, which were placed back to back on the lower segment (Fig. 5). In addition to the NEPP area, this construction technique has also been observed for capitals in the Roman Theater (Hammond 1965: 45), in the Temple of the Winged Lions (Hammond 1977: 47), and the Dionysian Hall in al-Bayḍā (Bikai *et al.* 2008: 496). The examination of the capitals in recent years has shown that this construction technique was applied equally to all Type 1 capitals that had a lower diameter of at least 0.60 m.

2. Nabataean blocked-out half-capital of upper segment from NEPP area Structure 2 (by M. Dehner).

3. Nabataean blocked-out capital lower segment from NEPP area Structure 2 (by M. Dehner).

4. Nabataen blocked-out half-capital of smaller order from NEPP area Structure 2 (by M. Dehner).



5. Construction of a Nabataean blocked-out capital of Type 1 (by M. Dehner).

Construction Lines on Nabataean Capitals

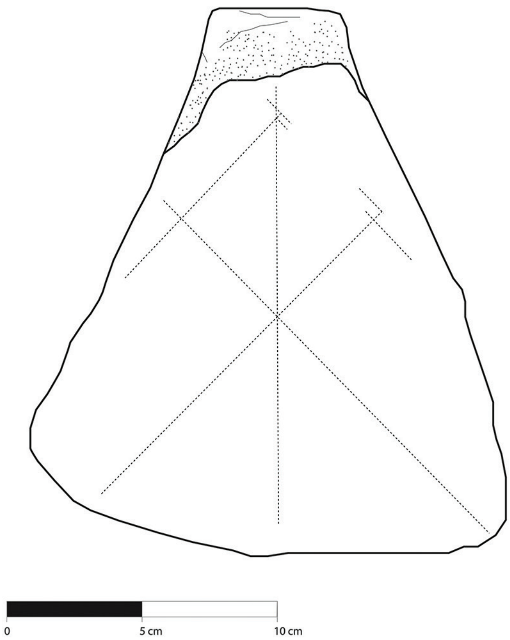
In addition to their size and construction mode, these capitals had another feature in common. Several examples of the upper segments show clearly recognizable, incised rectangular lines on their respective top surfaces and partly also on the bottom ones, which can be understood as supporting lines for capital production.

During the investigation of capitals in Structure 2 of the NEPP, fine lines were observed on the surface of different sandstone capitals (Fig. 6) showing regular intersecting lines at 45° and 90° angles to each other. These finds are mainly representatives of smaller capitals of an interior order of that building. The state of preservation of most capitals of larger dimensions in Structure 2 unfortunately does not allow further examples to be found, as their surfaces are too heavily eroded. Corrections of these lines can also be seen indicating a rather high degree of geometrical accuracy.

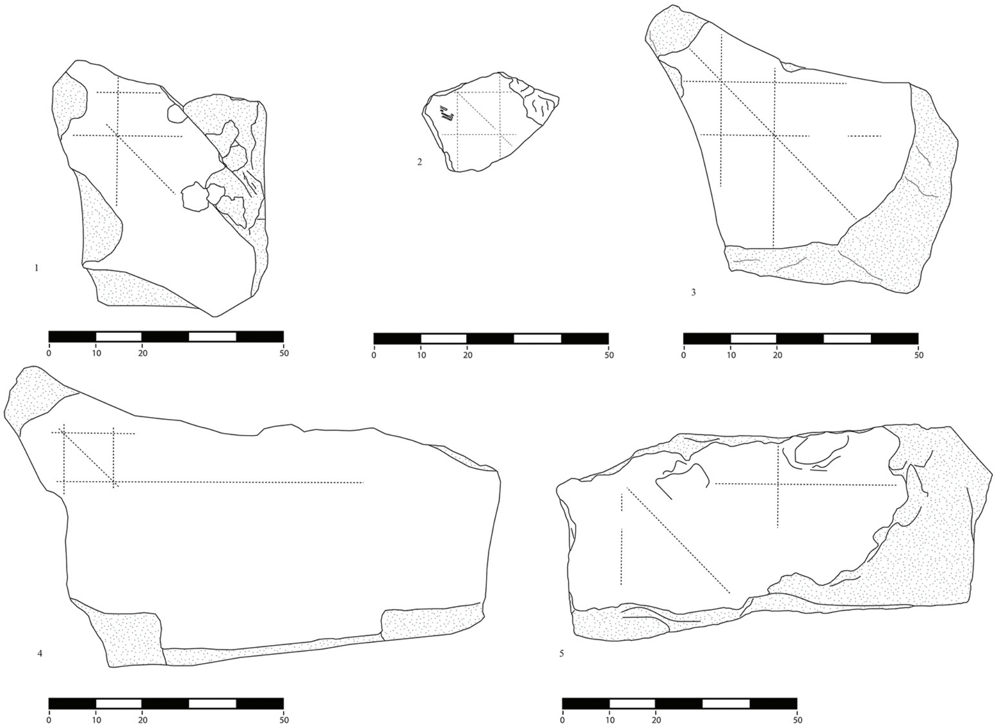
Comprehensive evidence of incised lines on capital surfaces can be found on examples at the Temple of the Winged Lions. While the aforementioned examples have only been blocked-out capitals, the temple area sees several limestone capitals or fragments of floral Type 1 capitals as well as several blocked-out sandstone capitals of Type 1 which show similar incised lines on the upper surfaces (Fig. 7). In some cases, such lines are also visible on the bottom surfaces. The half-capitals have a height between 0.32–0.35 m. They belong to capitals which, in total, have a height of 0.65 to 0.70 m with a lower diameter of the same dimensions. Several lower segments of blocked-out and floral capitals are preserved here. While representatives of both capital forms are gathered in the vicinity of the Temple of the Winged Lions, it is not clear whether they originally came from the same building. Nevertheless, both have the same dimensions and show similar traces of supporting lines on their respective surfaces.

Another half-capital of a Type 1 Nabataean capital on the Katūt Hill again shows the same incised lines on both the top and bottom (Fig. 8). The construction supporting lines on this capital constitute the best preserved example in Petra so far. This half-capital has a height of 0.32 m and belongs to a capital which must have crowned a column drum with a diameter of 0.60 to 0.70 m.

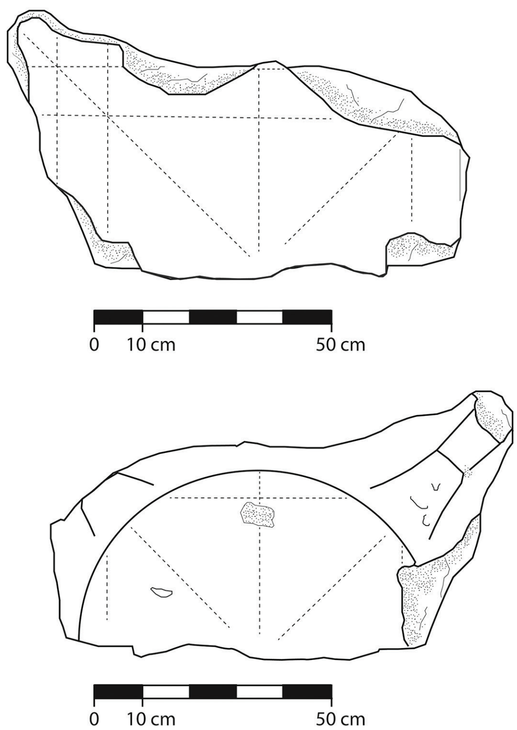
Such incised lines on capitals were further observed on the top surfaces of several capitals in the Dionysian Hall (Bikai *et al.* 2008: 480 fig. 14, 497–498 cat. no. 9). They remain preserved on capitals of a larger order with diameters of 0.64 m and a smaller order of about 0.30 m. Here, the high degree of geometrical accuracy



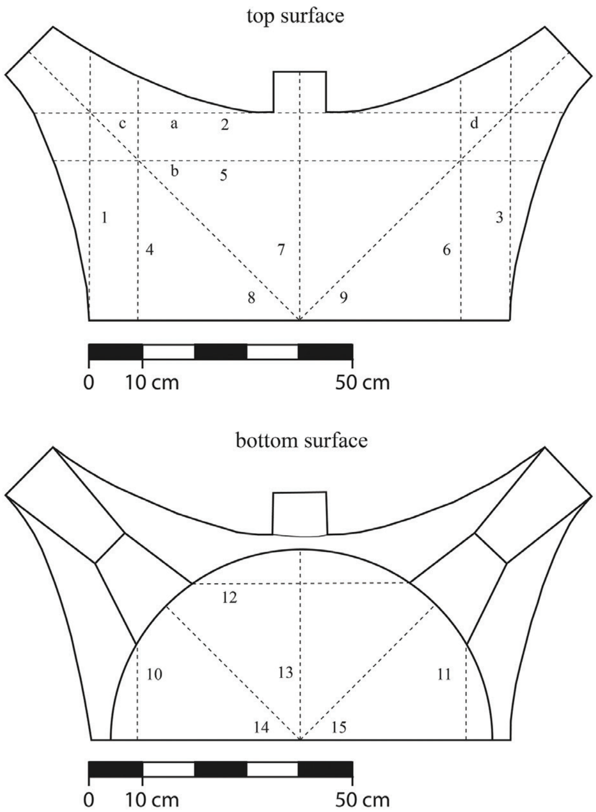
6. Supporting lines on an abacus fragment from the NEPP area (by M. Dehner).



7. Supporting lines on upper surfaces of Nabataean blocked-out capital from the TWL area (No. 1, 3, 4–5) and in the NEPP area (No. 2)



8. Supporting lines on a Nabataean blocked-out capital from the Katūt Hill (by M. Dehner).



9. Schematic illustration of construction lines on Nabataean capitals' top and bottom surfaces (by M. Dehner).

is underlined by the fact that the intervals between the lines on the smaller capitals are exactly half of those of corresponding lines on the larger capitals. Further examples on az-Zanṭūr,[2] in the gallery in front of the Nazzāl Camp, and other places in the city center that were registered during the examination of all capitals in the city center prove that the use of such supporting lines was quite common in capital production in Petra.

The lines on those capitals that show them on their top surfaces are fine, orthogonal lines (1–9 on Fig. 9) of 1–3 mm width and form two rectangles, a larger (a) and a smaller one (b) inside the first, as well as two small squares (c, d). Diagonal lines bisect each rectangle (7, 8) and run towards the center of the abacus corners. In most examples, an additional line marks a vertical axis through the middle of the block (9), cutting the rectangles in half. This line corresponds to the radius of the capital at the point where it intersects with the larger rectangle. It continues to the edge of the block, where it marks the center and probably also the length of the abacus flower. The bottom end of this last line is where the two diagonal lines (7, 8) meet. On various capitals, corrections of the lines can be seen. The distance between lines 1 and 3, the shorter sides of the larger rectangle (a), appears to indicate the width or upper diameter of the capital. Towards the front of the abacus, there goes a connecting line (2) between the two lines on the short sides of the half-capital (1, 3). The larger rectangle also indicates the point up to

[2] M. Grawehr shared a drawing of a capital with such incised lines from az-Zanṭūr IV which also shows several adjustments on the top surface. U. Bellwald confirmed the observations on az-Zanṭūr as well.

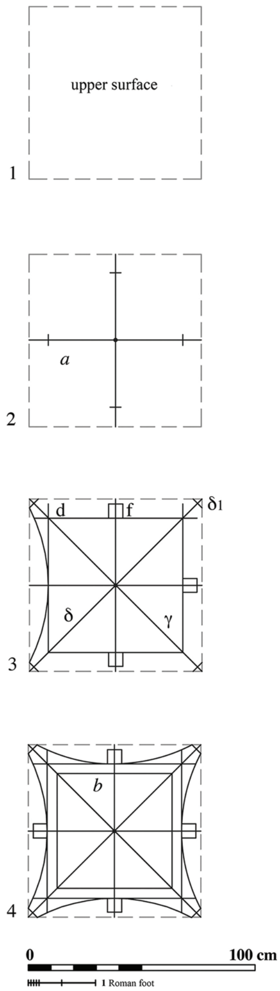
which the concave curvature of the abacus was going to be executed. After crossing each other, the lines (1–3) continue until they reach the edges of the block. Another three lines (4–6), which run parallel to the respective lines of the larger rectangle, form a second, smaller rectangle (b). As with the larger one, the lines of the smaller rectangle continue to the end of the block. Thus, two small squares (c, d) are formed between the corners of rectangle a and b. The two diagonal lines (7, 8) that cross the intersections of both the smaller and larger rectangle on each side, and by that cut the squares (c, d) in half, seem to indicate the length of the abacus corners.

