

THE WĀDĪ AZ-ZARQĀ'/WĀDĪ AḌ-ḌULAYL ARCHAEOLOGICAL PROJECT REPORT ON THE 1997 AND 1999 FIELDWORK SEASONS

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1. Introduction

The present report outlines the main activities conducted during the 1997 and 1999 campaigns of survey and soundings in the Wādī az-Zarqā'/ Wādī aḌ-Ḍulayl region وادي الزرقاء/وادي الضليل. During these two years the work concentrated especially on prehistoric sites, but the regional survey and preliminary survey work at two other sites, one Roman-Byzantine (Khirbat al-Wad'ah خربة الودعة) and the other Islamic (Khirbat al-Makhūl خربة المكحول) have provided important information on other periods of occupation and maintained the balance of interest and a global perspective on human occupation in this region, which has been a characteristic of this project since its inception in 1993. In seven years we have witnessed an exponential increase in the urbanization and heavy agricultural use of the region. Of the 450 sites identified so far by the survey, many are lost without having been studied, and many more are threatened and being destroyed. The ephemeral nature of human occupation in this region (one of the characteristics of this "living in the fringe") is also the reason why sites are being lost so easily. With this project we are trying not only to study the variety of land use and occupation in the region, but also to raise awareness among local people and administrators about the importance of this heritage, and to work with them in order to find an acceptable compromise between socio-economic development and heritage conservation.

2. Survey Campaigns

2.1. Field Research

The second survey campaign, mainly focusing on the historical periods, was conducted during August and September 1999 by Massimiliano Munzi, Barbara Bianchi, Laetitia Thomas and Zacharia Nu'eimat. During this survey 59 sites were documented: 27 identified from aerial photos, and 32 found as a result of ground explorations (Table 1).

The survey began, following the same strategy adopted in 1993 (Palumbo *et al.* 1996), with the field control of sites identified by aerial photographs. Priority was given to areas not investigated during the previous survey. With this strategy, the team conducted the following surveys (Fig. 1):

1. The *jibāl* north of Wādī az-Zarqā' and Wādī aḌ-Ḍulayl (the northernmost portion of the whole area).
2. The hills in the south, to the west of the city of az-Zarqā'.
3. A portion of the mountain crest near Khirbat Abū az-Zighān/Zighān (خربة ابو الزيفان).
4. The small Jabal Ḥajawī (جبل حجوي) chain, west of al-Hāshimiyya (الهاشمية).
5. The northern slopes of Jabal Ruḥayl (جبل رحيل).

The sites on the mountain to the west of Gharisa (غريسة) are almost exclusively stone cairns, usually built over the crest and upper slopes of hills and mountains. Pottery is rarely found on these sites, while stone tools are sometimes found as 'background noise', without a clear association to the use of the cairns. The only exception was at site 423, where some small Roman pottery fragments were found.

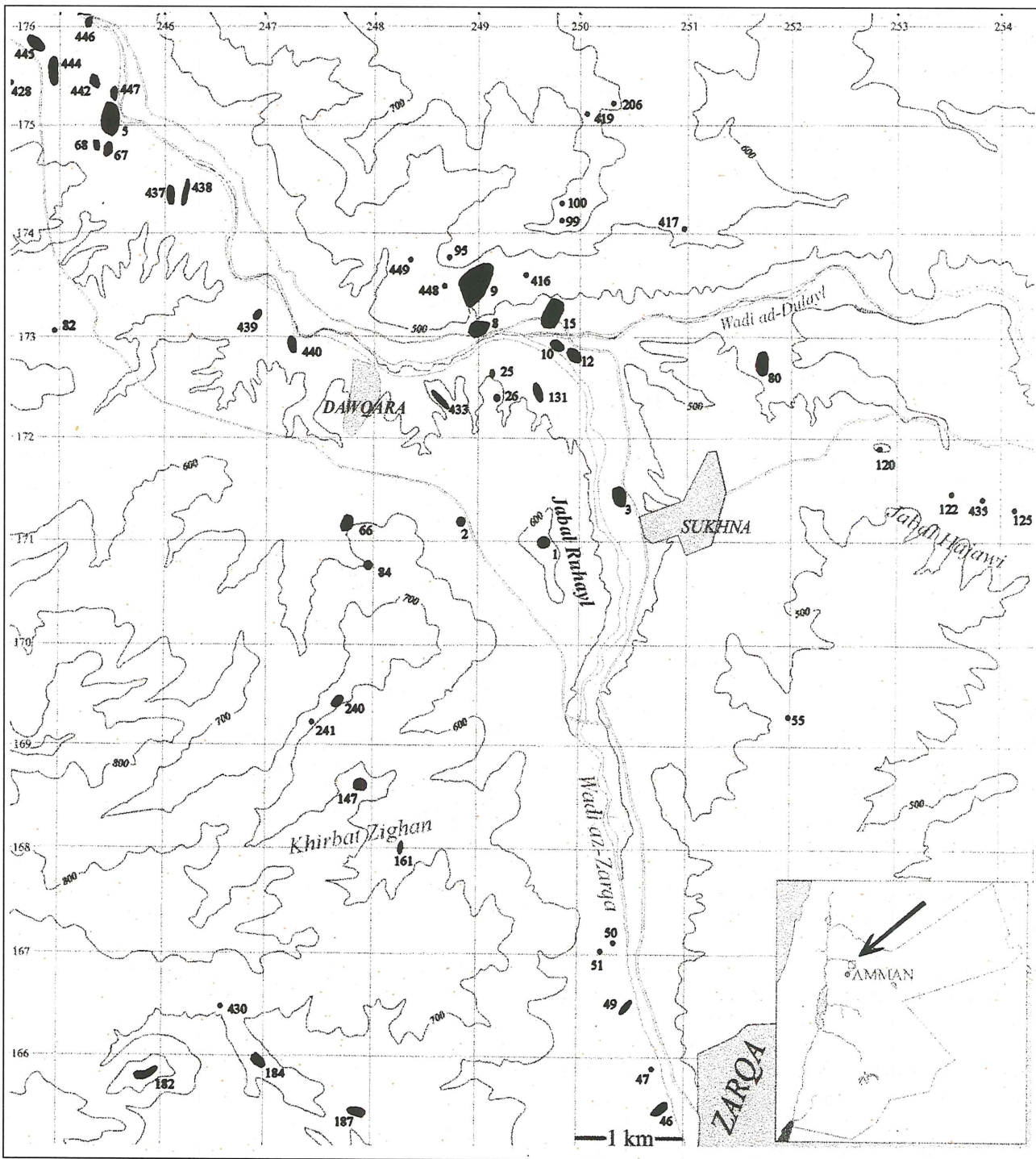
Similarly, in the southern portion of the project area, stone cairns and circles are the only site types identified, with the single presence of a rock shelter.

In the area of Khirbat Zighān the cairns are located on the crest to the north of the site (147). The promontories to the north of Jabal Ruḥayl have traces of Roman occupation, probably linked to the agricultural use of the area (sites 25-26, 431-433). The survey of the hills to the south of Wādī Sa'da (وادي سعدة) and west of al-Hāshimiyya revealed the presence of nine sites, including stone circles, cairns, animal pens (sites 120-125, and 434-436), and two "desert kites" (site 124).

During this first part of the survey it became evident that there is a sampling bias in the sites found through aerial photo interpretation: the sites visible

Table 1: List of surveyed sites.

Site n.	Coordinates (E-N)	Type of site	Periods of occupation
8 (ext.)	248.94 / 173.10	sherd scatter	(besides main Neolithic occupation): EBII?; Roman/Byz; Mamluk
25	249.11 / 172.66	sherd scatter	Byzantine?
26	249.16 / 172.41	sherd scatter	Lower Pal.; EB; Roman; Mamluk
95	248.72 / 173.78	cairn	UD Lithics; EB I/II; Byzantine
96	248.99 / 174.02	cairn	Upper Pal.
98	249.31 / 174.06	cairn	UD Lithics
99	249.80 / 174.12	cairn	Epipal.; UD Lithics; Roman, Modern, UD pottery
100	249.80 / 174.28	cairn	Roman, UD lithics
101	249.99 / 174.89	cairn	UD pottery
102	250.18 / 174.28	cairn and circle	Upper Pal.?
120	252.84 / 171.90	stone circle	UD Lithics, Roman, UD Pottery
121	253.22 / 171.66	stone circle	UD pottery
122	253.53 / 171.46	stone circle	EB II?; Roman/Byz.
123	253.67 / 171.47	animal pen	UD lithics
124	253.34 / 171.71	animal pen	UD lithics
125	254.14 / 171.28	cairn	UD lithics; Roman
148	248.18 / 170.07	animal pen	Iron Age; UD Lithics
182	245.88 / 165.77	cairn and animal pen	Roman/Byz; UD Pottery
184	246.96 / 165.93	cairn	Roman/Byz
187	247.87 / 165.44	cairn	Roman/Byz
188	248.29 / 165.19	cairn	UD Islamic
190	245.14 / 165.24	animal pen (block built)	UD Lithics; UD pottery
206	250.39 / 175.18	cairn	UD Lithics; Roman
234	248.30 / 173.40	cairn	Middle Pal.; UD pottery
237	248.35 / 173.88	cairn	?
239	248.06 / 169.78	cairn	UD Lithics; UD pottery
240	247.64 / 169.39	cairn	Epipaleolithic; UD Lithics; Iron Age; Roman
241	247.41 / 169.19	cairn	UD Lithics; Roman/Byz
416	249.41 / 173.63	sherd scatter	UD Lithics; Roman/Byz
417	250.98 / 174.04	cairn	UD Lithics; UD Pottery; Roman
418	251.86 / 174.33	cairn	UD Lithics; Iron Age
419	250.02 / 175.18	cairn	Middle Pal; Roman; Roman/Byz; Mamluk
423	250.02 / 174.50	cairn	UD Lithics; UD pottery
424	249.81 / 175.33	cairn	?
425	249.44 / 175.34	cairn	UD pottery
426	250.53 / 175.06	cairn	?
427	249.92 / 175.48	cairn	UD Lithics; UD pottery
428	244.47 / 175.44	cairn (qasr?)	Roman; Byzantine?; Mamluk/Ottoman; Modern
429	248.07 / 165.32	cairn	?
430	246.58 / 166.47	cave	UD Lithics; Byzantine; UD pottery
431	249.58 / 172.51	structure (farm)	Byzantine; UD Pottery
432	248.79 / 172.41	sherd scatter	Modern; UD pottery
433	248.60 / 172.44	sherd scatter	Roman
434	253.94 / 171.36	cairn	UD pottery
435	253.82 / 171.41	animal pen	Byzantine
436	253.47 / 172.27	animal pen	Mamluk
437	246.04 / 174.37	sherd scatter	Iron Age; Roman
438	246.16 / 174.40	sherd scatter	Lower Pal.; Middle Pal; UD Lithics; Chalcolithic?; EBII; Roman
439	246.85 / 173.23	sherd scatter	Roman/Byz
440	247.18 / 172.92	sherd scatter	Bronze Age; Roman, Mamluk
441	247.53 / 172.24	sherd scatter	Bronze Age; UD pottery
442	245.34 / 175.46	sherd scatter	Iron Age, Roman, UD pottery
443	245.15 / 175.38	sherd scatter	Iron Age?; UD pottery
444	244.94 / 175.55	sherd scatter	Roman; UD pottery
445	244.84 / 175.77	sherd scatter	Roman; UD pottery
446	245.24 / 175.98	sherd scatter	Roman
447	245.48 / 175.36	sherd scatter	EB II; Iron Age; Roman; Byzantine; Mamluk
448	248.66 / 173.53	sherd scatter	PPN?; Roman; Roman/Byz; UD pottery
449	248.34 / 173.76	cairn	Roman; UD pottery
450	248.54 / 174.35	cave and sherd scatter	UD Pottery



1. General map of principal Roman, Byzantine and Islamic settlements.

on the photos belong only to a limited building typology (cairns, stone circles, animal pens). Pottery and stone tools are rarely found at these sites. The larger part of cairns and animal pens found so far cannot be precisely dated.

For this reason it was decided to conduct also a sample of intensive survey on the left bank of the az-Zarqā' River, an area where the aerial photos

did not reveal any clear traces of occupation, but where the potential for site location had already been identified during the survey of the northern slopes of Jabal Ruḥayl. This area, 500 meters wide, which includes terraces and hill slopes near the river bed, was possibly exploited for agricultural purposes not only during the periods from the Roman to the Islamic, but also during the Bronze and Iron

Ages. Ancient rural settlements were identified. In the area comprised between the confluence of the wadis az-Zarqā' and aḍ-Ḍulayl and Tall al-Birah (تل البيرة), each promontory extending towards the az-Zarqā' River has some kind of presence, a total of 10 sites (25-26; 431-433; 437-441). Where there are no settlements, the traces of agricultural use are clear. At the sites pottery from the Bronze Age was found (26; 433; 438, 440-441), together with Roman and Byzantine (25-26, 431, 433, 435, 437-440), and Mamluk (26, 440). The Bronze Age occupation must be linked to the presence of the large site number 79, discovered in 1993.

The good results of this survey encouraged us to continue it beyond Tall al-Birah (site 5), in a north-westerly direction along the az-Zarqā'. This sector, as the preceding one, is extremely rich in settlements, mostly Roman and Byzantine. It is evident that these must be considered "satellites" of the large centre at Tall al-Birah, which must have had a function of central place for many more sites in the area. Six sites were found in this sector (442-447).

The last days of the survey were dedicated to the impressive site of Khirbat al-Wad'ah (9), extending from the Roman to the early Islamic periods. The site is unfortunately affected by clandestine excavations. The area immediately to the west of al-Wad'ah was also surveyed: this revealed the presence of a Roman site (448), a series of cairns (234, 237, 449), and a cave with abundant traces of occupation found around it (450).

The study of the chipped stone tools and of the pottery found at the sites, still at a preliminary stage, does not allow a precise dating of the sites. It is however possible to outline a chronology that needs to be confirmed by further study.

2.2. From Palaeolithic to Iron Age

Only a small portion of the numerous sites identified during the regional survey had material that could be clearly dated to the periods between the Palaeolithic and the Bronze Age: 2 sites (26, 438) had Lower Palaeolithic material, 3 Middle Palaeolithic (234, 419, 438), 2 Upper Palaeolithic (96, 102), and 1 Epipalaeolithic (240). This is all surface material found in scatters or nearby a cairn. None of these sites seem to be of major importance. The same can be said for the PPN and Chalcolithic periods: only one (possible) site for each period was found (448 and 438, respectively). Six sites each belonged to the Early Bronze Age (especially I/II) and to the Iron Age. The sites of the Early Bronze Age (8, 26, 95, 122?, 438 and 447) and of the Bronze Age (440, 441) are mostly sherd scatters, but some of them may belong to

pastoral camps or hamlets, and their further study may provide interesting data on the relationships between the larger centres already identified in previous campaigns, and the "periphery". The same can be said for the Iron Age occupation (sites 148, 240, 437, 442, 443?, 447). Two of these sites are a cairn and an animal pen, but all others are sherd scatters that, as in the case of the Early Bronze presence, may indicate the presence of small hamlets or encampments. The survey however has demonstrated that throughout the long history of human occupation in this region, permanent settlement was established in the immediate vicinity of water, while more remote areas were only used by shepherds or for functions other than human settlement (below).

2.3. Cairns and Stone Circles

The survey has confirmed the presence of a wide array of site types in the valley. Closest to the river, agricultural sites prevail, with actual settlements and villages slightly removed from it and occupying hilltops or defensible slopes or promontories. Farther away, seasonal settlements and camps prevail, with the hill crests usually marked by the presence of a large cairn or cairn groups. Animal pens and stone circles complete the picture of site types found in the areas most distant from the river and other water sources. Unfortunately, date and function of the latter structures are still difficult to understand. Some were certainly tombs (188, Fig. 2), perhaps of tribal leaders, other were linked to the presence of seasonal pastoral camps, but many cairns do not contain graves, and at the same time many stone circles are too carefully prepared to be animal pens. In our opinion, these sites may hold a symbolic or even religious value for people living in the area perhaps during several periods and until a relatively recent past. We believe that the construction of these very visible structures filled not only a practical, but also a symbolic function. The better understanding of these sites may be one avenue of future research in this area, together with the investigation of a few settlements, which



2. The cairn-tomb 188.

may also hold the key to understand the function of their satellite sites.

2.4. The Roman-Byzantine Landscape

As regards the classical periods, no new Hellenistic sites were found, in confirmation of the crisis of the agricultural settlements, which is evident in the whole of Jordan between the fifth and the first century BC. The political and economic stability seems to follow the Pompeian annexation of Syria and organisation of the Decapolis alliance in 64-63 BC.

According to Eusebius (*Onomasticon* 102.2; Bietenhard 1977: 224.), the border between the territories of Gerasa and Philadelphia was marked by the Jabbok River (Wādī az-Zarqā'), or it ran further south as indicated by the IX milestone. The northern bank of the central az-Zarqā' Valley should have been administratively controlled by Gerasa (Jarash), located 20km to the northwest, the southern bank by the more distant Philadelphia ('Ammān). The ancient and new epigraphic data shows now a more complex arrangement. On the milestones of the Gerasa-Philadelphia road, the *caput viae* changes only beyond the ridge between 'Ālūk (عالوك) and Kamsha (كمشه), to the south of Wādī az-Zarqā' and 13km to the west of as-Sukhna (السبخنة) (Thomsen 1917: 63, n. 204; Avi-Yonah 1966: 175-177; Rasson-Seigne and Seigne 1995). Moreover, on the same ridge between 'Ālūk and Kamsha some inscriptions have been found, bearing the text "πο(λις) Γε(ρασεων)"; these supposed *termini* of the *territorium* of Gerasa seem to indicate the extension of the border further to the south of az-Zarqā' (Seigne 1997). But the whole series of *termini* describes a too small territory, limited to the hilly areas best suited for agriculture. The eastern steppe, with mixed dry-farming and semi-pastoralism, would be under the administrative umbrella of the distant Bostra (Kennedy 1998: 48-54) and/or Philadelphia. The picture would be different reading πο(λεως) Γε(ρασηνων), i.e. *termini* of the municipal property of Gerasa (Sartre 1997). In this case the territory of Gerasa could have been larger to the east and the border with Philadelphia along the az-Zarqā', which in the eastern tract runs more to the south than in the 'Ālūk-Kamsha sector. On the other side, it is possible that Eusebius testified a later territorial reorganisation that favoured Philadelphia. In every case, the agricultural production of the region was supporting the large markets of Gerasa, a city in constant expansion at least until the age of Severus (Browning 1982: 36-52; Seigne 1992; Bejor 1993: 564-566).

After the conquest and during the entire Roman and Byzantine period, settlement increases until its all-time maximum during the fourth-sixth centuries AD, as it was already understood during the 1993 survey (Palumbo *et al.* 1996: 390). The Late Roman and Byzantine peak is a constant feature in the historical landscape of Jordan (Ji 1996: 589-594, 603; Ji and Lee 1997: 550). The Roman and Byzantine cultural landscapes were very similar, and this is reflected in the continuity of settlement from one period to the next.

Thirty-three sites, preliminarily dated to the Roman and Byzantine periods, were found in the 1999 campaign. The analysis of pottery, still in course, does not allow a firm division between the two periods. The sites must be added to the 23 identified in 1993 (Munzi in Palumbo *et al.* 1996: 388-392) (Fig. 1).

The majority of the Roman-Byzantine sites found during this campaign are situated on the lower or middle hill slopes (430-600m), directly above or near the course of the main rivers, i.e. Wādī az-Zarqā', aḍ-Ḍulayl, and Sa'da (25 sites within 1.5km from the rivers). But, as noted in 1993, during the Late Byzantine period some people settled the upper slopes, hilltops and higher elevations (600-780m), often located in remote areas, perhaps an indication of increased defensive concerns (Tables 2, 3).

The two most important sites of the period as identified so far are Tall al-Birah (5), whose frequentation begins in the Iron Age, and Khirbat al-Wad'ah (9). We have already interpreted these larger settlements as central villages or, in ancient term, *metrokomialai* (for the Syrian landscape see Tchalenko 1953: 377-403; Piccirillo 1985: 260; Bowersock 1991: 427-430; Kaplan 1992: 89-134). Both were visited by Glueck in the 1930s (1939: 213, sites 320 and 318 respectively) and during our 1993 campaign. Around the first site, research has identified a complex system of agricultural satellite sites, dating back to the Roman period but still used (or perhaps expanded) in the Byzantine period, dislocated along the south bank of Wādī az-

Table 2: Distribution of sites per elevation.

Altitude	Sites	Tot.
400-450	442, 446, 447	3
451-500	25, 431, 437, 438, 439, 440, 444, 445	8
501-550	26, 428, 433	3
551-600	125, 416, 435, 448, 449	5
601-650	95, 120, 122	3
651-700	187, 417	2
701-750	99, 100, 184, 206, 240, 241, 419, 430	8
751-800	182	1

Table 3: Distance of sites from most important wadis (az-Zarqā', ad-Dulayl, Sa'da).

Distance (km)	Sites	Tot.
0 – 0,5	25, 26, 120, 122, 125, 431, 433, 435, 437, 438, 439, 440, 442, 445, 446, 447	17
0,5 – 1	95, 416, 417, 428, 448.	6
1 – 1,5	99, 100, 449	2
1,5 – 2		-
2 – 2,5	206, 240, 419	3
2,5 – 3	241	1
3 – 3,5	187	1
3,5 – 4	184	1
4 – 4,5	430	1
4,5 – 5	182	1

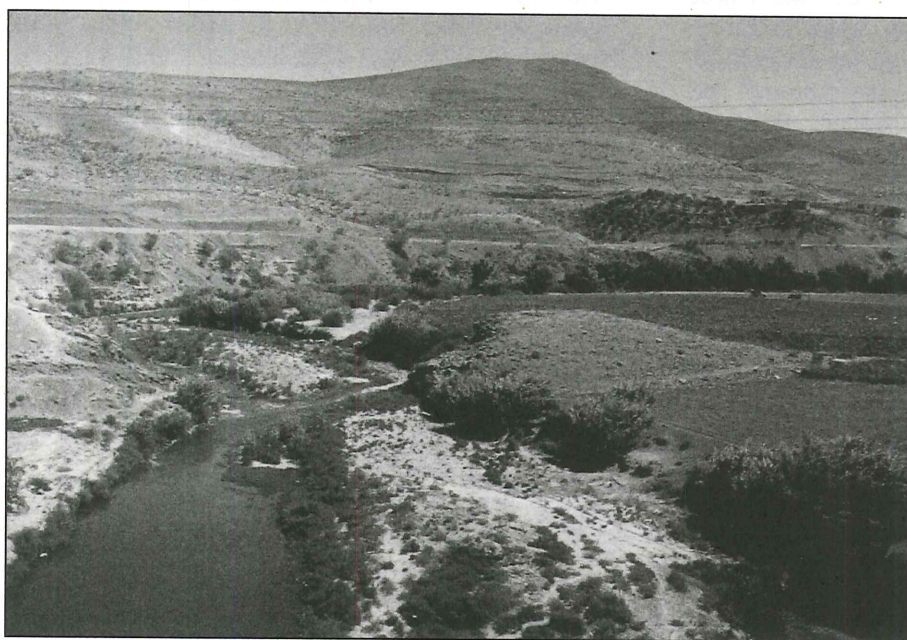
Zarqā'. Among these, sites 446 and 447, situated directly on the wadi, possibly functioned as market places (even though the river could not allow the passage of boats) (Fig. 3). These sites are very rich in Roman pottery, including imported wares, such as Italian, African, and eastern terra sigillata.

Khirbat al-Wad'ah, the largest Roman-Byzantine site with its seven hectares on the lower slopes of a hill overlooking Wādī az-Zarqā', has been intensively re-surveyed. The presence of public buildings is confirmed by the discovery of other fragments of architectural decoration (see 2.5. below), among which there is a rough capital with engraved volutes and another stone door. Together with a late Roman or Byzantine bronze coin (AE 4 - nummus), many stone tesserae of different sizes and colours are also found, coming from destroyed floor mosaics. Some of the tesserae probably decorated courtyards, given their roughness and dimensions, but others most probably decorated internal spaces.

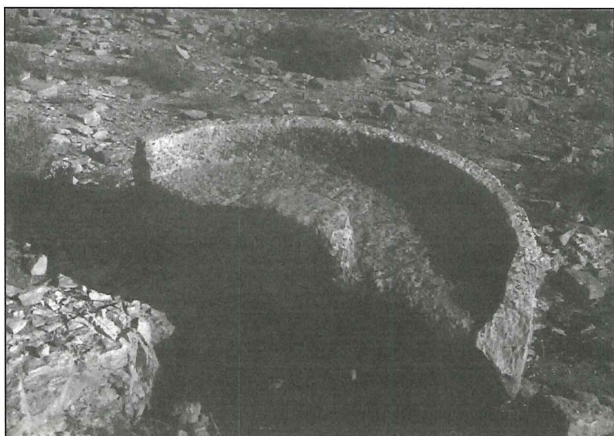
We also re-examined the architectural elements found in 1993. This demonstrates the existence of a double arch or a series of arches, possibly built

over columns, to which the capital found this year could belong. These elements could demonstrate the existence of a church, possibly confirmed by the finding of a small Byzantine bronze cross pendant (see Fig. 8), just inside the main central complex, 60m (200 Roman feet) long. This building, either during the main period of use or at a later stage, was also used for industrial activities, as demonstrated by the presence of a basalt grindstone. 150m to the west of al-Wad'ah an important Roman farm is located, which included a base for a large oil millstone (448) (Fig. 4).

The Muslim Arab conquest did not erase this landscape, perhaps due to the fact that Arab settlers had already occupied the area, and had been assimilated as foederati already since the fourth century AD (Parker 1992; Shahid 1984a: 62-63; 1984b: 500-503; 1992; Grouchervoy 1995). Traces of their presence were found just in Khirbat al-Wad'ah already in 1993, when a sculptured basalt door came to light, with a presumed pre-Islamic Arabic inscription. Now a new limestone slab was found with a probable Greek inscription and a well-sculpted North Arabic pre-Islamic wasm of

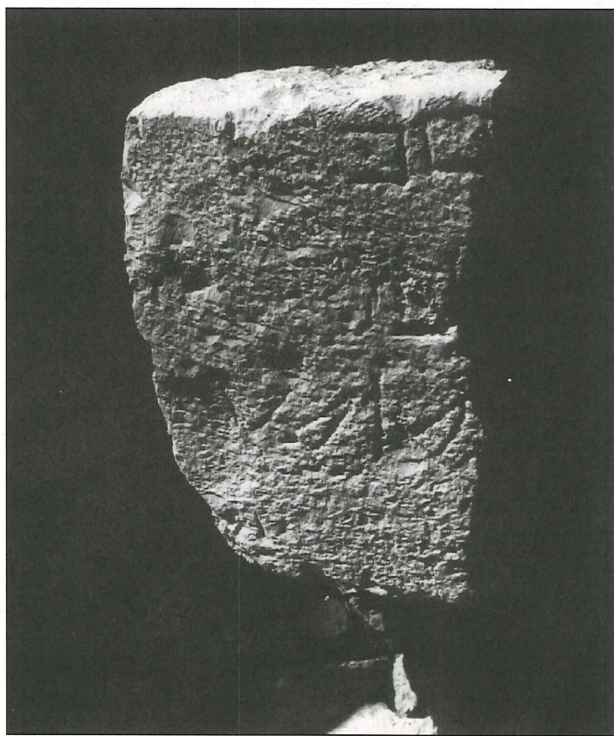


3. Tall al-Madra'a (site 446) on the left bank of Wādī az-Zarqā', looking East.



4. The Roman farm 448, 150m to the West of Khirbat al-Wad'ah: base of millstone.

Roman/Byzantine chronology (Fig. 5). Whereas the Greek inscription shows a cursive *ductus* and a nearly scratched engraving, the Arabic characters of square shape are carefully engraved. The relative chronology between the two inscriptions is not univocally definable. Both could be engraved *grosso modo* contemporaneously during the late Roman-Byzantine period. In the cairn 188, near az-Zarqā' (where local people mentioned the presence of a burial found there several years ago) two other graffiti were found, with apparently pre-Islamic Arabic characters, which will need further study and identification (they could also be symbols en-



5. Khirbat al-Wad'ah: limestone slab with a Greek (?) graffiti and a north-Arabic wasm.

graved by nomadic tribes of more recent date).

2.5. Khirbat al-Wad'ah: Architectural Decorations and Other Remains

The village, or *metrokome*, of Khirbat al-Wad'ah, located north of the az-Zarqā' River, possibly in an area under the control of Gerasa, was probably one of the main sites of the Roman-Byzantine settlement system in the region. The settlement maintained its important role during the Early Islamic period, and at least until the Mamluk period.