While the larger rectangle seems to define the limits of the concave part of the abacus, an explanation for the use of the smaller rectangle is not immediately apparent. The distance between the shorter sides of the smaller rectangle does not correspond to the lower diameter of the upper segment, as one would expect. However, it is apparent that the lines of the smaller rectangle correspond to the ones on the bottom surface (10–13) of the same block, which so far were found preserved only in three findings of blocked-out capitals. The incised lines on the bottom surface run parallel to each other on the short sides (10, 11). Another one (12) runs orthogonally to those last ones, parallel to the backside. This line again creates a kind of rectangle, even though the intersection of the lines is not visible anymore in any of the three examples. Each of these lines ends at the base of the volutes. A central line (13) marks the central axis as well as the lower radius of the block. With regards to its use, the smaller rectangle appears to be an indicator of the diameter of the corresponding column and the lower diameter of the capital's lower segment.

Construction Lines on Corinthian Capitals in the Mediterranean World

Capitals with incised supporting lines are not a new observation and they are not unique to Petra. In fact, they are known from various places throughout the Greek and Roman Mediterranean world (Toma 2015: 812 n. 7) and always show a similar layout as the examples in Petra. All around the Mediterranean Sea from Italica in Spain (Ahrens 2005: 116–7 pl. 101) to Priene in Turkey, Sabratha and Leptis Magna in Libya (Toma 2015: 812–5, figs. 2, 4, 6), or Dionysias in Egypt (Pensabene 1993: 236–7), incised lines can be found—especially on Corinthian capitals. In contrast to the examples in Petra, most of the Corinthian capitals were produced out of one block. The capitals from Dionysias, on the other hand, are made of limestone and consist of two separate segments. While the construction of the capitals is different from that at Petra, the layout of the incised lines on the surfaces is very similar for all of them.

N. Toma (2014; 2015) has discussed the purpose of such lines, which she defined as construction lines, on marble capitals in more detail. She has outlined the possible process of applying these lines to the stone block as follows (2015: 814–15): In a first step, two orthogonal lines (α, β on Fig. 10) were incised on the upper surface of the stone to determine the center of the block, followed by the second step, during which the capital's height was projected by marking it on the orthogonal axis, resulting in a square (a) with the center of the block in the middle. In theory, the height of the capital should equal the axial width of the abacus. This characteristic is known as the 'cross-section rule', which according to Wilson Jones applies to two thirds of all Corinthian capitals (Wilson Jones 2000: 145). After that second step, the concave shape of the abacus was outlined and the diagonal width of the abacus was marked (γ, δ). The square (a) created in the previous step indicates the diameter and at the same time the lowest point of the concave curvature of the abacus. The corners of the abacus are



10. Proposed incision sequence of construction lines on Corinthian capitals (Toma 2015: 817 fig. 8).

projecting from the corners of the square (a). Additionally, the dimensions of the projecting abacus flower (f) were marked during this step. In a last step, a second smaller square (b) is created to show the diameter of the capital's bottom side and thus the diameter of the column it would be placed on.

According to Toma, the construction lines bundled the dimensions for carving the abacus and the lower diameter but gave no hint for the proportion of the elevation of the capital (2015: 816), which had to be communicated in another way. The incised lines would be applied on a roughly dressed quarry block with a fine iron point, while it was inclined on one of its sides with the upper surface facing the craftsman. This way, it would have been relatively easy for the craftsman to apply the lines on the upper surface that was facing him (2014: 89–90; 2015: 816). After projecting the center of the top surface onto the bottom one on the same vertical axis, possibly by an incision on one of the side surfaces of the block (Wilson Jones 1991: 116 fig. 15 iii; Toma 2015: 816), the actual processing of the capital started with the bottom part, for which the block was turned over onto its top. The two rows of acanthus leaves were roughly carved before the capital was turned over again and the shape of the abacus and the decoration of the upper part were roughly formed to obtain a half-fabricate. To continue with the detailed processing of the decorative elements the block was turned onto its top again in order to carve the acanthus leaves properly, followed by the decoration of the upper part. In her description, Toma follows the general procedure already described by Asgari in the course of his work in the quarries of Proconnesus (1988: 115–6 fig. 1). Although such construction lines have been preserved only on a limited number of capitals, which is probably owed to weathering and the final surface smoothing of the stones, they were originally applied to all capitals and were not limited to one prototype (Toma 2015: 816).

Although the construction lines of the capitals in Petra display a lot of similarities, it can be assumed that the production process differed due to the construction technique of working the upper and lower segments of capitals separately. Before a proposal for the production methods of a capital is made, it is necessary to have a look at the available stone material in Petra and the quarrying technique for obtaining it. These two factors inevitably determine the construction technique and the carving process of the individual segments.

The Influence of the Quarrying Work on Specific Building Elements in Petra

Ancient building activities always depended on the locally available materials. Rababeh (2005: 31) and Bessac (2007: 36) have clearly emphasized this fact in their studies on Nabataean construction and stonecutting techniques. In Petra, this means that mostly the locally available sandstone was used for the construction of the freestanding buildings (Rababeh 2005: 37; Bessac 2007: 33–4). In addition, limestone originating from the area of the modern town of Wādī Mūsā (Rababeh 2005: 40) was used for several building elements, such as the floral Nabataean capitals (Hammond 1996; Schluntz 1998: 226; Hussein 2017: 123; Rababeh 2017: 46–7), some bases, and for pavement slabs (Rababeh 2005: 39). But compared to sandstone, which was used for wall stones, column drums, entablature elements, and also blocked-out Nabataean capitals, the use of limestone was rare. Thus, the building material and especially the extraction methods in the quarry determined the possibilities of stonecutting and production of individual building elements, which means that monumental architectural blocks or building elements are rarely found in Petra.

The size of a rectangular block, which was how stone was usually extracted from the quarry, is given at an average dimension of about 1.50×2.00×0.60 m, rarely larger (Rababeh 2005: 62, 77). This block then determines the size of the building elements that can be produced from it. Considering that this is a raw stone that also needs to be processed, it quickly becomes clear that the production of monumental building elements was hardly possible from the above mentioned dimensions of a single block.

Due to the quarrying methods, a maximum size for individual building units is therefore inevitable. At the Qaṣr al-Bint and the Temple of the Winged Lions, this means that decorative elements, such as metopes and triglyphs of the frieze and monumental cornices above them, were constructed from several different blocks (Hammond 1996: pls. 16, 18; Zayadine *et al.* 2003: 17–8, 51, 162–4 pl. 28–30). In general, no monolith columns were used in Petra. The monumental column drums of the Qaṣr al-Bint's pronaos with a diameter of 2.00 m and a height of sometimes more than 1.20 m are the absolute exception (Zayadine *et al.* 2003: 18, 135–6; Kanellopoulos 2004: 236). The rational and commonly used solution for the construction of monumental columns was realized by producing flat column discs that were much larger in width than in height, as featured at the Great Temple (Rababeh 2005: 126; 2017: 59) and the Temple of the Winged Lions (Hammond 1996: 48). Also, regular columns were constructed using column drums, which had varying heights between 0.20 and 0.60 cm, regardless of the diameter of the column. The common diameters of columns used in all other buildings were between 0.60 and 0.75 m. The average size of an ashlar was 0.40 to 0.60 m in height, with a width of 0.30 to 0.40 m and a varying length of 0.30 to 1.00 m (Rababeh 2005: 113). These dimensions were the same everywhere, whether the stone was cut for a temple building or a mansion or regular house in Petra.

Yet, not only the size of common ashlars, column drums, frieze and cornice elements, or parts of the entablature, also the construction of the Nabataean blocked-out and floral capital, as shown above, was affected by the limiting parameters set by the stone material and the quarrying. Given the average dimension of a quarry block, the splitting of a capital into an upper and a lower segment is almost inevitable if the final result is to surpass a lower diameter of 0.50 m. Considering that the height of the capital usually corresponds more or less with the diameter of the column, and also taking into account the lateral length of the abacus, which is about 35% bigger than the diameter, it becomes obvious that constructing a capital larger than 0.70×0.50×0.50 m out of a regular rectangular block from the quarry would have been difficult. The common diameter of most capitals in the city center ranges from 0.62 to 0.70 m, as mentioned above. The height also varies within the same dimensions. With a lateral abacus length of 1.05 to 1.15 m and an adding stone mass that is lost during the cutting process, it becomes clear that capitals of a certain diameter were produced in at least two segments, an upper and lower one. If the capital had a larger diameter than 0.60 m, the upper part was additionally produced as two half-capitals (see Fig. 5). Instead of one full upper part, three or more likely four standardized half-capitals, whether blocked-out or floral, were obtained from a 2.00×1.50×0.60 m rectangular, raw block.

The standardized manufacturing process was not limited to sandstone quarries. The equal dimensions of sandstone capitals from Structure 2 in the NEPP area and limestone capitals in the Temple of the Winged Lions or the Dionysian Hall indicate that the quarrying procedures in the limestone quarries were the same as in the sandstone quarries. Also, the incised lines and the general construction of a capital from three single elements show that the floral Nabataean Type 1 capitals were produced in the same way as the blocked-out ones. Therefore, the Nabataeans seem to have used the same quarrying methods in limestone quarries as in the sandstone quarries, even though the former would have allowed the production of capitals from one single block due to its different material quality. Even so, the Nabataean craftsmen intentionally decided to produce capitals from harder material in the same way as the sandstone ones. This becomes particularly evident when looking at the floral Nabataean Type 1 limestone capitals of the peristyle building in the so-called Great Temple. With basic measurements of 1.50×1.50×2.00 m (Hussein 2017: 125), these have monumental dimensions. Consequently, they are constructed of six individual elements: the lower segment is divided into two parts and the upper segment into four parts. Thus, the size of an individual block is reduced to such an extent that the craftsmen can work with familiar block sizes despite the ultimately monumental dimensions.

Interestingly, the aforementioned "cross-section rule", which relates the axial width of the abacus to the height of the final capital, does not apply in Petra. Various capitals in the NEPP and the Temple of the Winged Lions with a combined height of the lower and upper segments of 0.64 to 0.70 m and a lower diameter between 0.62 and 0.70 m usually have an abacus diameter of 0.80 and 0.84 m. As it seems, it is rather the column diameter which corresponds to the height of the capital. Thus, the upper diameter of a capital is about 30% larger than the column diameter. The same can be said about the monumental capitals of the so-called Great Temple. As a result, the Nabatean capital Type 1 appears more compact and heavier than the Corinthian normal capital. The question must remain open whether this is also to be seen as a consequence of the quarrying processes, or rather as an expression of the Nabataean concept of proportion.

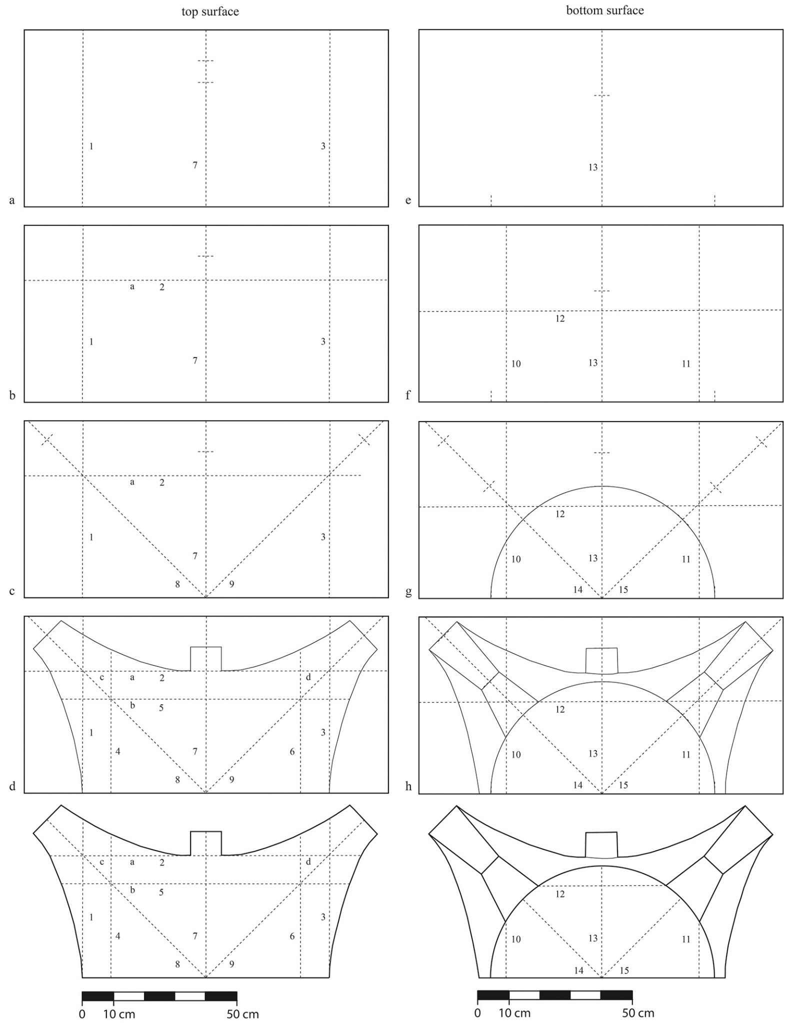
Building a Capital

At this point, a brief overview of the entire production process of a Nabataean capital will be given, whereby the production of Corinthian capitals in the Greco-Roman world will be considered in comparison, as Toma has outlined it. As already shown, the first significant difference results from the building material, at least concerning the blocked-out version of the Nabataean capital which was usually carved out of sandstone. Nevertheless, the construction lines on the top surface follow the same geometrical principles as Toma has shown for capital production in the Mediterranean world, whose capitals were usually cut from a single block. It is obvious that the Nabataean craftsmen adopted the system used by stonemasons in other places, yet adapted it to the requirements of their own local sandstone. The general height of one half-capital of the upper segment in Petra is 0.32 to 0.35 m, with a depth of 0.35 to 0.40 m and a lateral width of the abacus of 1.05 to 1.15 m. Since the lower and upper segments of the capitals have roughly the same height, the composite height of a complete capital would be 0.64 to 0.70 m.