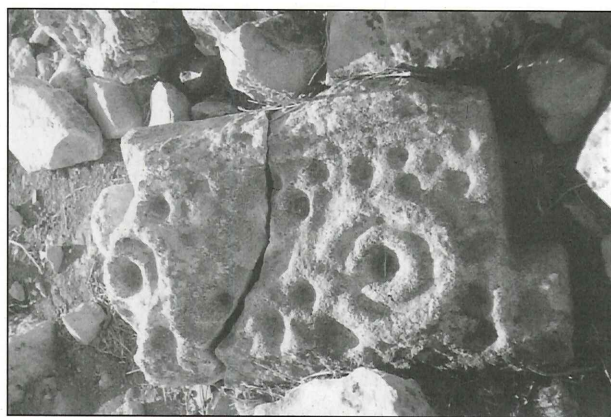
The settlement is dominated by a small hill in its eastern sector, described by Glueck. This small stone accumulation is formed by the collapse of an articulated monumental complex, 60m long. The intensive survey of this monument revealed the presence of a large number of limestone architectural blocks, together with architectural elements witnessing the presence of important buildings at the site: an ashlar with double springer suggests the presence of a building with a series of arches (on columns?) (Munzi in Palumbo *et al.* 1996: 391); a quadrangular ionic capital (Fig. 6); a fragment of a corner entablature with a complex decoration of triangles, which seem to have parallels with other Umayyad examples (Fig. 7); a triangular limestone block, possibly filling the space between two arches. Many tesserae of different shapes and colour were also found, indicating the presence of floor mosaics. In the collapse of the large building mentioned above, a small bronze cross was found (4.1 x 2.2 x 0.2cm), with a small ring on the top and decorated on both faces by circular impressions executed with a punch (Fig. 8). Crosses of similar dimensions are known as being used in association with lamps and incense burners, but those usually also have a small hole in their lower portion to attach other decorative elements such as precious stones. In this case, however, we



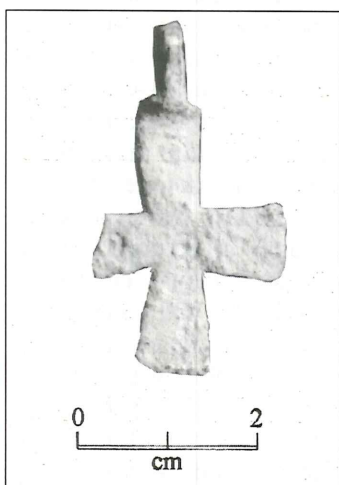
6. Khirbat al-Wad'ah (site 9): capital.



7. Khirbat al-Wad'ah (site 9): frame.



9. Khirbat al-Wad'ah (site 9): decorated limestone door.



8. Khirbat al-Wad'ah (site 9): Byzantine bronze cross.

prefer to think that this is a personal ornament, a small pectoral cross. These were used already in the fourth century AD (see Gregorius of Nissa, *De vita S. Macrinae*, PG, XLVI, col. 989). For its dating we refer to the crosses impressed on the type D African terra sigillata, in particular those with impressed circles in the style E II, dated to AD 530-600 (Atlas: pl. LX, 2-4, n° 255; 131 on dishes Hayes 1972: 104 A on sigillata D2 dated to the mid sixth century AD).

In the valley sector of the settlement, among the collapse of a building of uncertain date, in an area where buildings of probable Early Islamic date are re-used today as sheep pens by local shepherds, we retrieved a limestone door element with a rough decoration made by two knobs, one on top of the other and surrounded by small holes (Fig. 9). In 1993 another door, in basalt, was found, decorated with floral and zoomorphic motifs in bas-relief (Wilson in Palumbo *et al.* 1996: 404, 407). Stone doors are normally used in tombs of the Roman period.

2.6. The Islamic Periods

After the Islamic conquest the area was divided

administratively between Jund Filastīn and Jund al-Urdunn (or Jund Dimashq) (on the *jund/ ajnād* system, see Shahid 1987; 1989; 1994a; 1994b). The border between the two military districts ran on the Wādī az-Zarqā' (Walmsley 1987: maps 3-4; Gousous 1996: 80, 83; Schick 1998: 79-80). The settlement system in the border strips of Jund al-Urdunn and Jund Filastīn was still dominated by the villages of Tall al-Bīrah and Khirbat al-Wad'ah, respectively controlled as before by the still active Gerasa and Philadelphia (Al-Muheisen and Tarrier 1994: 334-335; Dauphin 1998: 522-525).

There was initially little change to the structural aspects of the landscape. Rural life continued as before, but in a background of an accentuated rarefaction of the socio-economic connective tissue, always delineated by the topographic research in Jordan (recently Ji 1996: 589-594; Ji and Lee 1997: 550; in general Al-Muheisen and Tarrier 1994: 338-341). If the local rural population in the 1993 sample seemed to be reduced to half of what was in the Byzantine time (Palumbo *et al.* 1996: 392-393), the proportion of decrease is bigger according to the new campaign. Only seven small Islamic sites were identified, among which six are preliminarily datable to the Ayyubid-Mamluk period (26, 419, 428, 436, 440, 447). Pottery of this period (hand made coarse pottery with linear banded or geometric decoration) was also found at al-Ḥasayyah الحسيية (8), where in 1993 only Neolithic and Byzantine presence was documented. Most of the sites are found on or near Roman-Byzantine ruins, perhaps to take advantage of construction material and the existence of cisterns. The Islamic settlement is also concentrated along the river strip between the two settlement poles of Tall al-Bīrah and Khirbat al-Wad'ah, both still extensively frequented. The sub-circular stone circles, which lean on the well built ancient structures of the two villages, could be Ayyubid-Mamluk. In the southern

area another central place was Khirbat al- Makhūl (4), located on a hilltop south of as-Sukhna (Palumbo *et al.* 1996: 393-394; Kafafi *et al.* 1997; this article: 3.3). During the 1999 campaign an Islamic coin has been found at the site.

The increase of settlement in the Middle Islamic period is a phenomenon identified elsewhere (King *et al.* 1987; Mabry and Palumbo 1988). This is the last significant agricultural and pastoral use of the countryside before the massive peopling that happened *ex imperio* at the end of the Ottoman rule.

3. SITE SURVEYS AND EXCAVATIONS

3.1. The Lower Palaeolithic of the Dawqara Formation

3.1.1. The Quaternary Outcrops of the az-Zarqā' Valley

The 1996 survey campaign on the Palaeolithic outcrops of the az-Zarqā' Valley had led to the discovery of a very consistent archaeological and palaeontological deposit of the lower Pleistocene, provisionally dated at 1 million years, on the top of mixed colluvio-alluvial Dawqara formation (Parenti *et al.* 1997). Because of the importance of these finds for the prehistory of the first peopling of the Jordanian side of the rift, the campaigns of 1997 and 1999 have been essentially oriented to the survey and stratigraphy of the oldest archaeological bearing formations and localities of the region.

The first days of the 1997 season were employed investigating the uppermost terrace, also pertaining to Dawqara formation according to Besançon *et al.* 1984, that we preliminarily consider older than the upper one, so dating from Upper Pliocene/ Lower Pleistocene. Five new sections (411-416) were recorded in this portion of the valley that lies 2km north-west of the village of Dawqara (دوقرة) and 70-80m above the present river bed (Fig. 10).

This terrace was mainly the product of alluvial and possibly lacustrine events. Two possible stone tools, a core and a flake, were recovered from 413 and 411, respectively. The correlation was made between the uppermost terrace and the lower Pleistocene/Dawqara terrace; the latter is definitely younger than the former. It was confirmed in the valley that at least four river terraces existed between Upper Pliocene and Holocene, as the French team who surveyed the region during the eighties had foreseen (Baubron *et al.* 1985).

3.1.2. Topographic Survey on the as-Sukhna Plateau

A detailed topographical survey was conducted immediately north of the village of as-Sukhna

(السبخنة). The rectangle in Fig. 10 shows the area of survey and in Fig. 11 the location of the agricultural terrace sections selected for investigation during the 1997 and 1999 seasons is plotted. The survey was carried out with plane table and optical alidade and field drawings were executed at the scale of 1:1000, covering an area of ca. 0.7km² and encompassing sections 330, 331, 332, 342, 343, 409, 410, 414 and 415. Contour lines have been drawn each one meter, so precise stratigraphic relationships are possible between the sections.

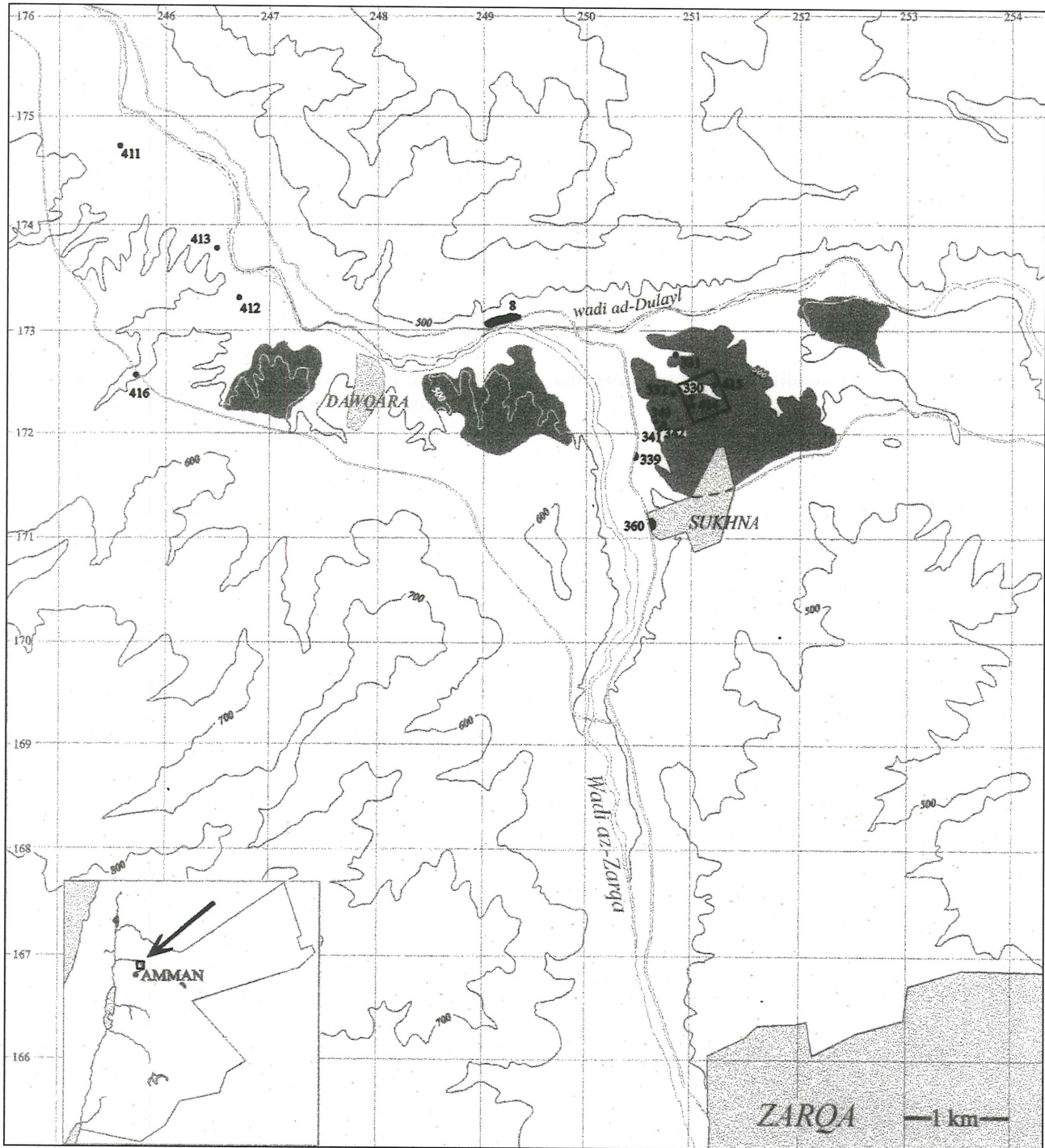
The main goal of the survey was both the description of the artificial terraces for the construction of which the Dawqara upper strata have been bulldozed and of the drainage system immediately downstream of section 330. A detailed altimetric control has been provided for the setting of stratigraphic correlation between sections 414, 330 and 415. Some additional points have been plotted for positioning the new trench at site 414. On the top of the outstanding limestone crust an altimetric datum (502.85m above sea level) has been fixed with an iron stick.

3.1.3. Explorations at Section 330, as-Sukhna North (1997)

All the exposed sections are the result of agricultural terracing and positioning of water pipe line for irrigation. In 1996, 22m of an old section front at site 330 were cleaned and investigated (Parenti *et al.* 1997). In the 1997 season, during 11 days of fieldwork, a further extent of 40m was cleaned at the western side, investigated and recorded at 1:20 scale. In addition, a short narrow trial trench, 3m long, was placed at the foot of the section in order to identify the depth of the fossiliferous horizon (see Fig. 16).

A total of 1,240 artefacts were recovered from section 330 (1996 and 1997), comprising 23 choppers, 74 cores, 891 pieces of débitage, 204 retouched pieces, 19 chunks and 20 fossil animal remains. The Ordnance Datum was established for the site and the position of more than 700 finds was plotted using X, Y and Z co-ordinates. All sediment from cleaning and excavation was sieved in order to achieve maximum faunal and artefact retrieval. The removal of each piece of fossil animal bone required careful attention and strict technical procedure, in order to avoid its disintegration.