After the stone block was extracted from the quarry in its rectangular raw shape, it was divided into three or four blocks, each roughly the size of an upper segment. The lower segments with a size of 0.90×0.90×0.32 m were made from another block. In order to avoid great loss of material, the block could have been cut smaller from the quarry already to begin with. Both upper and lower segment needed to be reduced in weight as much as possible to give them the approximate dimensions of the final product. Whether the capitals were then processed in the quarry, in a central workshop in the city, or directly at the construction site cannot be said. The next step in the production of an upper segment was most probably determining the height. In contrast to the production of a capital from a single block, it was not possible to define the overall dimensions of the whole capital directly on the block. Therefore, it was necessary to have fixed guidelines for the overall dimensions of the specific capital elements regarding height, length, and depth. After determining the height, the backside of the capital was straightened, followed by the smoothing of the top and bottom surfaces to prepare them for the application of the construction lines. These two steps may as well have been reversed. The incised lines were then applied to the top surface using a type of drawing nail or iron point. This step resembles the common practice in other places. The size of the blocks would have made it necessary that they were lying on their bottom side and raised on substructures to make them more accessible as the construction lines were applied.

The central axis of the abacus was defined by the backside of the block, the later half-capital. Thereon, the width of the abacus was marked by lines (Fig. 11a). Those were extended by perpendicular lines (1, 3) running towards the front of the block. From the center of the backside, a third line (7) was marked in a right angle to it which also ran to the front of the block, determining the maximum extension of the abacus flowers. The two outer lines (1, 3) were orthogonally connected by another line (2), defining the radius as well as the deepest part of the concave abacus on the front (Fig. 11b). Once these lines formed a rectangle, two diagonal lines (8, 9) were drawn from the bottom of the central axis, intersecting the corners of the rectangle and defining the diagonal width of the abacus (Fig. 11c). Finally, the curvature of the concave sides of the abacus and the smaller rectangle was established accordingly (Fig. 11d).

In a next step, the block was probably turned onto its backside. This would have made the bottom surface of the block accessible for incising the central axis of the block and determining the lower diameter of the upper segment and radius (Fig. 11e). The projection of the central axis could have been realized by an incision along the front surface. After that, the two vertical lines (10, 11) indicating the column diameter would have been established followed by the



11. Proposed incision sequence of construction lines on Nabataean half-capitals (by M. Dehner).

horizontal line (12) which connects both (Fig. 11f). Once these three lines form a rectangle, again, two diagonal lines (14, 15) could have been drawn from the bottom of the central axis, marking the rough measurements of the volute (Fig. 11g). Whether there was a carved preliminary drawing of the form of the *kalathos*, including the volutes or the shape of the abacus, cannot be said (Fig. 11h). It can be assumed that after all supporting lines were established the rough shape of the abacus was worked first in a concave swing with the lowest point close to the large rectangle on the top surface. Once the shape of the abacus was established, the capital was cut out of the block from bottom to top. Subsequently, the volutes were worked out from bottom to top, using the lines on the bottom surface before the surface on the sides was smoothed or the floral decoration was carved out.

Individual processing stages for the lower segment of the capital cannot be reconstructed yet. It can be assumed that the processing started with the smoothing of the support surface on the top and the definition of the diameter. It is not unlikely that the column shaft on the bottom side was established in correspondence with the upper diameter. Processing the profile of a blocked-out capital or the acanthus leaves of a floral capital may have been done in the same way as Asgari and Toma have shown for Corinthian capitals in the Mediterranean world. Finally, the two parts of the upper segment were placed back to back on the lower capital element which was placed first on the column.

Conclusion

The procedure for capital production outlined here is the result of observations made on the extraction process in the quarries and the capital finds in Petra. So far, this process can only be generalized for Type 1 capitals. No construction lines have so far been identified on Nabataean capitals of Type 2. Considering the similarity in appearance to the upper part of the Type 1 capitals as well as the fact that Type 2 capitals were mainly used as pilaster capitals and, therefore, were worked as half-capitals, it can be assumed that those were produced in a similar way. Capitals of other types, like the Pseudoionic one and the Elephant-headed capitals in the so-called Great Temple (Dimitrov 2013; Joukowsky 2017b), were special designs and did not reach a height of more than 0.60 m and were consequently carved out of one block. Nabataean capitals of Type 1 and 2, whether blocked-out or floral ones, were the dominant capitals in Petra. The incised supporting lines on the surfaces of the capitals clearly show that the Nabataeans adopted geometrical principles of capital production from other areas. These were transferred and adapted to the needs of the local quarries and the resulting stone processing. The manufacturing process remains roughly the same but varies in detail. The production of a capital with separately worked lower and upper segments also makes it easier to handle the geometrically divergent design of the same than producing a capital from a single block. Both elements can be manufactured as individual parts in serial production. If one considers the wide distribution of capitals of roughly the same dimensions, one can certainly postulate that these were worked in a standardized mass production. The production process is certainly an indicator of this assumption.

However, some questions remain open regarding the proportions of the capital as well as those of the whole column, including base and capital. As it was shown, the “cross section rule” as one of the most common rules of proportion for Corinthian capitals was not adopted from other places of production. Furthermore, there are some difficulties regarding the size of single capital segments which, although very similar in their basic dimensions, show no identical proportions. It would seem that height and width are the only constant measurements, though they still vary by a few centimeters. Whether there was a common standard of measurement or an effective table of proportions cannot be said with certainty on the basis of these findings. When looking at the ancient units of measurement, especially the Egyptian long cubit, which was identified as the unit of measurement at the Qaṣr al-Bint, it is not possible to determine such a unit for a single building element, as these are usually no longer preserved in their original dimensions due to damages, and the original measurements can only be estimated.

Nevertheless, a clear uniform procedure is noticeable and an optimization and standardization of already existing manufacturing processes can be observed both in stone extraction and in the capital production. At the same time, the evidence also shows that the blocked-out capital, also in combination with the floral Nabataean capital, experienced a much wider distribution in freestanding architecture in Petra than often assumed in the past.

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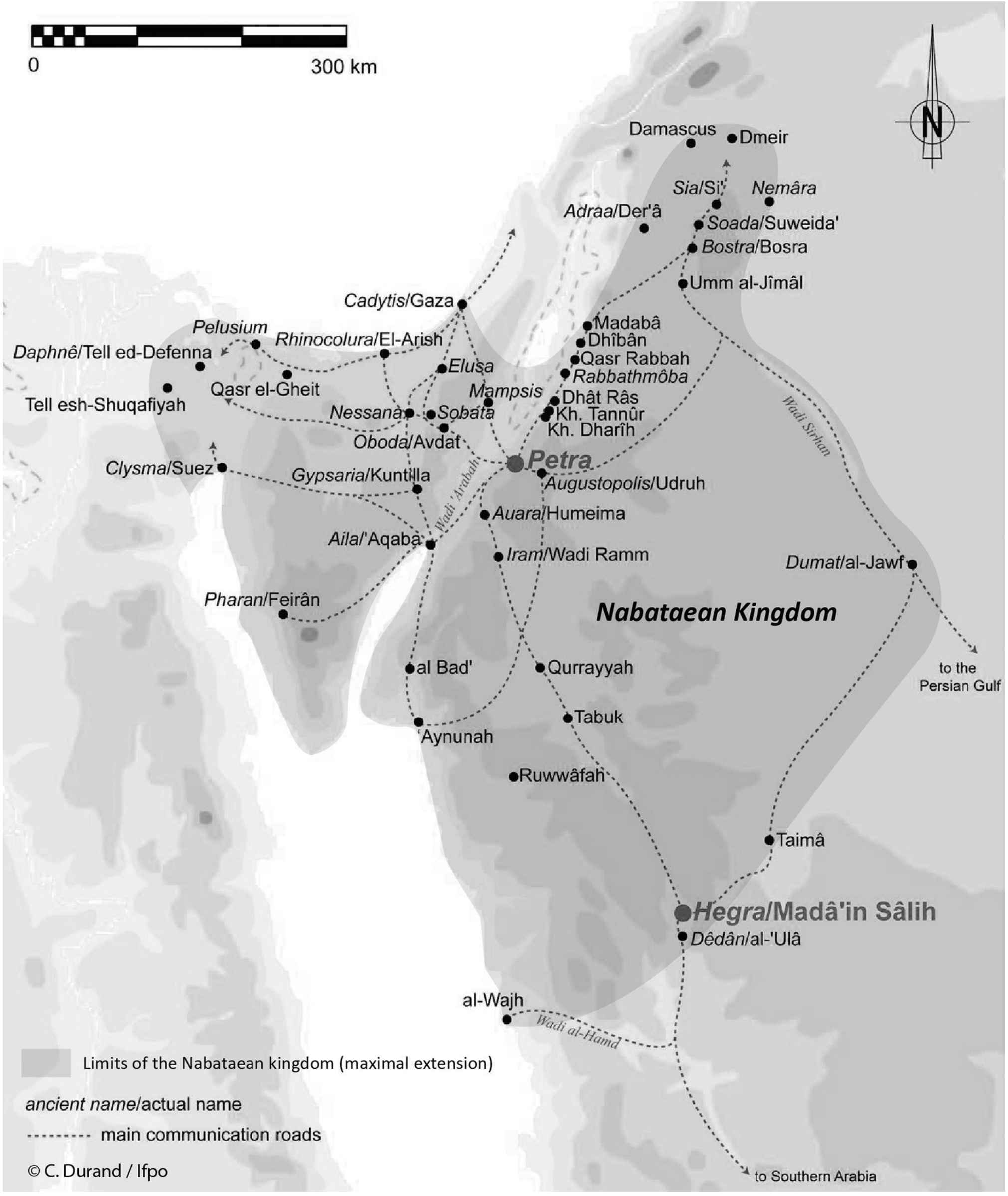
When the Nabataeans Settled in Hejaz: New Data from the Nabataean Painted Fine Ware found in Hegra/Mada'in Salih (Northwest Arabia)

Introduction

Since 2008, a Saudi-French archaeological project has been investigating the major Nabataean site of Hegra/Mada'in Salih, in northwest Saudi Arabia (Fig. 1; see mainly Nehmé 2004; Nehmé *et al.* 2008; Nehmé 2009; 2015; recently Abu Azizeh *et al.* 2020. The complete reports of each campaign are available online).[1] Considered as forming the southern limit of the Nabataean territory, Hegra was one of the main cities of the kingdom after the capital Petra. It is located around 20 km north of Al-Khuraybah, the religious core of ancient Dadan, close to present-day Al-ʻUla. The Nabataean settlement of Hegra is surrounded by more than 100 monumental rock-cut tombs, very similar to those at Petra, that are scattered around a large residential area built primarily of mud bricks, today highly decayed (Fig. 2). However, excavations in the city centre yielded a very deep stratigraphy and a long pottery sequence. After 10 years, we have now obtained a clear idea of the chronology of the site, which was occupied without interruption for approximately one millennium, probably from the 4th c. BC to the early 5th c. AD (see Rohmer and Charloux 2015; Rohmer and Fiema 2016; Durand and Bauzou forthcoming on the earliest occupation phase; Charloux *et al.* 2018 on the latest occupation phase). During its millennium of existence, the city was placed under the rule of successive regional powers such as the Lihyanites, the Nabataeans, and the Romans. Although the proper Nabataean period in Hegra likely lasted less than two centuries, it was nevertheless a time of major development for the city. Besides the above-

[1] The authors wish to thank the Saudi-French Mada'in Salih Archaeological Project directed by Laïla Nehmé (CNRS) and Daifallah al-Talhi (University of Hail) for providing the opportunity to publish these results. They are grateful to Laïla Nehmé for her reviewing and suggestions.