The vast majority of the stone tools and fossil remains has been recovered below the limestone crust, scattered in the filling of sedimentary fluvial structures, mainly fossilised channel beds. Their spatial distribution which, at first glance, seems to show no particular features nor clustering, can be a

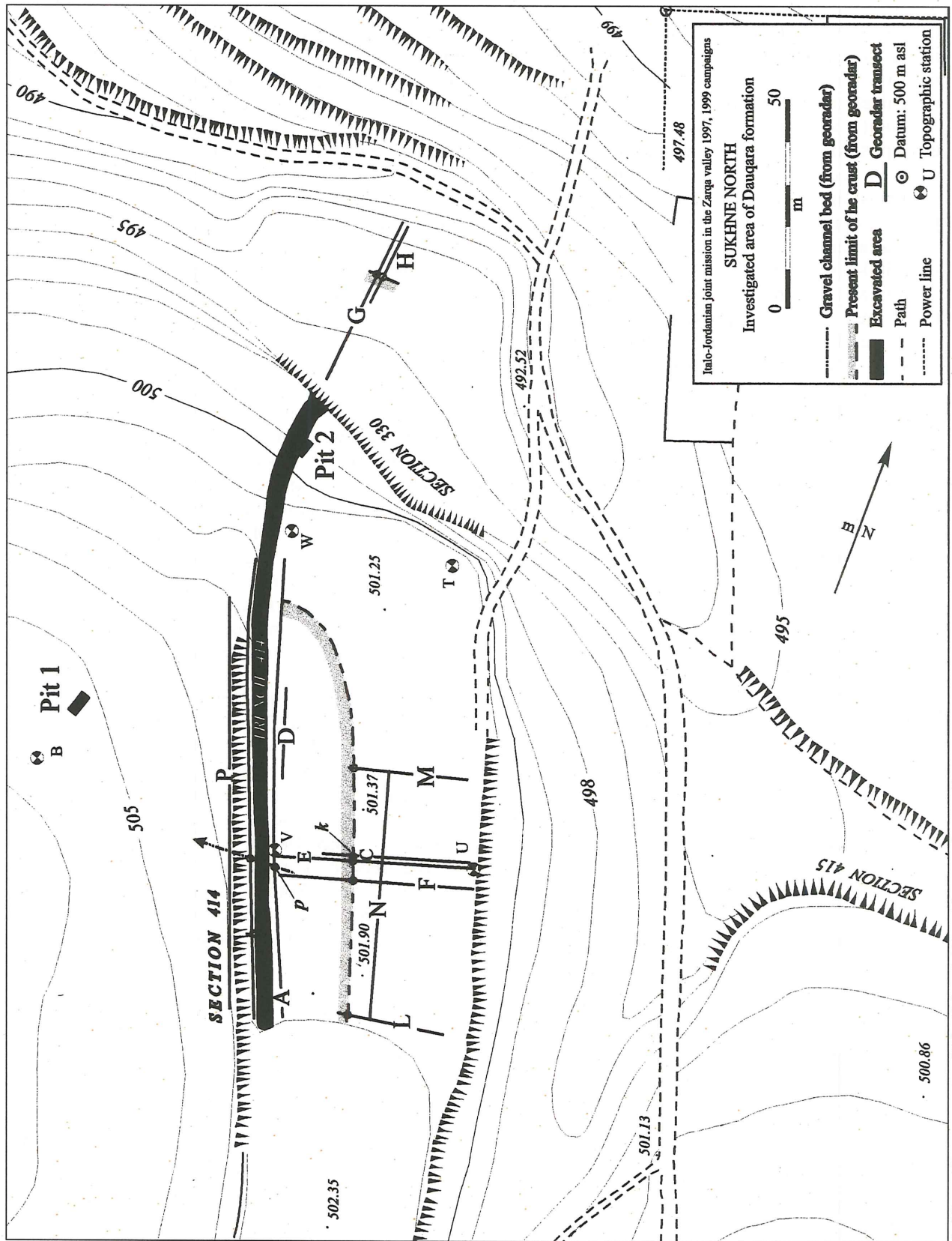


10. General map of the area with Palaeolithic and Neolithic sites mentioned in the text; the rectangle indicates the detailed map at as-Sukhna North (Fig. 11). Shaded areas: outcrops of Dawqara formation (upper terrace).

valuable source of information about the sedimentary history of the Dawqara formation and the taphonomy of the faunas. In general terms, it seems that the whole alluvial fan north of as-Sukhna, composing the bulk of the Dawqara formation, was formed by several depositional micro-events, containing a high density of cultural remains.

3.1.4. Test Pits South of Site 330 (1997) and Explorations at other Dawqara Sections

During the 1997 season, machine assistance was employed over a period of one and a half days to excavate two exploratory trenches to the south of pit 1 and above pit 2 (Fig. 11) section 330. The objective of the trenches was to ascertain the depth



11. Map of Dauqara sites 330, 414 and 415, with georadar profiles.

and character of deposit in the selected areas. In 1997, with the information acquired from both the study of the sedimentary structures, generally pointing to a south-north water flow, and from the results of the topographical survey, showing a small palaeo-channel upstream, it seemed possible to pinpoint the original provenance (i.e. the primary deposition site) of the artefacts and fossils recovered at section 330. Because of that, a compressor was initially employed to break through the upper limestone crust. The thickness of the crust, the top laminar layer of which has a strength evaluated at 500-800kg/cm² (Yaalon and Singer 1974), the colluvial overburden in the first trench and the scale of area excavated, proved too great for the reach of the 360° back-acting machine which was employed. The intended deposits were not encountered in pit 1 because of this depth, greater than 4m. In the second pit, 8-12 meters south of section 330, two hardened layers were encountered, both requiring breakage by compressor. The dimensions of the pit were 4m x 2m x 4m deep. The sections were cleaned, examined for artefacts, recorded and correlated with the stratigraphy exposed at section 330. A total of some 100 artefacts were recovered and their positions plotted in the usual manner. Again, all sediment from cleaning was sieved for faunal remains.

During the 1997 campaign, several other exposed sections of the Dawqara terrace were identified, cleaned and examined, in order to establish correlations with the main outcrop (Fig. 11).

Section 331: A 30m length of this section was cleaned, examined in detail, photographed and drawn to 1:20 scale. 26 artefacts were plotted using the same procedure employed elsewhere.

Section 415: Only one meter of this important outcrop has been cleaned from the top to the bottom, for a total height of 2m. The section (already

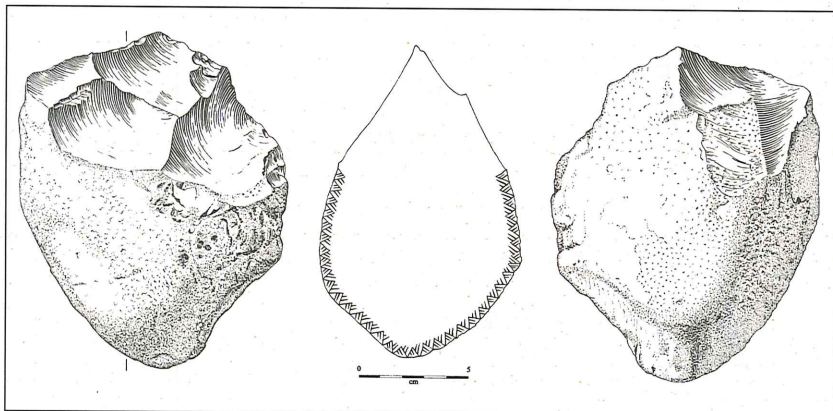
present in the reports of the French team as locality 19 in Besançon *et al.* 1984: 131) is on the eastern escarpment of the (fossilised) gully running from the top of as-Sukhna plateau and separating it from section 330 (Fig. 11). A total of 99 artefacts have been recovered in the section (Fig. 12).

Sections 342, 343: Where accessible, short lengths of these sections were cleaned and the coordinates of recovered artefacts plotted. A photographic record of fluvial structures was made at each section along an established baseline. Because the distance between sections 330 and 414 and the lateral variation in fluvial environments, the correlation between these outcrops is not confirmed.

3.1.5. Stratigraphic Trench at Site 414 (1999)

In the 1999 season, a trench of 150m long, 3m width and 2m deep has been opened by a self-moving hammer and a loader (Fig. 13). The position of the trench was chosen almost at right angle with section 330, in order to achieve a better understanding of the geometry of all sedimentary bodies. Due to the presence of the agricultural section, a total of 3m of the stratigraphic sequence are available for detailed study. The western side of the trench has been divided by vertical metric subdivisions, to determine single excavation units. As for the height, levelled lines were placed along the section. The cleaned wall of the trench has been scraped by hand on one meter by two, for a total of 64 units: meters 0-1, 2-3 etc., till 120-121, and meters 125-126, 135-136, 140-141, 145-146. Each recovered artefact has been plotted on the basis of a centimetre grid. Finally, the whole section has been drawn at 1:100 scale, and schematically reproduced in Figs. 14, 15.

The deposit is essentially composed by gritty and silty layers. Some sedimentary structures, as channel beds and erosional surfaces, are clearly visible, mainly in the southern part of the trench. A



12. Lithic industries from Dawqara formation: chopping-tool on flint cobble, section 415, lower layer 5 (N 415-99).



13. Panoramic view of 1999 trench at site 414, from South.

total of 1131 artefacts have been recovered in the backdirt of the earth-moving machines (so without any stratigraphic position), and 334 have been plotted on the section; their relative frequency is available in **Figs. 14** and **15**. No macrofossil remains were recovered, pointing to a possible gravitative reason for explaining their presence in the nearby section 330, which is at the bottom of the old terrace edge.

3.1.6. Stratigraphy of Sections 330, 414 and 415

When working on section 330, the “starting point” of our study on the Lower Pleistocene of the az-Zarqā', a preliminary stratigraphic subdivision has been made on the basis of field observations. From the top to the bottom of the eastern part of the exposed sequence, six units were observed as follows (**Fig. 16**):

- 1) Modern backdirt, deriving from the agricultural terracing: it contains artefacts of mixed ages.
- 2) Limestone hard crust, upper cemented part, with scattered flakes in a matrix of sand and grit.
- 3) Lower, un-cemented, portion of the crust: grit in sandy matrix and rare cultural remains.
- 4) Grit and medium sand, with sedimentary fluvial structures and lateral discontinuity. Both 3) and 4), corresponding to unit 3a of fig. 3 in Parenti *et al.* 1997: 12, are not clearly recognised from m 25th westward.
- 5) Gravel and occasional cobbles in sandy matrix, locally reddened on the bottom of palaeo-channel beds. The texture of this brownish layer as its the richness in palaeontological and archaeological remains lead us to consider this unit as the remnant of a palaeo-soil (= layer 3b in Parenti *et al.* 1997).
- 6) Greyish gritty layer, in sandy matrix, containing a rich cobble and flake industry (= layer 3c in Parenti *et al.* 1997).

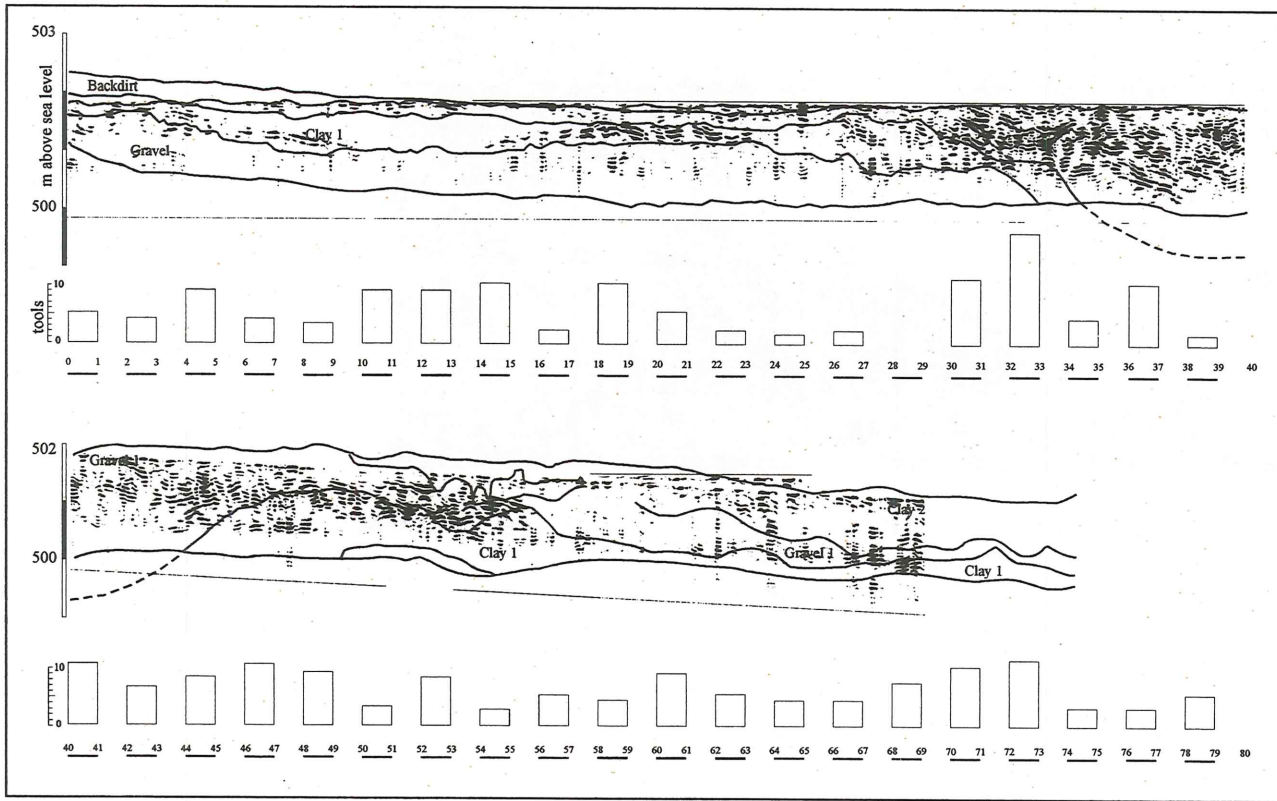
Among the units identified, layer 5 is the richest both in lithic and faunal remains and could be considered — up to now — the best available chronostratigraphic reference for the Dawqara formation. Its limits are unclear in the western part of section 330, where all the sedimentary sequence seems thinner. The unit is possibly recognised in the far northern portion of section 414, where its colour is lighter. In these latter section, however, it is, till now, completely devoid of fossiliferous remains.

Layer 6, because of its greyish colour and its matrix, has been also recognised at the very bottom of section 414 (m 125-130); in the 1999 field season the trench was not deep enough to allow an indisputable correlation with section 330. At the bottom of section 415, however, layer 6 is clearly present, having its top 1.27m higher than at section 330. At 415, layer 6 was observed to be very rich in artefacts (66 in a total of 0.1 cubic meter of explored sediment).