1. Map of the Nabataean kingdom, showing the localisation of Petra and Hegra (© C. Durand).

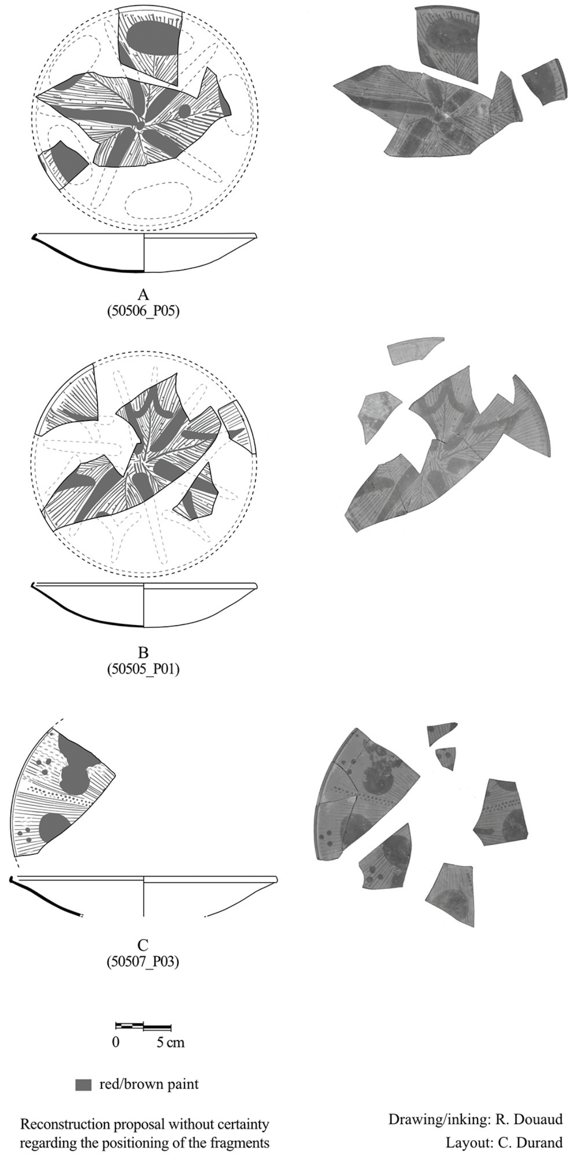
mentioned monumental rock-cut tombs, the Nabataean presence is also evidenced by several triclinia, some isolated architectural elements such as typical Nabataean capitals, many Nabataean inscriptions and graffiti, as well as Nabataean coins and pottery scattered on the surface and found in stratigraphy. This article focuses on pottery finds, especially on the Nabataean painted fine ware bowls found in Hegra. Indeed, these painted vessels are not only the most characteristic Nabataean pottery style, but are also thought to have had specific ritual and social functions (Durand 2017). Therefore, their study can help us understand the settling process of the Nabataeans in Hegra.

2. View of the site of Hegra (© L. Nehmé).

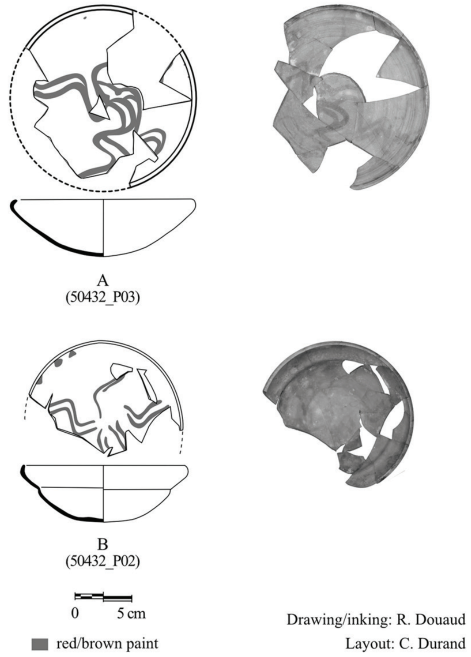
Nabataean/Petraean Painted Fine Ware in Hegra

The so-called Nabataean painted fine ware corresponds to a specific painted pottery style originating from the Petra region, consisting primarily of footless bowls made of highly levigated clay with extremely thin walls. Their decorative patterns followed a stylistic evolution from the mid-2nd c. BC to the 5th/6th c. AD, as evidenced by stratigraphical studies undertaken at az-Zanṭūr, a domestic area in the city centre of Petra (Schmid 1996; 2000) and by Late Roman/Early Byzantine pottery kilns discovered in the suburbs of the Nabataean capital (ʿAmr 2004).

In Hegra, fragments of Nabataean painted fine ware imported from Petra were found in significant numbers in all the excavated areas (Durand and Gerber 2014: 159–60 fig. 6). This type of pottery, however, was especially represented in the Jabal Ithlib, which seems to have been occupied exclusively during the Nabataean phase and devoted to ritual meetings (Nehmé 2015: 30–2; Durand 2017: 91–2 fig. 8), as well as in the Nabataean sanctuary called 'IGN 132' (Nehmé 2012) and in the monumental tombs, where painted bowls were probably used as funerary offerings during the Nabataean period (see examples from tomb IGN 116.1, Fig. 3). A study of the distribution of the Nabataean painted fine ware according to the phases of production as defined in Schmid's typo-chronology, shows that it had been imported into Hegra during the whole Nabataean period, from the mid-2nd c. BC to the early 2nd c. AD. Nevertheless, we can observe strong variations within this time-frame. From Schmid's phase 1 to Schmid's phases 2b/2c (*i.e.*, from the mid-2nd c. BC to the late 1st c. BC/early 1st c. AD), the quantity remains rather low. Fragments from these phases



3. Examples of Nabataean painted fine ware bowls imported from Petra, from tomb IGN 97 in Hegra (© R. Douaud, C. Durand).



4. Examples of Nabataean painted fine ware bowls, '2 red lines' type, from tomb IGN 97 in Hegra (© R. Douaud, C. Durand).

represent around 22% of the total of the Nabataean/Petraean painted fine ware sherds from Hegra. Then, the quantity increases considerably during the 1st c. AD, with Schmid's phases 3a and 3b representing around 76% of the total. The latest phases, from the Late Roman provincial period, are almost absent (only 2% for Schmid's phase 3c corresponding to 2nd c. AD productions) or completely absent (0% for Schmid's phase 4 produced from the 3rd to 5th/6th c. AD).

The 'Two Red Lines' Group: A New Type of Nabataean Painted Bowls

A previously unknown type of Nabataean painted fine ware bowl, different from the bowls imported from Petra, has been observed in Hegra. It is characterised by a painted pattern made of several groups of two parallel red lines—usually zigzag lines rudimentarily executed—crossing at the bottom of the bowl (see examples from tomb IGN 97, Fig. 4). For this reason, this group has been named the 'two red lines' type (Durand and Gerber 2014: 159–61 fig. 7). Examples appear in Nabataean contexts and represent the largest group of painted fine ware bowls in Hegra. Their fabric closely resembles the Petraean fine ware bowls; they are similarly thin-walled, scarcely tempered, and well-fired. This explains why they were first thought to have been imported from Petra.

A decorative pattern consisting of two parallel red lines, straight or zig-zag, is known from Petra on deep rounded bowls which belong to Schmid's decoration phase 1, dated from the *ca.* mid/end-2nd c. to the mid-1st c. BC (Schmid 1996: 200–1 figs. 683–686; 2000: 183 figs. 73–76; Tholbecq and Durand 2013: 213 fig. 9). In Hegra, however, this decoration occurs also on carinated bowls (Fig. 4:B) which, in Petra, would only bear Schmid's decoration phase 2b, the latter starting around 20 BC (Schmid 1996: 204–5 figs. 693–5; 2000: 183–4 figs. 83–85). The combination of the two red lines decorative pattern and carinated bowl profile is not attested in Petra. Moreover, the fabric of the Hegra 'two red lines' bowls is very similar to that of Schmid's decoration phase 2 products from Petra. The bowls seem 'technically equivalent' to those which belong to Schmid's phases 2b and 2c from Petra. We can therefore assume that they probably started to be produced around the last third of the 1st c. BC.

Having addressed the issue of their date, their provenance remains to be examined. The fabric of these bowls is very fine and is hence quite different from the fabric of the other local products from Hegra. Because of their strong similarity with the Petraean productions, our first thought was that these bowls had been produced in the Petra pottery workshops, with the same raw clay as that used for the locally made Petra bowls, and then exported to Hegra. However, if this hypothesis was correct, it would be difficult to explain why this type of bowl was never found in Petra. A second hypothesis is that these bowls were produced either elsewhere in southern Jordan or in the Hegra region itself. If this is true, the 'two red lines' bowls from Hegra should have a different chemical and mineralogical composition from that of the Petra bowls. In order to answer this question, it was decided to undertake chemical analyses on the clay and to compare the results with Petra fine ware.

Archaeometric Studies

A preliminary selection of Hegra Nabataean fine ware samples, painted and unpainted, were chemically analysed by a portable Energy-dispersive X-ray fluorescence spectrometer by Fisher Scientific.[2] For comparative purposes, a selection of Nabataean fine and common ware samples from the Swiss-Liechtenstein excavations on az-Zanṭūr in Petra were analysed with the same portable equipment. The Petra samples were produced in the pottery workshops near the ancient city, as shown previously (Gerber 2003; 2005). The production site and the chemical composition of the Petraean fine ware sherds, painted and unpainted, form a reliable reference for the ceramic chemistry of the Petra region.

Technical Notes

As this was the first time we used a portable Energy-dispersive X-ray fluorescence spectrometer rather than the stationary lab equipment we had used in previous studies, we needed to test its performance and stability. Each sample (from Petra and from Hegra) was analysed at least three times. In addition, five Nabataean fine ware sherds were reference-measured over a

[2] The authors are much obliged to the "Institut für Archäologische Wissenschaften, Prähistorische Archäologie," of the University of Bern, Switzerland, for granting them the privilege of using its portable XRF: Thermo Scientific Niton XL3t 950 with GOLDD technology. For this specific portable spectrometer, see also Stapfer 2019.

period of five days. A notable fluctuation in some of the crucial elements, usually in the form of partly time-dependent shift or drift, was detected. But the fluctuation patterns diverged. At odds with the usual experience of repeated measurements when compared to reference samples, there appeared to be no way to determine which single value among the several measurements was more accurate, or closer to a true mean. Repeatedly measuring a constant identical surface yielded non-randomly, divergently shifting values. Under such circumstances, taking the mean made no sense, because we have no idea what the true offset is. Taking the mean might just consolidate the error. Therefore, we worked under the provisional assumption that the series of measurements are to be regarded as bundled realisations of independent measurements. They are plotted as such. The five sherds with more than three measurements (≥ 20 measurements) are discernible by the increasing size of the near-overlapping symbols.

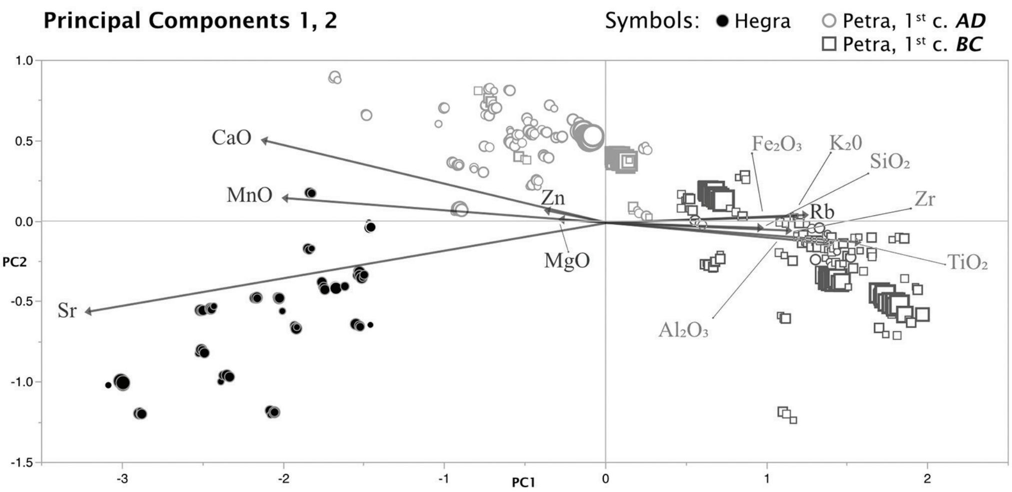
For the current statistical evaluations, the major chemical components MgO, Al_2O_3, SiO_2, K_2O, CaO, TiO_2, MnO, Fe_2O_3 and the trace elements Rb, Sr, Zr, Zn were taken into account.

The chemical results hereafter are treated within the appropriate statistical framework of 'Compositional Data Analysis' (Pawlowsky-Glahn *et al.* 2015; Greenacre 2018). The data as presented, and used in further calculations, are *centered logratios*, and explicitly not raw percentages or ppm. Within the scope of the current investigation, the unfettered use of percentages would be inappropriate in statistical terms, and grossly misleading.

Statistical Analyses

Principal Components

All Petraean fine and common ware samples, found and produced in Petra, are shown as open squares and open circles. The samples found in Petra and produced in Petra feature two distinctive clusters along the 1st principal component axis (Fig. 5). While this was not a specific aim of the investigation, the result is a nice confirmation of the previous investigations from 2001, which revealed that the chemical composition of the earlier Nabataean fine and common ware pottery from the 1st c. BC



5. Principal components on centered log-ratios of CaO, MnO and Al_2O_3, SiO_2, K_2O, TiO_2, Fe_2O_3, Rb, Zr (© Y. Gerber).

to the beginning of the early 1st c. AD differs significantly from the chemical composition of the later Nabataean pottery of the 1st c. to early 2nd c. AD (Gerber 2003: 134–9).

The same kind of difference is perceived in the newly analysed data set. The differentiation follows the negatively correlated ratios of CaO, MnO and Al_2O_3, SiO_2, K_2O, TiO_2, Fe_2O_3, Rb, Zr. Nevertheless, all pottery is known to have been produced near Petra. From this we can deduce that the Nabataeans began to alter their clay recipe in the early 1st c. AD (Gerber 2003: 141–4). This alteration is now chemically recognisable. The AD-ware group is not as homogeneous as the BC-group; a few BC-ware samples already show the later recipe-composition. This suggests a rather slow and gradual change.

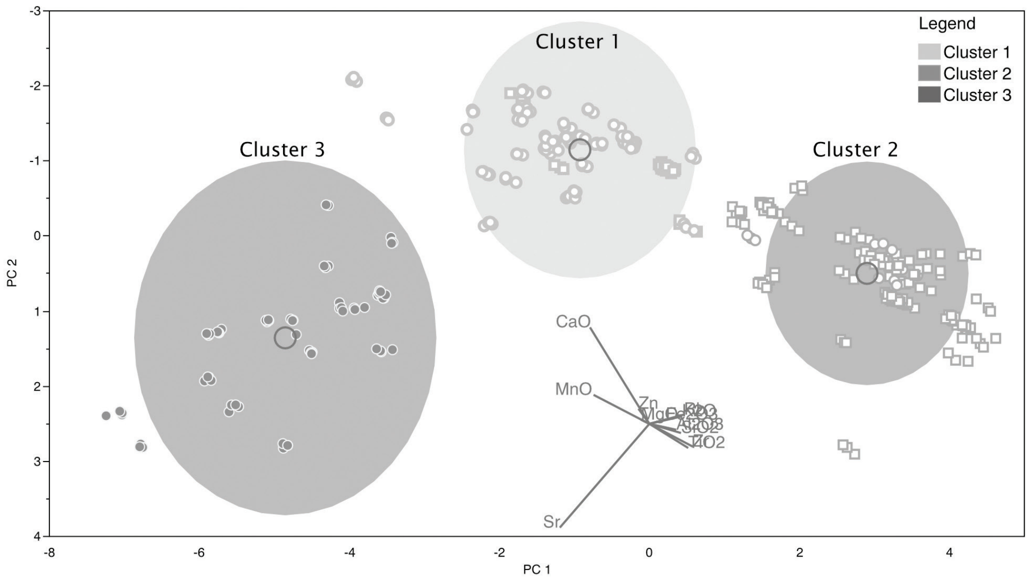
However, the crucial discovery is that all the Hegra fine ware samples which we already 'earmarked' visually as probably not produced in Petra (shown as dark closed dots) form a distinctive cluster along the 1st principal component axis. A signal feature of the chemical differentiation between the Petra and Hegra samples is the higher Sr ratio of the Hegra samples.

*K*means Clusters

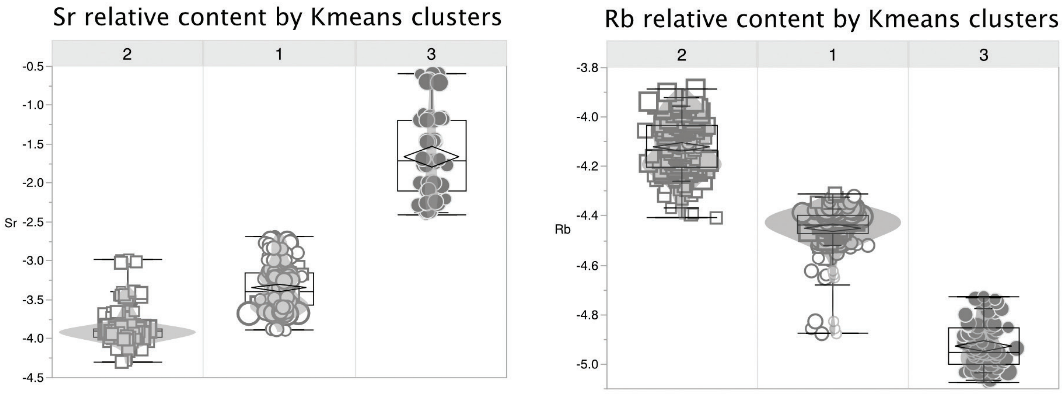
The *K*means algorithm is an iterative algorithm that aims to partition the dataset into *K* pre-defined, distinct, non-overlapping subgroups (clusters), where each data point belongs to one group only.[3]

The *K*means cluster analysis (Fig. 6) is based on data without any extrinsic information, resulting in three distinct, non-overlapping clusters. Inner circles mark the confidence intervals of the cluster centroids. Extrinsic categorical information reveals that *K*means clusters 2 and 1 correspond to the 1st c. BC and 1st c. AD Petraean fine and common ware samples, while cluster 3 covers the entirety of the Hegra fine ware samples. Higher CaO and MnO ratios are diagnostic indicators for the 1st c. AD group, and higher Sr ratios for the Hegra fine ware samples. *K*means thus confirms

[3] It tries to reduce the intra-cluster distances while maximising the inter-cluster distances. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster.



6. Kmeans cluster analysis biplot (for symbols, see Fig. 5) (© Y. Gerber).



7. 'Violin' plots of Sr and Rb ratios; grouped by Kmeans clusters (for symbols, see Fig. 5) (© Y. Gerber).

and reinforces the results of Principal Component Analysis.

'Violin' Plots

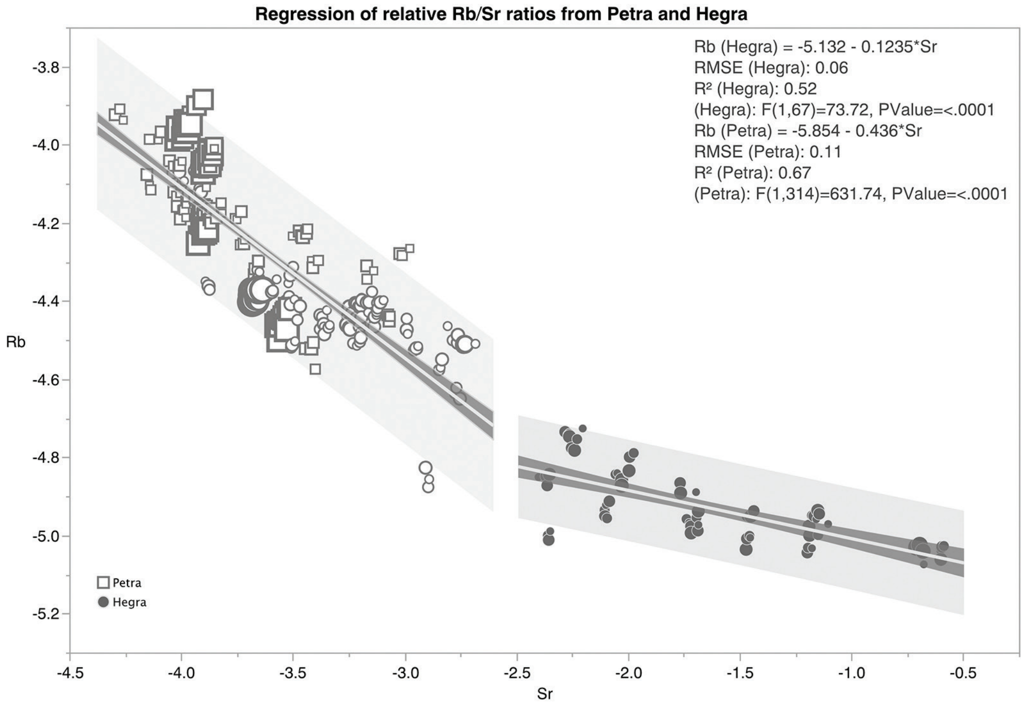
'Violin' plots show the distribution of a variable (or sample distribution), usually across different categories. The shape is given by a rotated kernel density plot.[4] The Sr and Rb ratios illustrate the relative chemical differences seen in the *K*means clusters (Fig. 7). These are characteristic for three chemical recipes from Petra and Hegra. While the distribution of the Sr ratios among the 1st c. BC and 1st c. AD Petra samples does not vary significantly, the Sr ratios from the Hegra fine ware samples mark a distinctive chemical cluster. The trace element Rb is an even more striking differentiator. The Rb ratio decreases from 1st c. BC Petra to 1st c. AD Petra to 1st c. AD Hegra, as shown in Figure 8, resulting in a 'broken stick' regression of relative Rb/Sr ratios from Petra and Hegra. The graphic features the 95% confidence intervals of the regression lines and the predicted bandwidth of the distribution.

[4] Typically, a violin plot will include all the data that is in a box plot: a diamond marker for the median of the data; a box indicating the interquartile range; and possibly all sample points, if the number of samples is not too high.

Conclusions

The differentiation of the chemical compositions of the Nabataean Petraean and Hegra ceramic production is explicit. The 'two red lines' fine ware bowls found in Hegra were not produced in the same workshops as the Nabataean/Petraean fine ware, probably not even in the neighbourhood of Petra. But does this prove that these specific Nabataean fine ware sherds found in Hegra were also produced in Hegra? Not yet. Although this hypothesis is highly probable, it remains to be confirmed or rejected by analysing a large reference group of various local wares from Hegra. We have a huge reference group of local Petraean common and fine ware. We are still lacking the chemical analyses of the reference group (at least 40 samples or more) consisting of Hegra sherds of ascertained local production and of local raw clay. This is a research project which should hopefully be performed in the near future. Whether the portable Energy-dispersive X-ray fluorescence spectrometer can be the analytical instrument of choice remains to be seen.

Nevertheless, the strong assumption that the 'two red lines' bowls were produced locally allows us to propose a few conclusions. The study of Nabataean/



8. Regression of relative Rb/Sr ratios from Petra and Hegra (© Y. Gerber).

Petraean painted fine ware found in Hegra reflects the regular contacts between Hegra and Petra throughout the Nabataean period, beginning slowly as early as the end of the Hellenistic period and clearly increasing after the late 1st c. BC/early 1st c. AD. This period is also assumed to be the starting point of the 'two red lines' bowls production. This sudden need to produce painted bowls imitating the Petra fine ware vessels may indicate a population change in Hegra, and reflect the installation of a group of people coming from Petra. These may have formed the new political, administrative, religious, and social 'elite' of the city. These new inhabitants must have included a few skilled potters, trained in Petra, who had the required know-how to produce the Nabataean fine ware painted bowls. Or—and this does not contradict the first hypothesis—the production of local painted bowls could also reflect the desire of the local population to join the political and religious practices dictated by the Nabataean capital when Hegra was officially included in the Nabataean kingdom. As noted above, these painted bowls are known to have been used in specific social contexts, in particular during the ritual/political gatherings in triclinia (Durand 2017).

The presence of small quantities of Nabataean/Petraean fine ware from the earlier period (pre-mid-1st c. BC) suggests that the Nabataeans visited Hegra and its region as early as the end of the Hellenistic period. These early contacts are not surprising and have to be related to the Nabataean trading activities with the city of Dadan (Durand and Bauzou forthcoming). By contrast, it is interesting to note that almost no Petraean painted fine ware sherds from the 'post-Nabataean'/Late Roman phases were found in Hegra. It is even more interesting if one considers that contacts between Hegra and Petra are attested through imports of common ware during the Late Roman period. Again, we are tempted to interpret this as a reflection of social changes, such as a possible Roman ban of the ritual gatherings of fraternal societies in Hegra after the annexation of the Nabataean kingdom. We can also assume that the Nabataean 'elite' group who used to practise banquets left the city (or were removed) after the Roman takeover.

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A Typology of Ceramic Pipelines in the Petra Garden and Pool Complex

Introduction

The Petra Garden and Pool Complex (henceforth PGPC) is located on the Southern Terrace of the Petra Basin amidst the monumental civic structures that make up the City Center of Petra, the capital of the Nabataean kingdom (Fig. 1). The area measures roughly 65 m east-west x 85 m north-south and is bounded to the north by the Colonnaded Street, to the west by the Great Temple complex (henceforth GT), to the east by the so-called (unexcavated) "Middle Market," and to the south by the Ez-Zantur ridge. The PGPC is composed of an expansive garden terrace (north) and terraced monumental pool with central island-pavilion (south).

The PGPC is one component of an elite (royal) complex at the heart of the ancient city of Petra, Jordan. Its central location, monumental scale, and labor-intensive construction suggest that this area had an important role in the ceremonial, economic, and political center of the city. The ongoing archaeological investigation of the garden site provides valuable information regarding Nabataean concepts of landscape design utilizing water, vegetation, and monumental architecture as a display of power and status in the Hellenistic-Roman East.