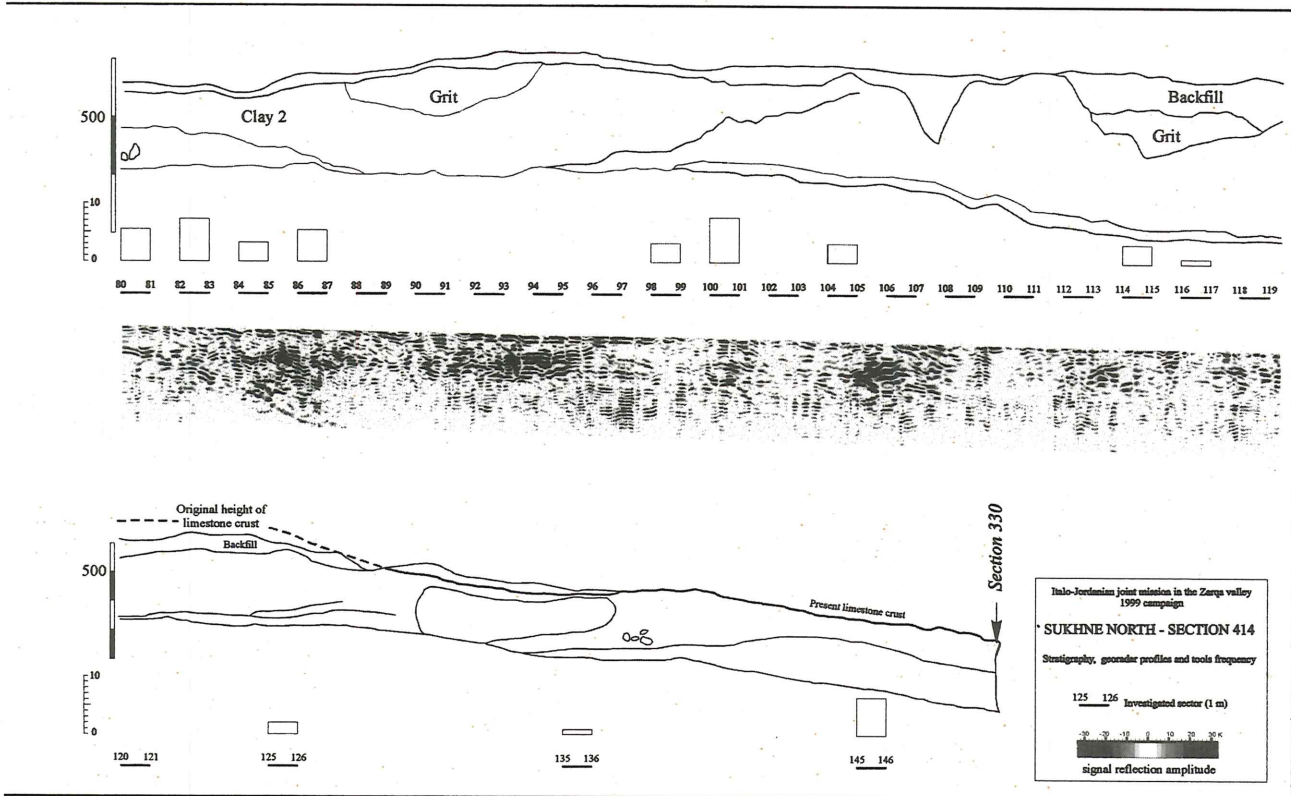
Finally, an older artefact-bearing unit has been recognised at the bottom of pit 2 and in m55-62 of section 330, underlying layer 6; identified as layer 7, it is composed by a subangular grit in a matrix of brownish sand. Up to now, it represents the oldest archaeological phase in the sequence.

3.1.7. Sampling for Microfaunal Collecting (1999)

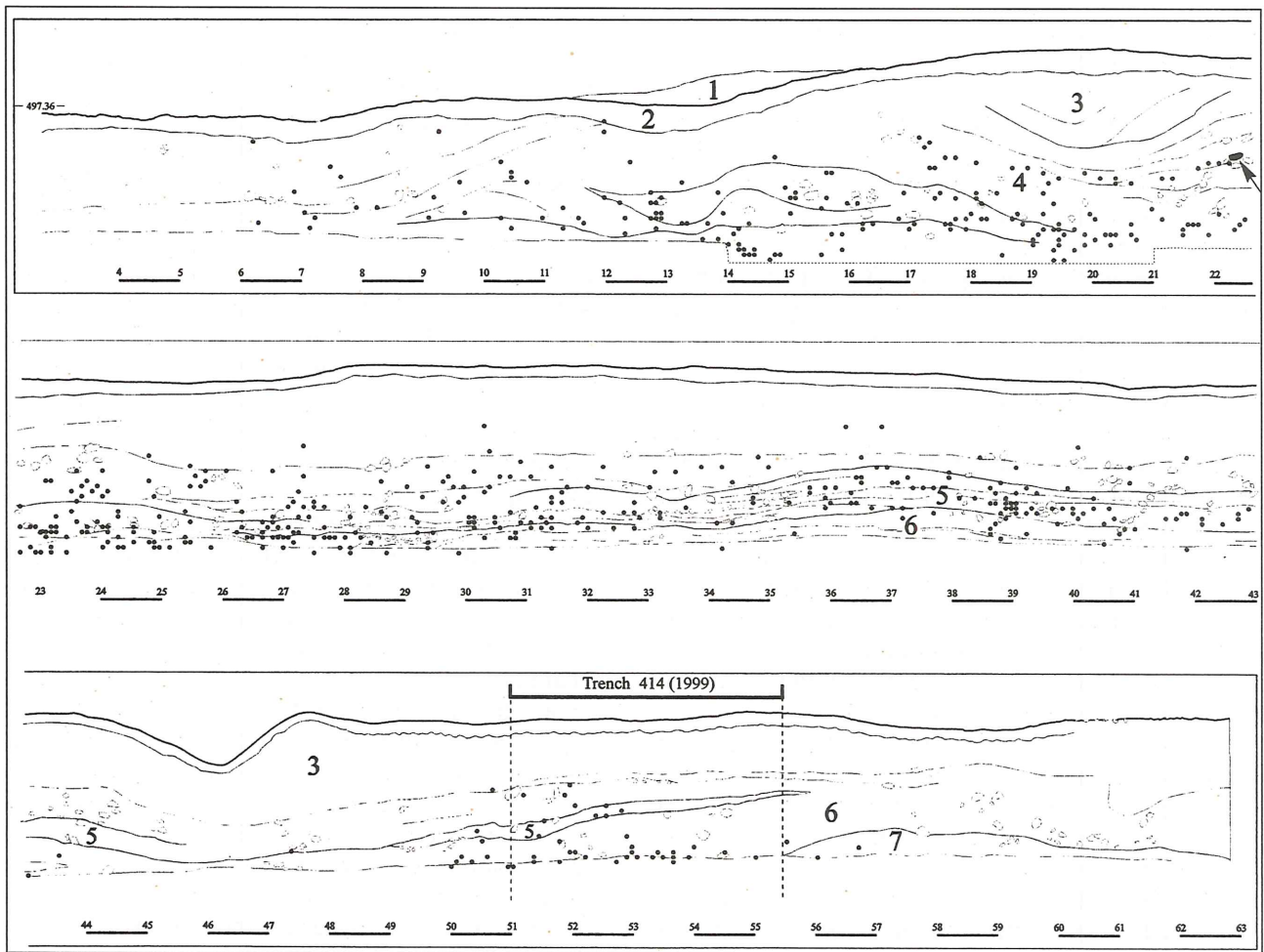
The presence of rodent remains in sedimentary deposits can be extremely useful for palaeo-environmental reconstruction and dating. Several outcrops of Dawqara and Birah formation have fine-grained layers or lenses. A first exploratory sampling has been done on sections 330, 339, 414, 411 (**Fig. 10**). An average of 30kg of sediment has been collected for each sample. After washing and screening with 0.4mm mesh, the sediment was observed by binocular lens Wild, at 6.4, 16 and 40 magnifications. Some dental roots of rodent have



14. Section 414 with recovered lithics and georadar profiles (m 0-80).



15. Section 414 with recovered lithics and georadar profiles (m 81-150). Note the unmodified vertical scale of lower profile (m 120-150).



16. Section 330: main sedimentary units and plotted lithics; arrow pointing to the dated molar of *Mammuthus meridionalis*.

been recovered from section 339 (Birah formation): because of this important, even if quantitatively reduced, result we can affirm that also the Acheulean terrace is fossiliferous. Regarding the Dawqara sample, the prepared sediment has been sent to the laboratory of mammalian palaeontology of the University Claude Bernard, Lyon (France), and treated under the responsibility of Claude Guérin.

3.1.8. Georadar Survey at Sites 414 and 330

A geophysical prospecting campaign was performed in the area around section 414, aiming to test the validity of this method for the stratigraphic research on buried fluvial environments. In view of the geological characteristics of the site and the type of problems likely to be encountered, it was decided to use Georadar prospecting. An SIR2 GSSI instrument with a 400 MHz antenna was used in order to ensure good resolution and sufficient penetration capacity.

Before illustrating the results obtained it is deemed useful to briefly describe the method.

3.1.8.1. Description of the Method: The georadar sends high frequency electromagnetic wave pulses from a transmitting antenna and receives the signal reflected back by the ground by means of a receiving antenna. The reflected signal is amplified and processed in order to obtain a vertical section corresponding to the profile along which the survey was performed. The instrument records the various signals as a function of time, including those due to the reflection undergone by the signal as a result of the different electrical properties of the layers and/or objects its encounters in its path. In this case, in addition to the residual resistivity, which remains the most important feature, there is also the effect due to the dielectric constant of the medium, which is a much less variable characteristic than the former. In this way it is possible to locate an object by determining its distance from the point of observation and the direction of propagation.

The distance from the observation point is obtained by measuring the time taken by the pulse

emitted by the antenna to reach the object and return to the receiver.

It often happens in practice that the point on the reflected wave form is ambiguous owing to the dissipation of the energy of the transmitted wave. This dissipation, in the form of heat, is caused by the conductivity of the medium as the electromagnetic pulse passes through it. The higher the conductivity the greater the dissipation. The attenuation of the signal will follow a geometric progression because the propagation takes place in the form of spherical waves.

Another important parameter determining the attenuation of the reflected signal is the wave frequency. The depth of penetration of the signal depends on the conductivity of the medium, the wave frequency and the density.

Finally, a decisive factor is the resolution of the method, which is defined as its capacity to distinguish surfaces only short distances apart. This property is inversely proportional to the signal's wavelength and will thus be higher the lower the wavelength (high frequency).

This very brief description of the georadar method shows how the dielectric constant of the medium traversed, its conductivity and the frequency used have a decisive influence on the outcome of the prospecting.

Whenever the dielectric constant of the medium traversed by the signal is known *a priori* or else it is possible to measure it using particular configurations, it is possible to get some idea of the velocity of the signal and thus of the depth at which it was reflected with an intensity that is a function of the dielectric contrast of the interface.

The expression "some idea" is used as the first few layers of the soil are generally not homogeneous and it is therefore difficult to have an accurate measure of the real dielectric constant of the section crossed by the signal.

3.1.8.2. Results: The main aim of the survey was to evaluate the possibility of identifying stratigraphic elements, such as contact between layers of different types and erosion surfaces, in order to produce maps of the subsoil to be used in palaeomorphological investigation.

Several profiles were recorded, mainly around section 414 (Fig. 11): five long profiles (100 to 120m long) running east-west and 5 profiles running north-south (50-60m long). Two profiles were taken also in front of 330 (40m long). Each line was repeated using different set-up parameters to allow investigation at different depths. The data acquired were then processed and filtered using spe-

cial software to reduce instrument noise and to show as clearly as possible the contact surfaces between the different deposits.

The first profile (section B) located exactly at the western side of section 414, allowed an immediate check to be made of the results. Fig. 14 shows the results obtained after preliminary processing, together with a sketch of the section. Comparison between the georadar profile and the representation of the true stratigraphy (overlapped in Figs. 14 and 15) indicates that in the first 1.5m of soil the radar is able to show up the main stratigraphic contacts and the presence of palaeochannels. The base of the clay layer "clay 1" (in the first 25m of the section) is clearly visible: depending on the graphics scale used, the strong reflection due to passage through a medium with different characteristics is actually marked by two dark lines that correspond, with good approximation, to the boundary observed in the section, and marked with a continuous dark line. The gravel channel (gravel 1) of trench 414, which begins about 26m along the profile is easily recognisable owing to the different signal penetration: as the gravel is much less homogeneous than clay, different reflection surfaces are present and the radar-gram corresponding to the gravel is on the whole less homogeneous. Furthermore, owing to the greater resistivity of these surfaces, the signal is observed to have a better penetration. According to the georadar profile, the maximum depth at a distance of about 39m, is about 2.10m (assuming a dielectric constant of 10 on the basis of available data) and thus only slightly lower than the excavation trench. The clay instead displays no specific reflection surface and so, on the graphics scale adopted, appears in the georadar profiles only as a white layer in which only the discontinuity with the underlying deposit can be identified.

The same structures were followed in the profiles A, D and less clearly (see below) in the profiles P and N.

In sections A and D, it is still possible to identify the main stratigraphic contacts fairly accurately, although in this case the greater humidity of the soil slightly worsens signal penetration (profile B is instead taken precisely alongside the open trench, and thus in a less damp soil). In any case, the above-mentioned canals may still be recognised. Moreover, it is still possible to formulate a preliminary hypothesis concerning the direction of the palaeochannels, although the quantity of data at our disposal is in no way sufficient. In profile A the palaeochannel "gravel 1" seems to reach a slightly shallower depth (point P in Fig. 11) than profile B and,

since the deepest point was found 37m along the profile, seems to have a WNW-ESE orientation and a WNW flow. It should be further emphasised that a direction and a flow direction identified through only two points are merely conjectural.

The clay layer, identified along trench 414 (clay 2) and along profile B between 58 and 60m, was identified also along line A, but only between 66 and 72m (Fig. 15). It may thus be postulated that it is not a continuous layer but only a lens.

The profile P was implemented only a short distance from section 414, immediately above the limestone crust (Fig. 11). It was immediately noted that, as in the preceding cases, the survey depth did not exceed 1.5m, although in this case this means that it is practically impossible to investigate beneath the crust as its thickness is actually 1-1.5m. Also the N profile, performed on top of the limestone crust (see below), gave similar results.

The profiles recorded in a north-south direction (perpendicular to trench 414) produced the main result of identifying the intersection between the limestone crust and the topographic surface: the area investigated was in fact removed artificially to level out the ground. For practical reasons (for instance, to plan future excavations) it is useful to delimit the area in which the crust outcrops. In Fig. 17, for instance, the above-mentioned intersection along the line C is marked with the letter "k" (Fig. 11). In the first section the gravel layer is encountered and beyond this contact it is obvious that the signal is traversing a different, more homogeneous, medium lacking in reflecting surfaces. The same contact was clearly identified along lines L, F, E, M, in the final sections of A and B and along lines G and H. In this case the limestone crust overlies the clay layer and not the gravel.

In Fig. 11 all the points of intersection and the interpolation have been marked. It may be observed that this coincides with a hypothetical line that

could be drawn assuming a constant ground slope.

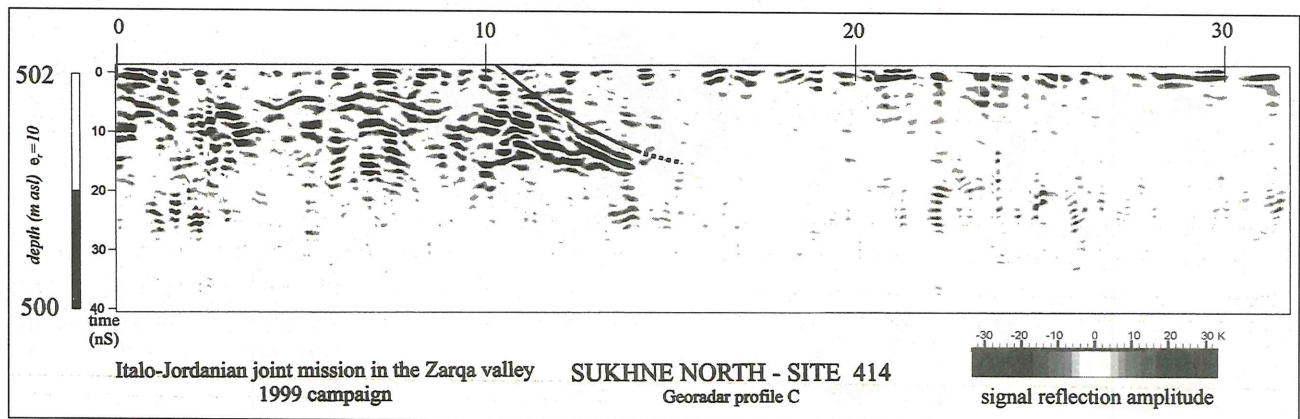
In conclusion, in this context it may be claimed that the georadar method is useful in stratigraphic studies: when a sufficient quantity of data have been acquired it should be possible to make a contribution to palaeomorphological studies, for instance, the definition of the palaeo-drainage. The method was found to present shortcomings as regards the depth of penetration, which was never greater than 1.5m. In future it could be attempted to increase this depth by using lower frequency antennae which also have a resolution that is adequate for these purposes.

3.1.9. Conclusions: The Significance of the Dawqara Remains

The whole cultural content of the Dawqara outcrops of the upper terrace studied till now (2000) and classed by technological lithic categories, is summarised in Table 4.

The deposit of Dawqara formation at sections 330 and 414 is extremely rich in stone artefacts, with a minimum density of at least 100/m³. They are especially dense in the brown palaeo-soil unit, as defined at site 330 (layer 5, Fig. 16). Preliminary observations on the entire collection confirm that the lithic assemblage pertains to the so-called Upper Olduvaiian Tradition, which is evidenced by the number of choppers and cores and by the absence of handaxes (Figs. 18, 19). The mint condition of at least 40% of the stone tools from the assemblage of section 330 further indicate that the original site(s), if at least a partly still preserved, lies not very far away. It is noted that, at least in the case of layer 6, there certainly is more than one phase of occupation represented, pointing to an older cycle of sedimentation on the upper plateau.

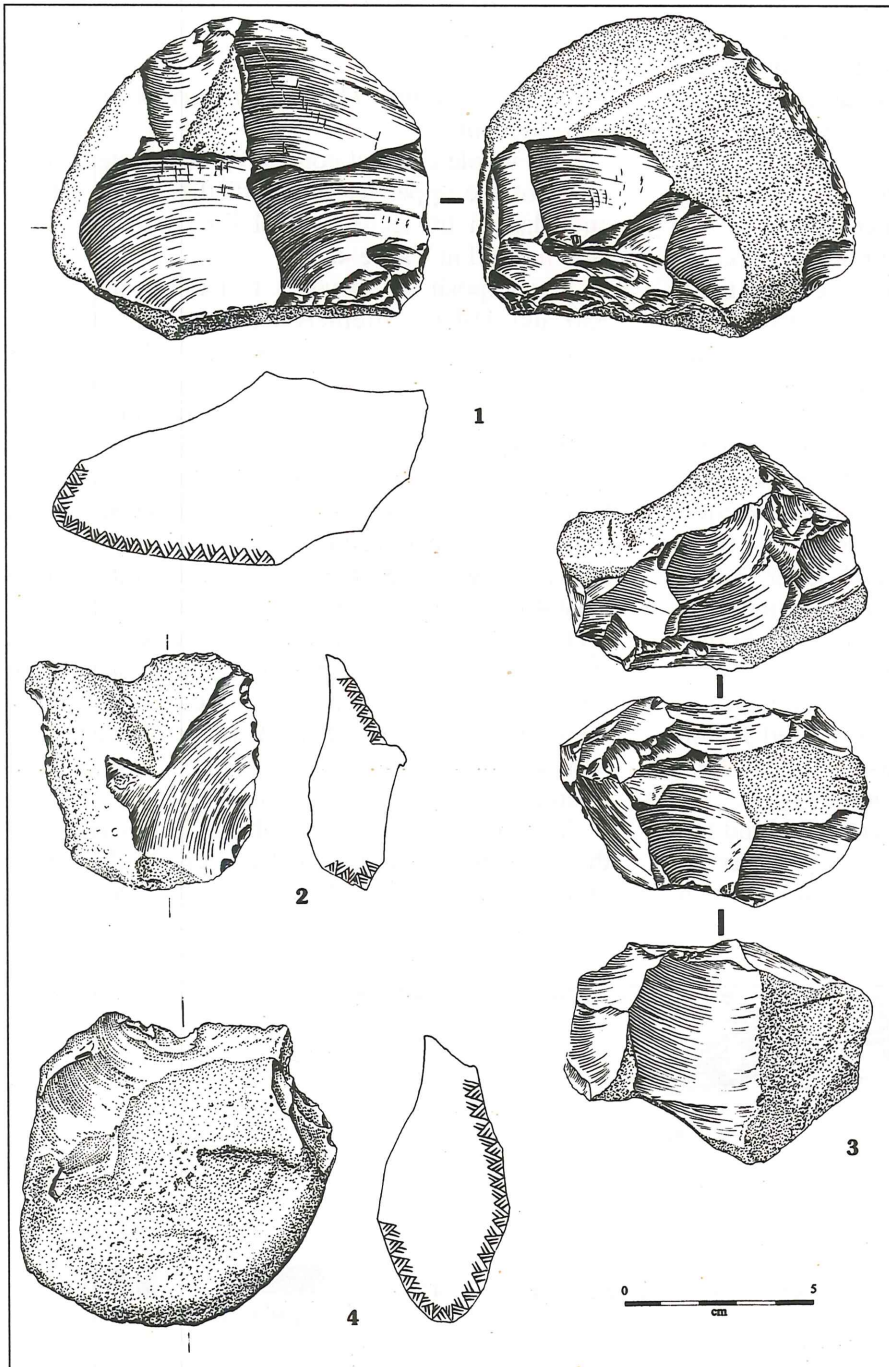
The spatial distribution of the lithics confirms the very rich archaeological content of the whole Dawqara formation, already observed at section



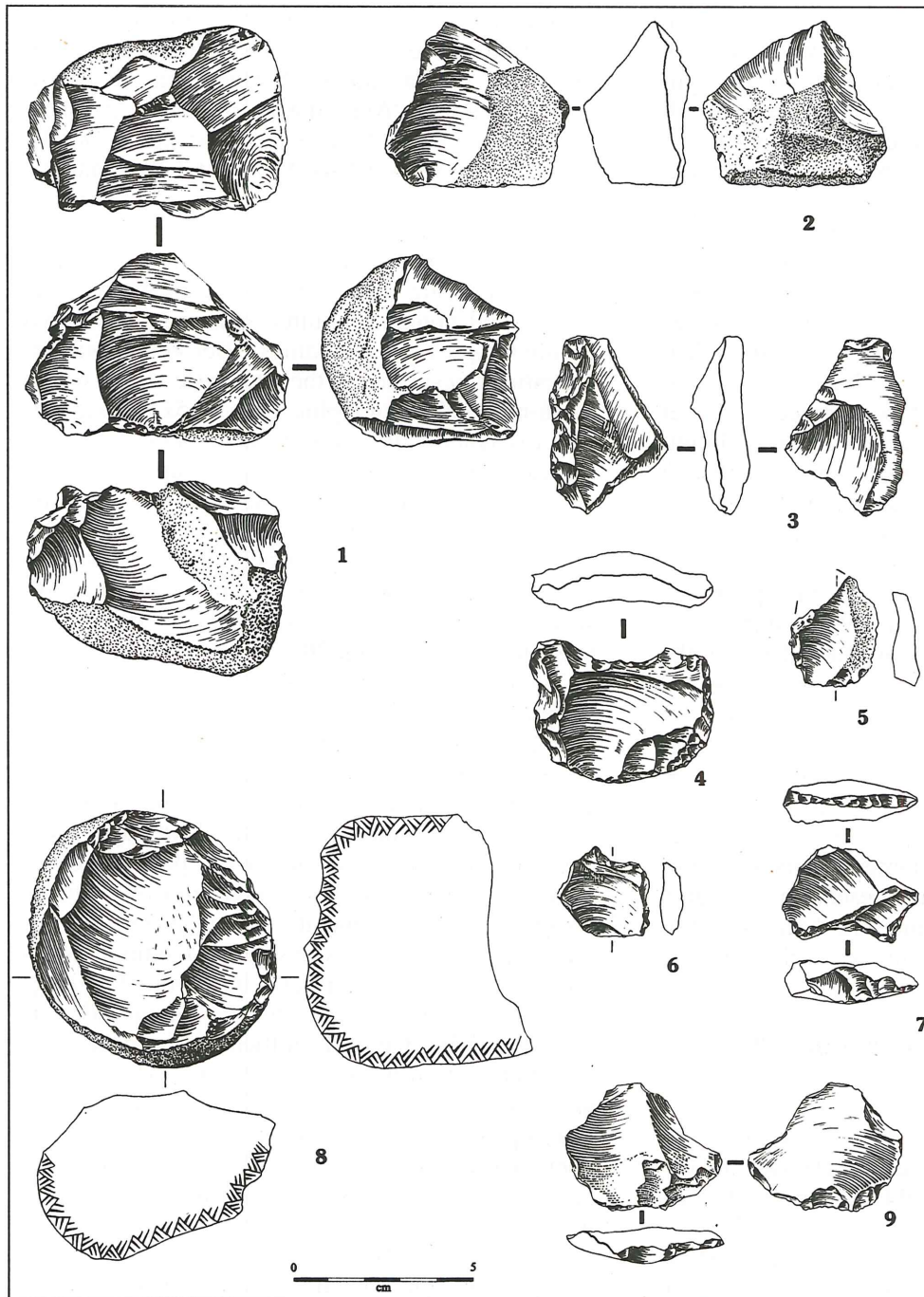
17. Georadar profile at site 414, line C, facing North: it shows the intersection between the crust and the present topography.

Table 4: Total lithics from Dawqara sections explored during the 1996, 1997 and 1999 campaigns.

Site	Choppers	%	Cores	%	Débitage	%	Retouched	%	Chunks	%	TOT
330	26	2.1	74	6.0	900	73.3	207	16.9	20	1.6	1227
331	1	3.8		0.0	22	84.6	3	11.5		0.0	26
342		0.0	4	20.0	12	60.0	4	20.0		0.0	20
343		0.0	1	5.3	13	68.4	5	26.3		0.0	19
414	57	3.9	196	13.2	1187	80.2	36	2.4	4	0.3	1480
415	1	1.0	3	3.0	73	73.7	16	16.2	6	6.1	99
tot	76	2.8	247	0.4	2080	77.0	267	0.4	30	0.0	2700



18. Lithic industries from section 330, Dawqara formation: 1) unipolar core on flint cobble, layer 5 (N 330-469); 2) denticulated on flint flake, layer 5 (330-394); 3) globular core on flint cobble, layer 5 (330-290); 4) notched piece on flint primary flake, layer 6 (330-544).



19. Lithic industries from section 330, Dawqara formation: 1) globular core on flint cobble, layer 4 (330-232); 2) small core on flint cobble, layer 5 (330-187); 3) side scraper on flint flake, layer 5 (330-902); 4) denticulated piece on flint flake, layer 6 (330-803); 5) broken flint flake, layer 7 (330-829/5); 6) denticulated on flint flake, layer 6 (330-830/30); 7) simple scraper on flint flake, layer 5 (330-266/1). Tool from uppermost terrace: 8) unipolar core on flint cobble, section 413 (413 II-1); 9) flint flake, section 411 (411-2).

330; in some ways it seems that the whole sedimentary body, i.e. the alluvial fan which composes the bulk of the formation, contains a widespread array of lithic artefact, all over its length, from upstream to downstream. Nevertheless, trench 414 shows quite a denser concentration of artefacts on the southern bank of the exposed channel, i.e. m 30-33 (Fig. 14). On the whole, the gritty layers contain the bulk of stone tools, confirming the hypothesis of some transport of the material; however, some artefacts, in very fresh conditions, have

been recovered in the fine-grained layers at site 414, but also at section 332, pointing to a more local origin of a part of archaeological assemblage. From these observations, our actual hypothesis on site formation is that the as-Sukhna plateau represents the composition of several alluvial events, each of them eroding and over-flooding the older; for this reason, we were not able to observe, till now, any indisputable remnant of an original "primary" site. The Dawqara formation, at least in its northern (and distal) part, contains a composite as-

semblage deriving from the nearby hills and from the stream action, which possibly re-worked an older terrace, but having also a local, syn-sedimentary, component, represented by the cultural flaking activity performed at the confluence of the two watercourses, a very remarkable place, existing from the middle Pliocene onward.

The evidence from the lower Palaeolithic of the as-Sukhna plateau is to be inscribed in the more general context of the old prehistory of the Rift (Bar-Yosef 1994) and in that, more specific, of Jordan (perfectly summarised in Copeland 1998). Till now, the Palestinian site of al-'Ubaydiya/ 'Ubei-diya is the only well-dated occurrence of lower Pleistocene in the region (Bar-Yosef and Goren-Inbar 1993; Guérin *et al.* 1993). As we established (Parenti *et al.* 1997) the Dawqara complex, visibly so rich in the cursory inspection we provided between 1996 and 1999, has a provisional age of one million years. The scanty remains of the uppermost outcrops we discovered in the 1997 campaign at sites 411 and 413, point to an older date for the first peopling of the region, a date possibly as old as that coming from the fluvio-lacustrine layers of al-'Ubaydiya. In order to build a firm chronological frame, we think that the stratigraphy of the whole az-Zarqā' Valley, till the confluence with the Jordan, is to be surveyed. It will be the only "right" way for achieving a better understanding of the modalities of the human presence in a region between the most important and famous extra-African corridor and the fringes of the Arabian desert.