Despite the important role of ceramic pipelines to the development of human settlement in the Southern Levant in Hellenistic-Roman and Byzantine periods and, more specifically, the achievements of hydraulic engineering in Petra, relatively few of the ceramic pipelines uncovered in archaeological excavations in Petra have been systematically documented to allow analysis of stylistic and technological developments. A similar pattern of poorly documented ceramic pipelines from archaeological sites across the region limits the possibilities of broader regional studies. This paper documents the initial phase of a study of the ceramic pipelines that are one

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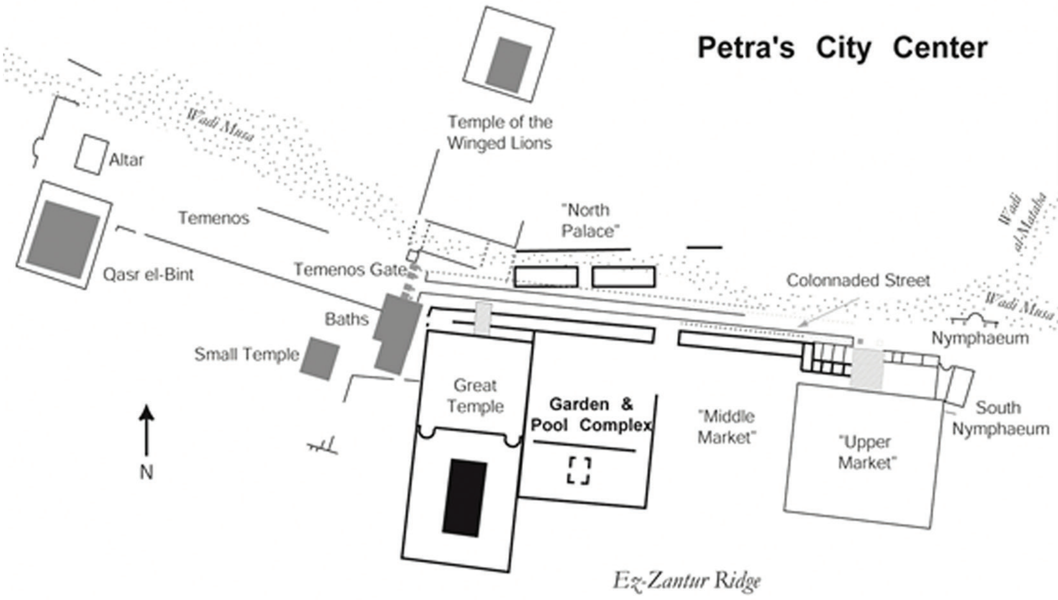


1. Map of Petra's City Center showing the location of the Petra Garden and Pool Complex.

Table 1. The chronology of the Petra Garden and Pool Complex.

Phase	Location	Dates
I	Pre-garden occupation	Nabataean, 2nd–1st c. BC
II	Monumental garden and pool	Nabataean, end of 1st c. BC–early 1st c. AD
III	Renovations under Roman annexation	Late Roman, early 2nd c. AD
IV	Decline and squatters	Late Roman, late 2nd–4th c. AD
V	Destruction	AD 363
VI	Squatter farmers	Early Byzantine, late 4th–early 5th c. AD
VII	Destruction	Early Byzantine, 6th? c. AD
VIII	Agricultural activity	Post-Classical/Medieval
IX	Modern occupation (Bedoul)	> 20th century

component of the complex hydraulic system designed to transport, contain, and display water in the PGPC, and alterations to that system that reveal chronological phases.

Chronology

The construction of the pool and leveling for the garden terrace date to the last years of the 1st c. BC or early 1st c. AD during the reign of Aretas IV (9 BC–AD 40), Phase II (Table 1). There is evidence for some renovations of the island-pavilion and the bridge in the early 2nd c. (Phase III), at the time of Roman annexation (AD 106). The decline of the site began sometime in the late 2nd c. AD, during which time the pool began to fill up with trash and soil, and conversion to a more utilitarian function of the site evolved (Phase IV). After the 363 earthquake that caused significant damage to the city's structures and destroyed the hydraulic system that brought water from external springs (Russell 1980; Bellwald 2008: 58–61), the garden terrace was used for agriculture, and some of the water channels were dug up and reused. The site continued to function as an agricultural field for inhabitants of the Petra valley well into the 20th century.[1] The ceramic pipelines of the PGPC date to the time period between the construction of the pool and garden (Phase II) and the 4th century (Phase VI).

Petra's Ceramic Pipelines

Gustaf Dalman (1912: 15–8) was the first Western explorer to describe some of Petra's hydraulic installations in detail. A systematic study of the hydraulic installations in Petra was initiated in the early 1980s by Zeidoun Al-Muheisin (2009) and has been greatly enhanced by reports of surveys and excavations conducted over the last four decades. Of particular importance is the excavation of the *Siq* (the narrow gorge entrance to Petra) in the 1990s, under the auspices of the Petra National Trust, which revealed valuable information about the transport and storage of water in the *Siq* as well as the floodwater diversion system (Bellwald *et al.* 2003), and allowed for a more comprehensive understanding of Petra's hydraulic infrastructure (Bellwald 2008).[2] According to Vitruvius' *De Architectura* (8.6), the use of terracotta pipes allows for an "easiness of repair when necessary. Moreover, water running in these canals is preferable to that runs through lead pipes and tasting better when drained in terracotta pipes" (as translated in Pollio and Morgan 1960).

The published general descriptions of the ceramic pipes of Petra's hydraulic system (cf. Bellwald 2008: 90; Al-Muheisin 2009: 53–7, 149–50), highlight several common, identifying characteristics:

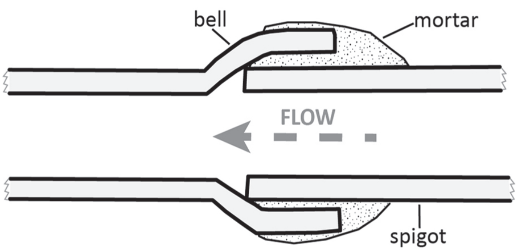
- The pipelines are composed of cylindrical segments with bell-and-spigot joins for which each segment has a narrower spigot at one end that fits into the wider flared end of another (Figs. 2–3); the join is then sealed with a lime plaster. Vitruvius describes this as the "Augustan style" (*De Arch.* 8.6). The spigot end is oriented downstream, creating pressure as the flowing water pushes through the narrowed opening (Fig. 3).
- The Nabataeans adapted their skills and technology for fine ware pottery to industrial terracotta ware pipes by manufacturing the pipe segments on the pottery wheel.[3] As a result, their walls are thinner (~7–9 mm) than pipes made by rolling a clay slab around a mold. The benefit of this weight reduction would have allowed the pipe segments to be mass-produced in a workshop and then transported *en masse* to the location. Bellwald (2008: 90) notes that due to their very thin walls, the pipes were completely embedded in lime mortar, which also secured them from movement and fracture as water rushed through them at a high pressure.
- In addition to a thin wall, another

[1] For a full review of the PGPC chronology, see Bedal *et al.* 2007: 162–7; 2011: 326–8. Some changes have been made as a result of subsequent excavations and data analysis.

[2] For studies of the extensive water collection and supply system of Petra and the Nabataeans in southern Jordan not specifically cited in this article, see Laureano 1994: 76–82; Oleson 1995; 2007; 2010; Al-Muheisin and Tarrier 1996; Lindner and Hubl 1997; Bedal 2002; Joukowsky 2004, Drap *et al.* 2006; Schmid 2008; Al-Farajat and Salameh 2010.

[3] Bellwald (2008: 90) reports that the Nabataeans were the first to produce pipes on the wheel.

2. Detail of the bell-and-spigot connection of PGPC Pipeline D (PGPC P5326a-b).



3. Diagram of bell-and-spigot connection showing the direction of water flow.

byproduct of wheel-thrown production is ribbing on the interior surface (Fig. 2). Bellwald suggests that these undulations directed air bubbles upward, resulting in better water flow (2008: 90).

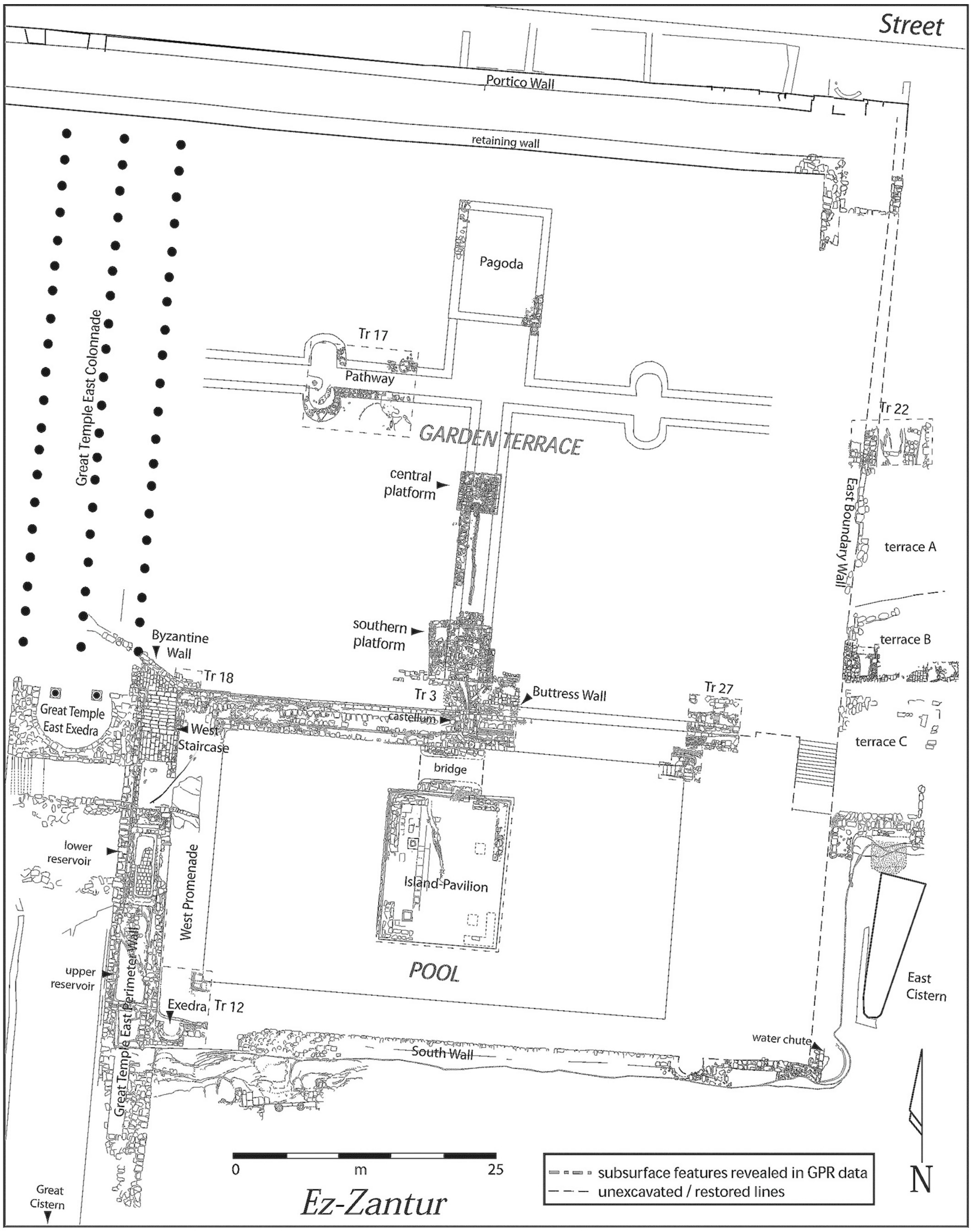
- The ceramic fabric of the pipes is consistent with local pottery production. This is expected for ceramic pipelines for which long-distance transport would be unnecessarily cumbersome and economically inefficient.

While ceramic pipelines are commonly uncovered by archaeological excavations in Petra, the pipes themselves receive little attention other than a passing mention in many excavation publications. One exception is Bellwald's study of the Petra hydraulic infrastructure which includes a photo and scale drawing of a Siq pipe in a review of the development of ceramic pipelines in the Classical world (Bellwald 2008: fig. 66). A more detailed study of Petra pipes resulted from the recovery of several ancient water pipelines when a wastewater system was laid in the area of Wādī Musa in the late 1990s. ʿAmr and Al-Momani (2001) established a chronological typology for the assemblage based on their analysis of the pipes' archaeological contexts. The pipes uncovered in central Wādī Musa (the site of ancient Gaia), where there is evidence for domestic settlement and monumental structures, date to the 1st c. BC through the 2nd c. AD. Additional pipes, dated to the 3rd–4th c. AD, were uncovered in the Az-Zurraba area, near a pottery workshop and the Az-Zurraba reservoir (next to the Petra Moon Hotel).[4] Although based on a small dataset, the typology illustrates changes in form and technology of production over four centuries, and exemplifies how different functions for hydraulic pipelines (private-domestic versus public-communal) led to a variety of forms and diameters (ʿAmr and Al-Momani 2001: 270 fig. 24). This initial typology provided a basis for the following study and typology of the PGPC pipes.