3.2. The Neolithic at al-Ḥasayyah: The 1999 Season

3.2.1. Introduction and History of Research

The site of al-Ḥasayyah (الحسيبة) was first explored during the 1993 field season in the az-Zarqā' basin (site 8: grid ref. 249.16E 173.14N, Fig. 10). Both pottery fragments and chipped stone artefacts scattered on the surface were found to be typical of the Yarmoukian culture and their number suggested that quite a substantial occupation was still *in situ*. The site was already crossed by a new road, along which a 500m long and 6m high section was cut into the archaeological deposits, showing remains of stone architecture. The results of a series of soundings carried out later in the eastern area of the site (Kafafi *et al.* 1997) confirmed the

thickness of the deposits and put to light a superimposition of several occupation layers dated between the PPNB and the Yarmoukian. As it had been the case at 'Ayn Ghazāl, therefore, this new site was expected to convey information on the transition between PPNB, PPNC and Yarmoukian, one of the most critical period of cultural transformations in the prehistory of the Levant.

A campaign of excavations was carried out in 1999 at the site, in order to investigate the pre-pottery and pottery Neolithic sequence discovered during the previous soundings.¹ Before excavation, the estimated surface of the site was covered with a north-oriented topographic grid of 5x5m squares. The excavation units consisted of 4x4m squares, separated by 1m balks, defined by numbers on the north-south alignment (starting from the road, on the south), and by letters on the east-west alignment (starting from the west). Investigations were concentrated on two areas, about 300m apart, respectively at the westernmost and easternmost extension of the site (Fig. 20).

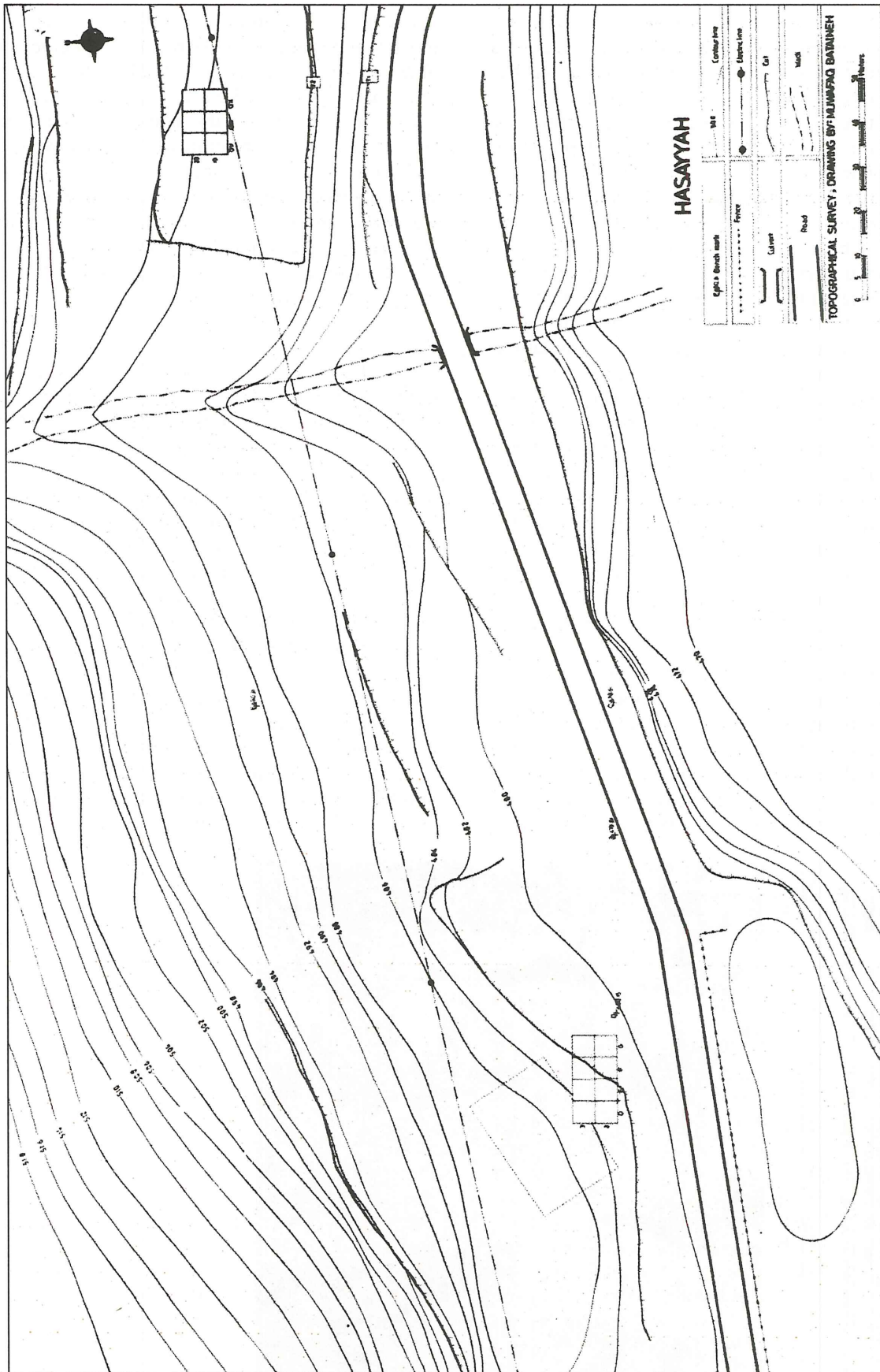
As already recorded in the previous reports, the prehistoric deposits of al-Ḥasayyah are located on the slopes of a limestone cliff which borders the valley of Wādī az-Zarqā' a few hundred meters downstream from its confluence with Wādī ad-Dūlayl. The original shape of the landscape, however, as well as the layout of the prehistoric occupation, have been slowly obscured by a heavy cover of colluvial deposits, and were recently almost obliterated by extensive agricultural activities, which involved terracing and deep ploughing. The slopes were reduced into two main wide terraces bordering the cliff on their northern side and the modern road on the southern one. The terraces are separated by a 2m step. Excavation trenches were opened on both terraces, in order to conduct a contemporary investigation in two superimposed occupation phases. Modern terracing, however, had cut the inner part of the slope deposits and accumulated the debris on the border, making the stratigraphic and topographical reconstruction of the prehistoric occupation a very difficult task.

3.2.2. The Western Area

The exposure in this area comprised four squares on the upper terrace (D3, E2, E3, F3) and three on the lower one (F2, G2, G3). Although the border between the terraces traced an irregular line across the grid (across square E2 and F3 in par-

1. Field activities lasted from 5 to 29 September 1999, supervised by Isabella Caneva and Nabil al-Qadi, with the following participants: Angela Trevisin, Muwaffaq Bataineh, Hussein Deibajeh, Marta Zambello, Ra'eda Abdalla, Abd el

Nasser Hassan, Zakaria Nu'eimat, Nicola Vallotto, Salvatore Lentini, Sharif Al-Bzour, Koji Oyama. Paola Conti joined the team for the geo-electric and radar survey.



20. Map of site 8 al-Ḥasayyah showing the excavation trenches.

ticular), the section on the step between the terraces was cleaned and comprised in the excavated area, in order to keep a stratigraphic connection between the operations at the two levels (Fig. 21).

A 1m thick layer of stoney soil has uniformly accumulated above the archaeological deposits on the upper terrace, as a result of both the erosion of the limestone outcrops and the redistribution of the debris during the agricultural works. Similar stoney layers have been also observed at other PPN and PN sites in Jordan (e.g. 'Ayn Rāḥūb, 'Ayn Ghazāl, Baṣṭa). Roman and later potsherds probably rolled down from the inner fortification were scattered in the debris. Below this unstratified accumulation, the uppermost archaeological layer revealed architectural remains made with huge limestone blocks. The walls were straight and the blocks roughly dressed and laid on a clayey mortar to provide a good alignment, while flat stones were sometimes placed on the floor. Due to the limited extension of the exposure, however, the plan of these structures remained incomplete. A rounded pit, about 1.60m in diameter and 1m deep, was dug into the soil beside one of the rectangular structures in square E3. Both the walls and the floor of the pit were carefully dressed with stone slabs.

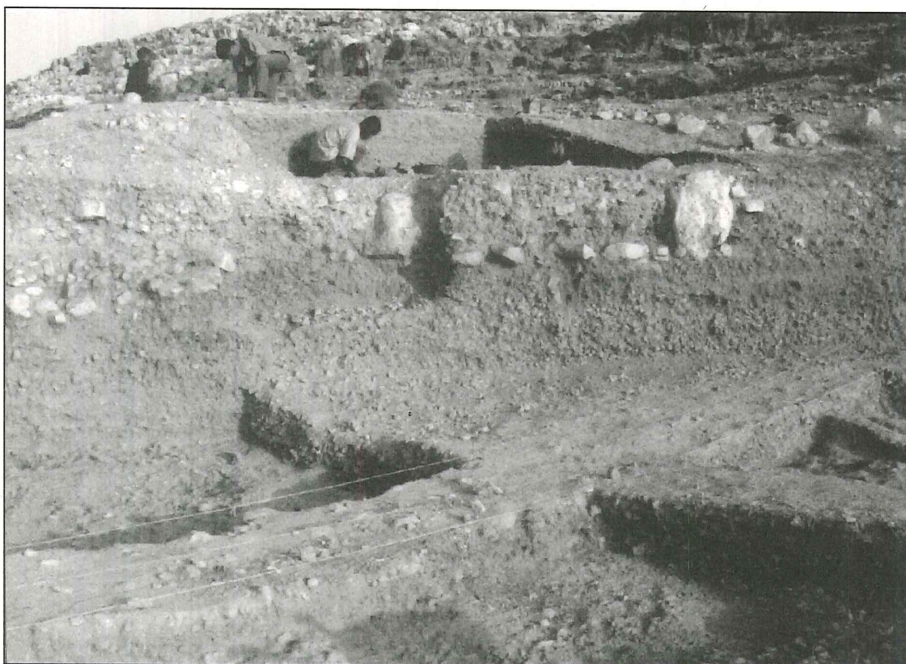
A sterile pack of small angular stones, well visible all along the stratigraphic section between the terraces, separated this layer from that below. Thick layers of the same stone deposits were also mixed with the underlying archaeological deposits, characterised by a fine-grained black sediment, rich of organic remains. The deposits of this earlier

layer, however, could be extensively excavated on the lower terrace only. Here, they appeared to be almost razed by the recent terracing and were probably partially reworked by repeated ploughing. They laid directly on the compacted sand of the fluvial terrace. No structures were preserved, but a consistent human occupation was attested by a great number of lithic and bone implements, clay figurines, animal bones and charred vegetables. Both the typology and technology of the lithic implements suggest that this phase belonged to a late Pre-pottery Neolithic B culture.

3.2.3. The Eastern Area

As this area is located further away from the upper limestone outcrop and shows a more gentle slope towards the wadi, the colluvial accumulation above the archaeological deposits was thinner and looser than in the western part. Roman potsherds, however, were more frequent and bigger in size. This suggests that a kind of human occupation existed here in Roman times and later, either a small village or a road leading up to the fortification. No trace of such architecture, however, was found so far in this lower area. The exposure in this area, as can be seen in Fig. 20, comprised four squares on the upper terrace (OV20, OW20, OX20, OY20) and three on the lower one (OV19, OW19, OX19), with one of the previous soundings (section 4) being included in one of them (OW19).

The upper terrace showed two superimposed building levels, both characterised by straight retaining walls, built with massive limestone blocks,



21. Al-Ḥasayyah. The PPNB level in the foreground, with the layer of angular stones and Yarmoukian structures in the profile above.

similar in construction technique to the correspondent upper terrace of the western area. Also the structure uncovered in the previous sounding, which was this year carefully investigated on both sides, was discovered to be a retaining wall. Since the two building layers were exposed in different squares, their stratigraphic relationships is not defined yet: they could actually be contemporary, in a step-like layout along the hill slope rather than in a chronological sequence. No real dwelling structure was discovered. The presence of a consistent *in situ* human occupation, however, was underlined by the presence of scattered pits of irregular shape and size, along with an enormous amount of anthropic debris, which included food residues, especially animal bones, as well as lithic and bone tools and some pottery sherds. The typology of these materials confirmed the attribution of these upper levels to the Yarmoukian culture. A few Yarmoukian arrowheads, with a long and robust bifacial tang, were discovered among the lithic implements, along with the typical bladelets with serrated and lustrous edges and a basal truncation, which are, in this context, interpreted and referred to as sickle elements.

As in the western area, the underlying level was characterised by a grey soil with a high stone concentration mixed with abundant ashes and charcoal. The deposits on the lower terrace were almost completely removed by recent agricultural activities. They could only be excavated in a small area, on the slopes and in pits dug into the rock. The structures of this level seem to be less heavily built than in the upper one. As revealed in the previous sounding, their contour was rounded and they were partially dug into the rock on their northern side (on the rising slope). No further remains of stone and mud walls were uncovered during the new operations. A number of lithic and particularly of bone tools was recovered *in situ*. The typology, the raw material selection and the composition of the lithic tool kit, at a preliminary examination, appeared to be identical to the PPNB collection of the western area.

3.2.4. Geophysical Survey

As a support for the archaeological investigations and in order to evaluate the performance of geophysical methods in this stratigraphic and anthropic context, a geoelectrical prospecting campaign was carried out at al-Ḥasayyah (site 8).

3.2.4.1. Outline of the Geoelectrical Method: Geoelectrical prospecting, in the resistivity profile

mode, is one of the most useful techniques available for use at shallow depths as it is not usually influenced by the presence of the environmental disturbance often present in the survey areas.

The basic principle underlying geoelectrical prospecting in resistivity profile mode is that of passing a current between two electrodes (AB) and measuring the potential difference at a given point using two other electrodes. What is thus measured is the apparent resistivity, which may be defined as the resistivity of a portion of soil considered as homogeneous. By performing measurements along profiles it is possible to detect any irregularities in the soil situated along the recording resistivity profile.

Essentially two different types of instrument are used for geo-resistivity measurements, DC and AC, while numerous different electrode configurations are possible. The choice of instrument type and electrode configuration is made on the basis of evaluations of the required survey depth and the type of survey, as well as the need to perform the field operations in a comparatively short amount of time.