PGPC Ceramic Pipelines

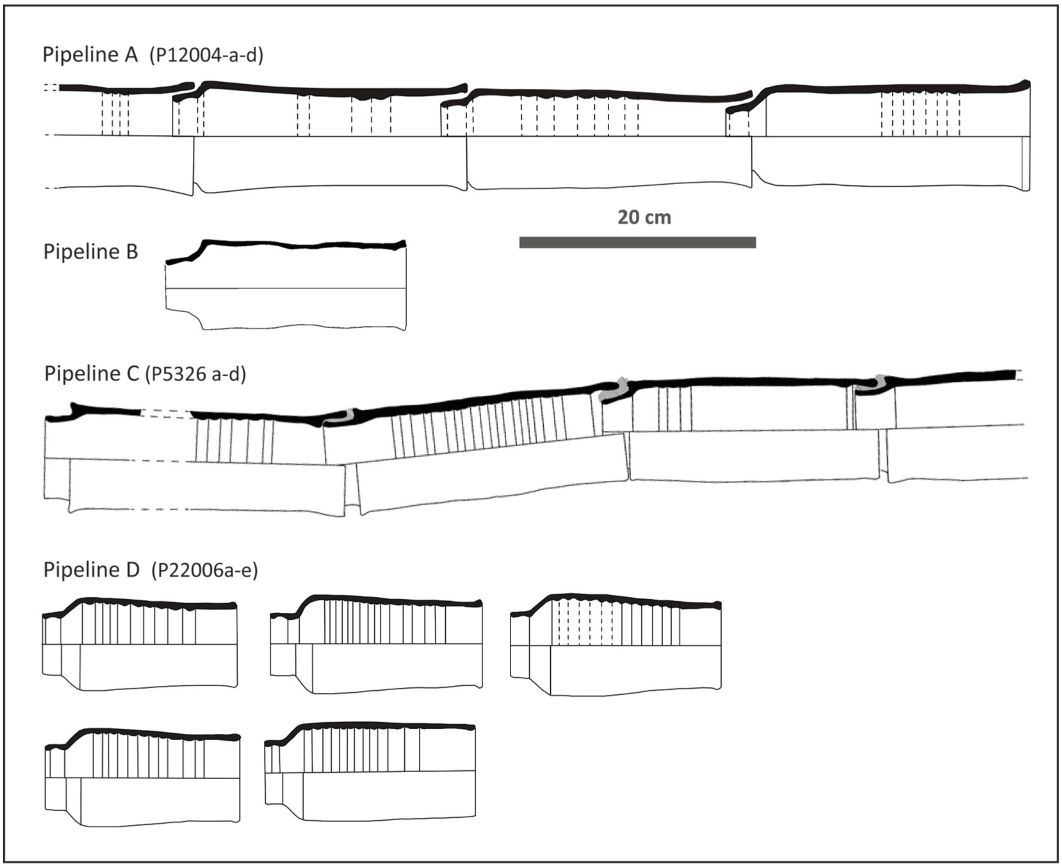
The hydraulic system of the PGPC is composed of a variety of features to transport, contain, and display water. In addition to the monumental open-air pool (23 x 43 x 3 m), there is a rock-cut water chute, two reservoirs, a castellum,

[4] The Wādī Musa pipes and their typology are currently on exhibit in the Jordan Museum.



4. Plan of the Petra Garden and Pool Complex.

several built stone channels and conduits, rock-cut channels, underground canals, lead pipelines, and ceramic pipelines. Excavations in the PGPC have uncovered four ceramic pipelines (A–D) located in different areas of the site and not connected with each other (Figs. 4–5; Table 2).



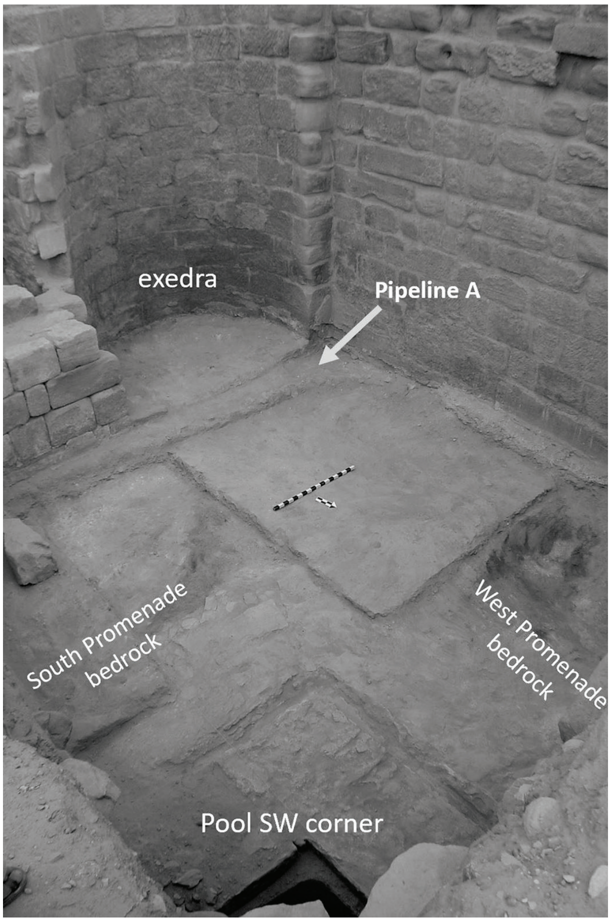
5. Representative pipe segments from Pipelines A, B, C, and D (drawings by Sherry Hardin).

Table 2. Location, measurements, phasing, and comparanda of the PGPC ceramic pipelines.

Pipeline	Location	Trench	L. (cm)	D (cm) shoulder	Direction of water flow	PGPC Phase	Petra comparanda
A	Pool Promenade, SW corner	12	25.5	8.5	west-east	II	Dar al-Birka, Jebel az-Zuhur, GT Pipeline 1
B	Pool façade, buttress wall	3, 27	19.5	7.0	east-west	IVa–b	Dar al-Birka, Jebel az-Zuhur, GT Pipeline 1
C	Basin outlet	3	36.0	13.0	south-north	VIa	Theater, Siq, az-Zurraba
D	Garden terrace, NE corner	22	19.5	9.3	south-north?	IVa–b	GT Pipeline 2

Pipeline A

Pipeline A runs along the west and south perimeters of the pool promenade. The excavated section was first uncovered in front of the exedra in the southwestern corner of the pool complex (Trench 12) and then traced along the base of the east face of the GT East Perimeter Wall, the



6. Pipeline A *in situ* in the southwestern corner of the pool complex.

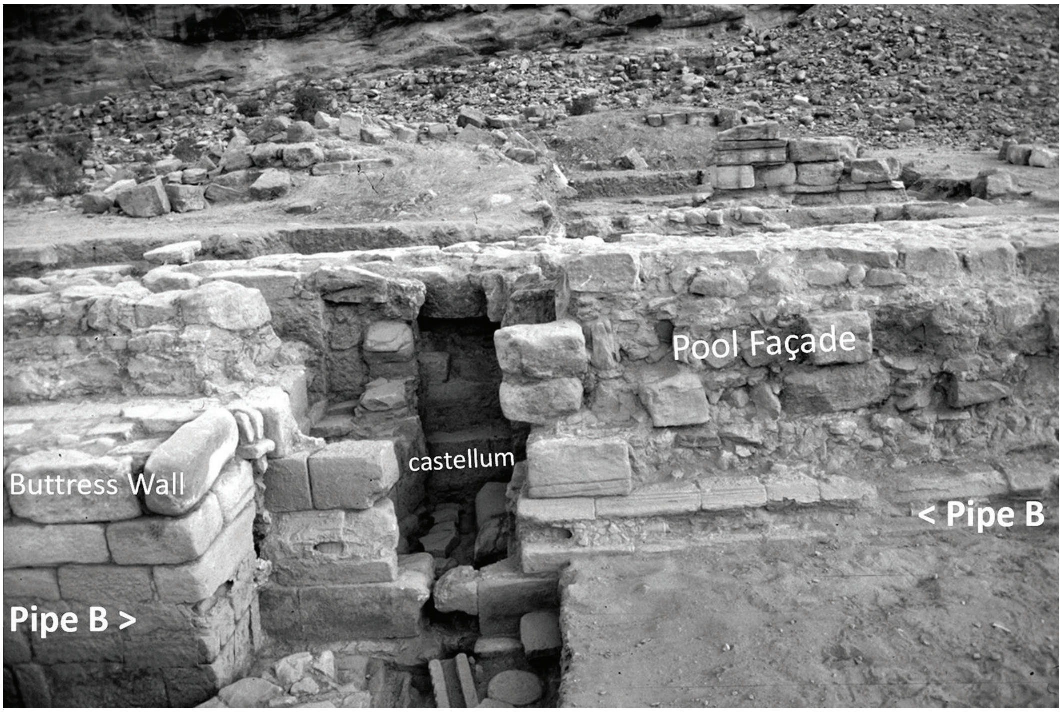
double (casemate) wall that forms the boundary between the pool complex and the upper terrace of the GT complex (Figs. 4, 6; Bedal *et al.* 2007: 165). The pipe segments are the usual wheel-made, bell-and-spigot form measuring 25 cm in length, with an 8 cm shoulder diameter. The pipe tapers slightly from a carinated shoulder and the bell end flares slightly (Fig. 5). Their form and dimensions are most comparable to the Dar al-Birka (L. 23.5 cm, D 10 cm) and Jebel az-Zuhur (L. 21.5 ; D 9 cm) pipelines of the Wādī Musa typology, both of which are from the central Wādī Musa area and are dated to the 1st–2nd c. AD respectively (ʿAmr and Al-Momani 2001: 264, 270–1 fig. 24).

Pipeline A was part of the original plan of the Nabataean pool complex when it was laid underneath the stone-paved surface (robbed out by Phase III). The pipeline remained undisturbed, well-packed in lime-ash mortar and pottery sherds (Fig. 7). The direction of the spigots reveals that the water flowed from west to east, from the direction of the GT and its likely source, the GT Great Cistern (located in the southeastern corner of its upper terrace), and eastward along the base of the South Wall.

Pipeline B

Pipeline B dates to the decline of the PGPC that began approximately a century after Roman annexation (Phase IV). This pipeline is laid in a channel on the face of a buttress wall built up against

7. Profile of Pipeline A packed in mortar and pottery sherds.



8. Pipeline B *in situ* set into a channel on the face of the Buttress Wall and decorative molding along the base of the pool's façade wall.

9. Pipeline B *in situ* set into the decorative molding along the base of the pool's façade wall, adjacent to the west Staircase, and sealed in place with mortar and pottery sherds.

the east half of the pool's façade wall (Fig. 8). It is believed that the buttress wall was constructed to shore up a weak point in the pool wall, which has not yet been identified. Pipeline B wraps around the west end of the buttress wall and then merges into the incurve of limestone molding along the remaining stretch of the pool's façade wall. The direction of the spigots shows that the water flowed from east to west from the direction of the Middle Market, seemingly bypassing the castellum and the water system of the Phase II Nabataean pool and garden, and continued westward toward the GT complex. The secondary use of the decorative façade molding as its channel and the crude packing of the pipe (Fig. 9) in a location that was clearly visible from the garden and from the colonnade along the adjoining lower terrace of the GT complex, supports the dating of Pipeline B and the coarsely-built buttress wall to a time after the garden and pool complex were no longer maintained and used as a luxury space. Based on this and its stratigraphic context, Pipeline B is dated to PGPC Phase IV (late 2nd–3rd centuries). The pipe segments of Pipeline B measure 19–20 cm in length and have a 7 cm diameter. This is the smallest diameter of the PGPC pipelines which may have been dictated by the molding's restricting dimensions. Otherwise, the shape is very similar in form to Pipeline A, with a pronounced, carinated shoulder and slight flare at the bell end (Fig. 5).

10. Pipeline C *in situ* with other components of a makeshift catchment basin that reused features (the castellum, stone conduits, and modified column drum) of the earlier garden site.

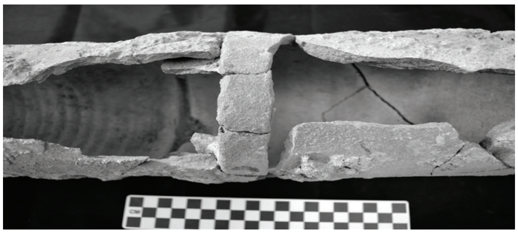
Pipeline C

Pipeline C belongs to the latest of the PGPC water installations. Excavations in Trench 3 revealed four joined pipe segments laid out on top of the paved surface of a walkway that runs along the southern edge of the garden terrace, in front of the pool façade wall. Stone blocks and cobbles flank either side of the pipeline to secure it in place. An additional single pipe segment was discovered about one half meter to the northeast in alignment with the others. The pipes were oriented so that water flowed from the direction of the castellum and basin northeast toward the garden (Fig. 10).

Associated with Pipeline C was a column drum (modified to take the form of a basin) found resting on a flat stone in front of the pool's castellum. The pavers in front of the castellum had been removed, revealing the original (Phase II) stone conduits that run northward under the south platform and continue northward toward the center of the garden terrace. A thin plaster coat found on the south platform's south face was traced along the edge of a row of stacked stones that formed a curb between the south platform and Pipeline C. It appears that the small area (3 x 3 m) defined by the pool wall and castellum (on the south), the southern platform (on the north), and the later Buttress Wall (on the east) was converted into a plaster-lined basin, reusing the castellum and stone channels for water catchment, and Pipeline C was installed to drain overflow toward the northeast (Fig. 10).

When excavating the fill in and above this basin, more than 70 copper alloy (bronze) coins were uncovered (Bedal *et al.* 2007: 166). The vast majority of the coins are badly corroded and illegible due to settling in a water collection point, but a handful are readable. Other than one Nabataean coin and one Late Roman provincial coin, the rest that can be identified are Late Roman Imperial, covering the 4th century from Constantine I (324) through Arcadius (385–393) (Bowsher in Bedal *et al.* 2007: 17–3). It appears that the makeshift basin and Pipeline C were components of post-AD 363 Phase VI agricultural activity on the terrace. This basin and reuse of the castellum would have cut off the water flow of Pipeline B which, as stated above, had bypassed the castellum. After the basin went out of use in the late 4th century, the coins washed through the water system from elsewhere and deposited into the abandoned castellum and basin which were filling up with soil.

The pipes of Pipeline C are the largest of the PGPC pipes. They measure 36 cm in length and 12–13 cm in diameter. They have a straight (not tapered or flared) profile, and in place of a wide shoulder to create the seal behind the pipe's spigot, there is an everted ledge or collar (Figs. 2, 5, 11). The larger dimensions may be an indicator that the pipe segments of Pipeline C originated from an earlier pipeline elsewhere in Petra that served a public function that required a greater capacity for water flow. The collar is a characteristic of some of the largest pipes in the Petra region. Examples from the theater (1st c. AD; Hayes 1965: 56 pl. XLIII, 2 and 3), Siq north channel (2nd c. AD; Bellwald 2004: 77 fig. 11), and the Wādī Musa-Zurraba site (4th c. AD; ʿAmr and Al-Momani 2001: 261, 270–1) all have the collar. However, their dimensions are notably larger, ranging from 44 to 46 cm in length and 18 to 20 cm diameter, and all three of these larger pipelines are waisted to reduce flow, unlike Pipeline C which has a straight body.[5]

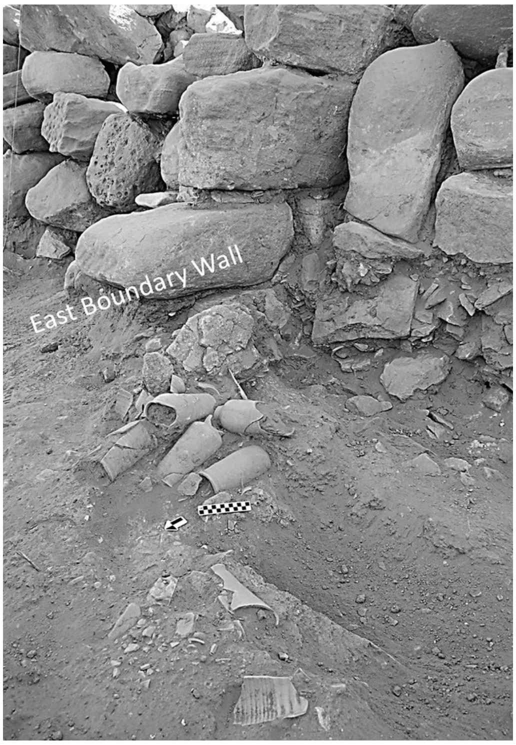


11. Detail of Pipeline C (P5236 b–c) showing the bell-and-spigot fitting with collar.

Pipeline D

Pipeline D was uncovered in Trench 22, along the monumental East Boundary Wall of the Garden Terrace. After removing surface rubble and topsoil, excavators uncovered a shallow pit along the wall face containing a scatter of ceramic pipe segments, crumbled plaster, a few roof tiles, and a fragment of a radial lamp (Grawehr Type K, 3rd–4th c. AD). Five complete pipe segments were recovered with an additional half dozen that were fully or partially reconstructable (Fig. 12). While similar in form to Pipelines A and B, the segments of Pipeline D have rounded shoulders, and have a shorter, more robust profile (19–20 cm in length and 8.5 cm diameter; Figs. 5, 13). Underneath

[5] The drawing of the Siq North Channel pipe in Bellwald 2004: fig. 11 does not show a waisted form. However, the Siq pipe segments with the same dimensions on exhibit in the 2014 "Desert Wonder" Exhibit in the Jordan Museum are waisted. A public mainline pipeline from Tel Dor, dated to the 2nd–3rd c. AD (Berg *et al.* 2002: 161), also has dimensions and form comparable to the larger-sized Petra pipes.



12. The scatter of Pipeline D pipe segments *in situ* in a disturbed area along the East Boundary Wall.

13. One pipe segment (P22006a) from Pipeline D with remnant mortar on its exterior surface.

the pipes was a rubble-filled pit that was dug to expose an underground rock-cut channel running parallel to the wall and capped with sandstone slabs and a layer of cobbles. The channel is contemporary with the wall, which belongs to the major design of the Nabataean monumental garden. The pit was dug after the decline of the PGPC to access, and likely reuse, the original water system. If Pipeline D was part of the original water system for the Nabataean garden, it is expected that the pipes would be secured with mortar and potsherds, as exemplified by Pipeline A. It appears that Pipeline D was laid down later and is not directly related to the underground water channel.

Great Temple Pipelines

A look at the water system of the neighboring GT complex is useful for placing the post-Nabataean PGPC Pipelines, B, C, and D, into a larger context. Although its primary water system consists of major underground drainage and diversion channels (Joukowsky 2004), there are two ceramic pipelines described by Cloke (2016), both of which were added when the GT monument was in disrepair and in reuse, and both originate from the direction of the PGPC.

GT Pipeline 1 is found on the north-eastern corner of the upper terrace in an area with the remains of domestic-like structures. One end of this pipeline is inserted into a small hole in the west face of the GT Temple East Perimeter wall. While it was initially thought that the pipeline fed water into the brick-lined reservoir (the Lower Reservoir) that was built into one of the intermural spaces on the other side of that wall (PGPC Phase IV), a look at the direction of the spigots reveals that water flowed *from* the reservoir. The pipeline carried the water westward across the top of the forecourt pavement in the direction of the bathhouse (Joukowsky 2004: 125 fig. 7). Joukowsky dates this pipeline to the late 2nd–3rd century domestic occupation of the GT complex (Joukowsky 2004: 123 table 2) which is supported by its relationship with the Lower Reservoir (PGPC Phase IV, late

14. GT Pipeline 1 in situ on the GT upper terrace. The pipeline originates from the Lower Reservoir in the GT East Perimeter Wall (pictured at right).

2nd–3rd century). There are no published drawings or measurements of the pipeline, but the eastern section remains visible on site (Fig. 14) The pipe segments measure 22 cm in length and 10 cm in diameter.[6] They appear most similar in dimension to the pipes of PGPC Pipeline D although they do not have the rounded shoulders. Their profiles are slightly tapered to straight as in Pipeline D.

The second GT pipeline is described as 50 cm long (two joined ~25 cm pipe segments) and set into a mortar bedding that is built into the "Byzantine Wall" that was constructed at an oblique angle across the East Triple Colonnade of the GT complex (Joukowsky 2004: table 1, fig. 16; Cloke 2016: 87). Two segments of this pipeline on exhibit in the Jordan Museum appear nearly identical in form and dimension to the PGPC Pipeline D pipe segments and are labeled as 8 cm in diameter at the bell end, which would be 9–10 cm diameter at the shoulders. This pipeline and its associated wall were constructed, at least in part, to capture the water from PGPC Pipeline B, and northwest across the GT's lower terrace toward an undetermined destination. One possibility is that the water was deposited into one of the large canals underneath the lower terrace. This redirection suggests that the presumed original destination of the Pipeline B water, the Bath Complex, was out of use and no longer in need of a water supply, placing the date of the redirection

[6] Based on measurements taken by the author from the pipe segments in the eastern section that remains *in situ*.

soon after the end of the use of the Bath Complex.[7]

Conclusion

The PGPC Pipelines B, C, and D and the two GT pipelines were additions to the water system of the Southern Terrace during a period when the monuments of the Nabataean capital fell into disrepair prior to the 363 earthquake (PGPC Phase IV, late 2nd–mid-4th centuries). The PGPC was no longer maintained as a luxury garden as the pool began to fill up with trash and debris (Bedal *et al.* 2007: 165–6). The Southern Terrace was transforming from an elite luxury complex into an area for habitation and agricultural cultivation, and there was a need to reorganize the water system for such purposes. Such activity is illustrative of Petra's economic decline and restructuring prior to the 363 earthquake (cf. Fiema 2003: 50, 52–3).

The Post-Nabataean pipelines of the PGPC and the GT represent at least three different sub-phases/phases:

- IVa - Pipeline B was the first of the Phase IV pipes to be laid when there was a need to transport water from east to west across the site. It is likely that this ceramic pipe merged with a lead pipeline, along with the Lower Reservoir, which was installed soon after Roman annexation (Phase III) to transport water from the subterranean Great Cistern, through the reservoirs in the GT East Perimeter Wall, to the new Bath Complex on the west side of the GT complex. Although the decline of the luxury garden and pool had already begun by this date, it seems that the Bath Complex continued in use and required an additional water source to meet demands.

  GT Pipeline 1 cannot predate the Phase IV Lower Reservoir and Bath Complex. The fact that it was laid so that it was openly visible across the top of the forecourt pavement signals the transformation of the GT complex from royal/administrative to a more utilitarian function. Its orientation, east to west, across the GT upper terrace, suggests its destination is the Bath Complex. The massive columns of the GT forecourt collapsed on top of fill that covered the pipeline during the 363 earthquake (Joukowsky 2004: 123).
- IVb – As the transformation of the Southern Terrace continued, the Bath Complex went out of use and the oblique wall was constructed with GT Pipeline 2 installed to redirect the water from Pipeline B toward the northwest.

  The placement of PGPC Pipeline D within the timeline of Phase IV is not precise due to its disturbed context. The lack of evidence that it was securely encased in mortar indicates that it does not belong to the Phase II Nabataean garden nor to the Phase II renovations by the Romans. Its stratigraphic context places it in the 3rd–mid-4th centuries. Its form and proportions are most comparable to GT Pipeline 2. Without further information, the assignment of Phase IVb is best supported.
- VI – The basin with Pipeline C was installed when water was needed to be directed to the garden terrace as

[7] This agrees with Joukowsky's date for the ceramic pipeline that runs from the PGPC ("Lower Market") to the GT Triple Colonnade (here referred to as GT Pipeline 2) to the period prior to the 363 earthquake collapse (Joukowsky 2004: 123 table 1) but conflicts with her date for the end of the Bath Complex to the late 6th century (Joukowsky and Cloke 2007: fig. 1.18).

> it transformed into an agricultural field. The channels and castellum of the Nabatean pool were cleaned out for reuse, finally cutting off the flow of water in Pipeline B beyond this point.

An overview of Petra's ceramic pipelines dated between the late 1st century BC and the 4th–5th c. AD does show a general shift from thin walls with proportionally narrow and tapered forms and sharply carinated shoulders, to thicker-walled with rounded shoulders for the smaller diameter pipelines such as those found in the PGPC (A, B, and D), and the GT. However, establishing a broad typology is complicated by variations in scale which are related to function primarily. A collared neck and waisted body are seen only in the largest pipes with large flow capacities that serve the demands of the city's public system.

The documentation of a sequence for the three PGPC pipelines and the associated pipelines in the GT helps to differentiate chronological phases that were not previously discerned through the analysis of stratigraphy or other categories of material culture that are typically relied on for such purposes, namely pottery, lamps, and coinage. It is hoped that the identification of the sub-phases of pipelines might help to reveal further sequences in other categories upon re-analysis of the associated materials.

An attempt to discern patterns of form and/or function and temporal distribution over a larger area of Jordan and the Southern Levant is restricted by the small number of pipes that are published with their measurements and illustrations. Some notable exceptions are the reports on excavated ceramic pipes in the water systems of Wādī Musa (ʿAmr and Al-Momani 2001) and Hippos-Susita (Ben David 2002), the Roman forts at Humayma (Oleson 2010: 330) and Lejjun (Parker 2006: 361, 371 fig. 16.80), the Bathhouses at ʿAyn Gharandal (Harvey, this volume) and Gadara/Umm Qais (Nielsen *et al.* 1993: 158 Taf. 34), and workshops at Jerash (Kehrberg 2009) and Jalame (Berry 1988: 247). One goal of this article is to appeal to excavators who have unpublished ceramic pipes in their corpus to include more details in the reports.

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