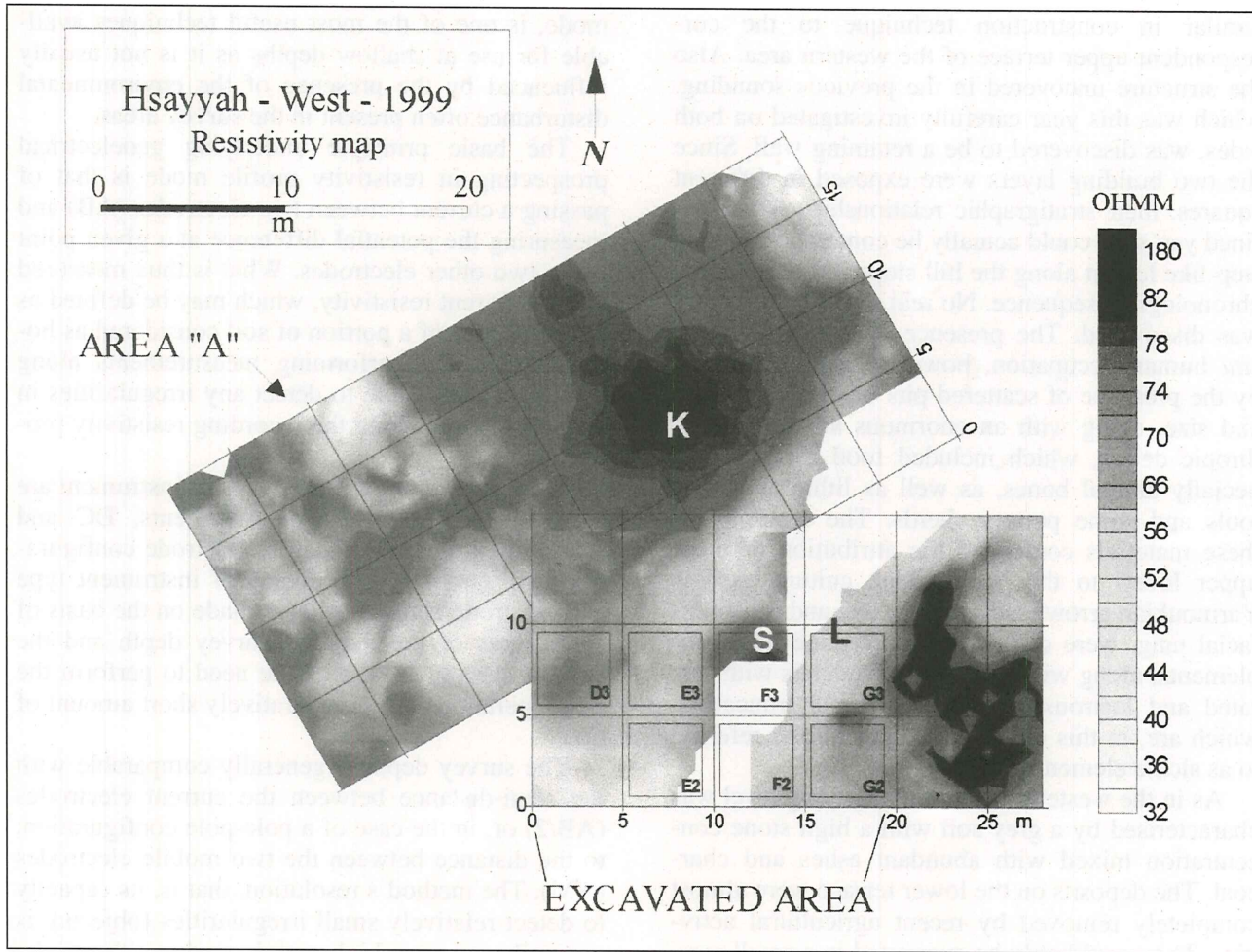
The survey depth is generally comparable with the semi-distance between the current electrodes (AB/2) or, in the case of a pole-pole configuration, to the distance between the two mobile electrodes (AM). The method's resolution, that is, its capacity to detect relatively small irregularities (objects), is generally not very high and depends partly on the density of the measurements per unit of surface area. It is in any case a good idea, in order to obtain good results, for the size of the archaeological elements not to be too small in relation to their depth.

3.2.4.2. *Survey Results:* For resistivity measurements performed using a pole-pole configuration a DC ABEM instrument was used.

In the first phase the western sector of the site was investigated, immediately below the outcropping limestone (area "A"). In a grid measuring 20 x 40m, measurements were performed first using the georadar method, the results of which proved unsatisfactory, and then the geoelectrical method.

Measurements were performed every metre, along parallel profiles varying in length between 30 and 40m, placed one metre apart. The distance between the mobile electrodes (AM) was one metre, which gives a probable survey depth of about 1.5m.

Fig. 22 shows the survey results. Several anomalous areas may be identified that are characterised



22. Resistivity survey at site 8, al-Hasayyah.

by strong increases in resistivity, such as the northern sector, marked "K" in the figure. The increases seem due mainly to geological reasons, such as a greater concentration of limestone blocks or a lower thickness of clayish soil.

The resulting data were processed in various ways using high-energy filters to reveal any smaller anomalies masked by geological effects. Even after this processing, however, no elements of archaeological interest emerged, while the overall trend seemed to be too strongly masked.

In the following phase the area corresponding to western excavation was investigated. Prospecting was performed in parallel with the excavation work itself so as to provide a valid means of calibration. The whole area was covered, with the investigated area extending 5m north and 8m west (Fig. 22).

Also in this case the results seem to be strongly influenced by geological elements: indeed the entire lower sector (squares G2 and G3 and the eastward extension) is characterised by high resistivity values, with the values increasing from west to

east. In much of the easternmost area values in excess of 180 Ohms were observed; this distribution seems to be in good agreement with the results of the excavations which encountered sandy and compact virgin soil at shallow depths.

Furthermore, at the centre of the map in Fig. 22, corresponding approximately to squares E2, E3, F2 and F3, an area extending in a NE-SW direction, marked "L" in the figure, corresponds to the sector in which the anthropic layer (clayey-sandy soil) is thickest (over one metre).

In the upper terrace the distribution of resistivity values is less uniform and the mean values are slightly lower than in the eastern sector. In square F3, the high values (zone marked "S" in the figure) are in all likelihood due to the presence of the stone structure unearthed in the course of the excavations (see above). Coinciding with square F3 another high-resistivity area emerged which seems to be the continuation of the large sector discovered in area "A" (K), and thus also in this case probably due to geological factors, as was con-

firmed by the excavation results.

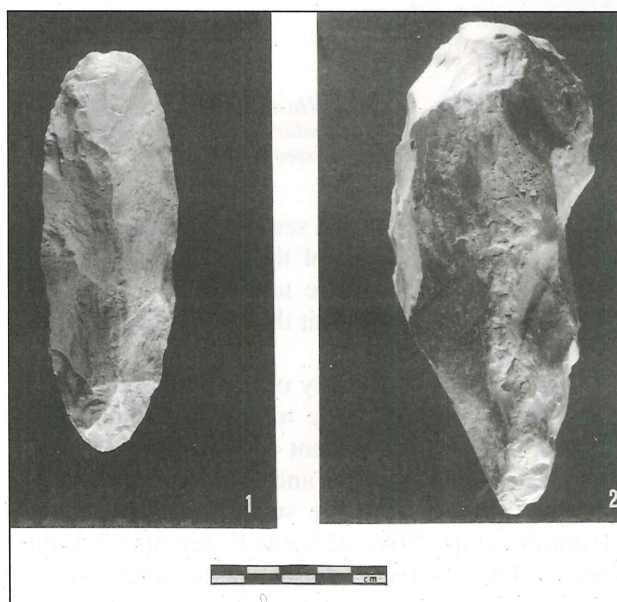
The round stone structure encountered during the excavations at a depth of about 1.5m is not clearly visible on the electrical resistivity map. This is probably due to the fact that it is located in a soil characterised by the presence of abundant limestone rubble and thus to a diminished sensitivity to the difference in physical properties between the structure and the surrounding environment.

3.2.5. The Finds

Although very few architectural remains were uncovered, the site proved to be very rich in archaeological remains, suggesting the presence of a permanent settlement in both phases. Despite the repeated disturbances, even the most fragile finds, such as some tiny bone implements, were quite well preserved. It is therefore assumed that the materials from each phase were still relatively *in situ*, although their frequency cannot be totally reliable, due to the partial removal of the deposits.

Although the analysis is still underway, a first examination of both surface collection and finds from the excavation points to the presence of the same two different cultural phases in both areas.

The lithic materials from the upper building layers included mainly heavy end-scrapers (Fig. 23) and denticulated sickle blades (Fig. 24a), to be typologically ascribed to the Yarmoukian culture. The few pottery fragments do not contradict this attribution, although no typical impressed or incised Yarmoukian pottery was found in the excavations. Several typical incised and painted Yarmoukian pottery, however, were collected from the surface

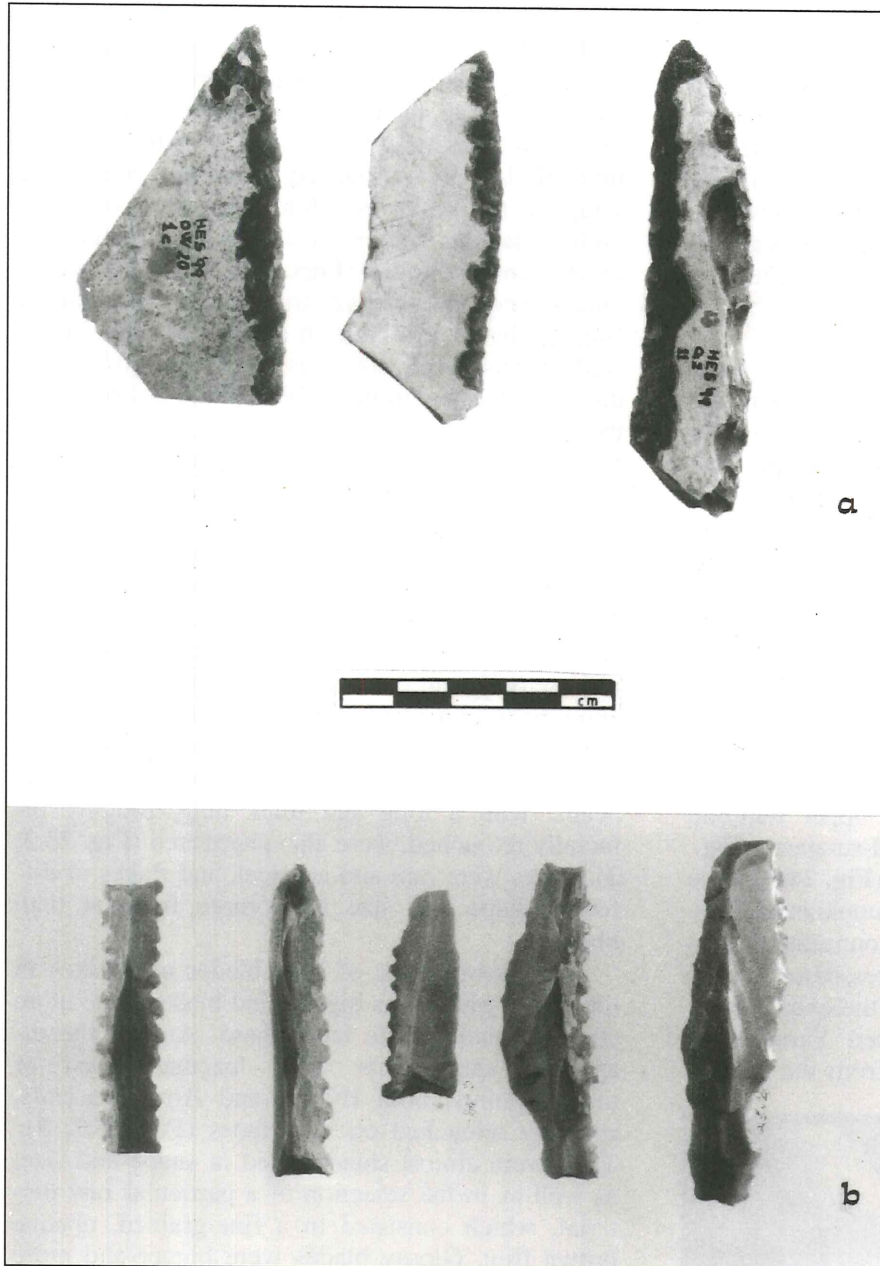


23. Al-Ḥasayyah: Yarmoukian end-scrapers.

during the survey in 1993 and 1994.

End-scrapers were among the most common tools. They were usually obtained from blocks of a whitish, opaque, medium-grained flint, with a steep retouch on the thick, round front, sometimes with a bifacial heavily retouched opposite end. Side scrapers (knives?) on thin plaquettes of fine-grained tabular flint with a bifacial marginal retouch were also found (Figs. 24a, 25.1). The sickle blades were on a brown, translucent, fine-grained flint, probably available in smaller pebbles in the wadi debris. Their size was small and quite standardised, the length being between 5 and 6cm and the width between 12 and 18mm. A glossy wear trace accompanied one or both edges, which were always finely serrated with a bifacial, quite regular denticulated retouch. Black spots of organic mastic were scattered on the surface of these blades, indicating their use as elements to be inserted in a shaft. A further suggestion in this sense is the occurrence of truncations, often at both ends of the blades. A typical fish-tail shape, with a pointed tip and a basal concave truncation, could represent the terminal elements to be put at both ends of the curved shaft (Figs. 24b, 25.4). A few tanged arrow heads, with a long and thick tang, roughly bifacially retouched, were also uncovered (Fig. 25.2, 3). Cores were rare and atypical, and flakes of different shape and size were more frequent than blades.

The average size of both blades and flakes in the earlier phase was bigger, and blades were more common than in the later phase. Among the diagnostic implements were lozenge-shaped or tanged points, both Byblos and Amuq variants, partially retouched on both faces (Fig. 25.7, 8). They were almost standardised in shape and size, as well as in the selection of a particular raw material, which consisted in a fine-grained, opaque brown flint. Glossy blades were bigger and more varied in shape and dimension than the later ones (Fig. 25.6). The same characteristics were described for the glossed blades of 'Ayn Ghazāl, along with the hypothesis that they were hafted as single blades rather than as multiple elements (Olszewski 1994). They had no serrated edges, but only irregular denticulations, most probably produced by use. Massive, bifacially worked tools were represented by a limestone chipped disk (Fig. 25.9) and by a partially polished axe with a curve cutting edge (Fig. 25.10). Finally, limestone hammers, pestles, celts, polished spindle whorls and bracelet fragments completed the lithic collection. Although nothing can be confidently said about this typology and tool composition before the analysis



24. Al-Hasayyah: a) side-scrapers on tabular flint; b) denticulated glossed blades.

will be completed, the rarity of burins makes this collection quite different from that at 'Ayn Ghazāl (Rollefson and Kafafi 1994; 1996).

As to the bone implements, they were particularly frequent in the lower layer, and especially in the eastern area. The most common tools were awls and spatulae, all well shaped and carefully polished.

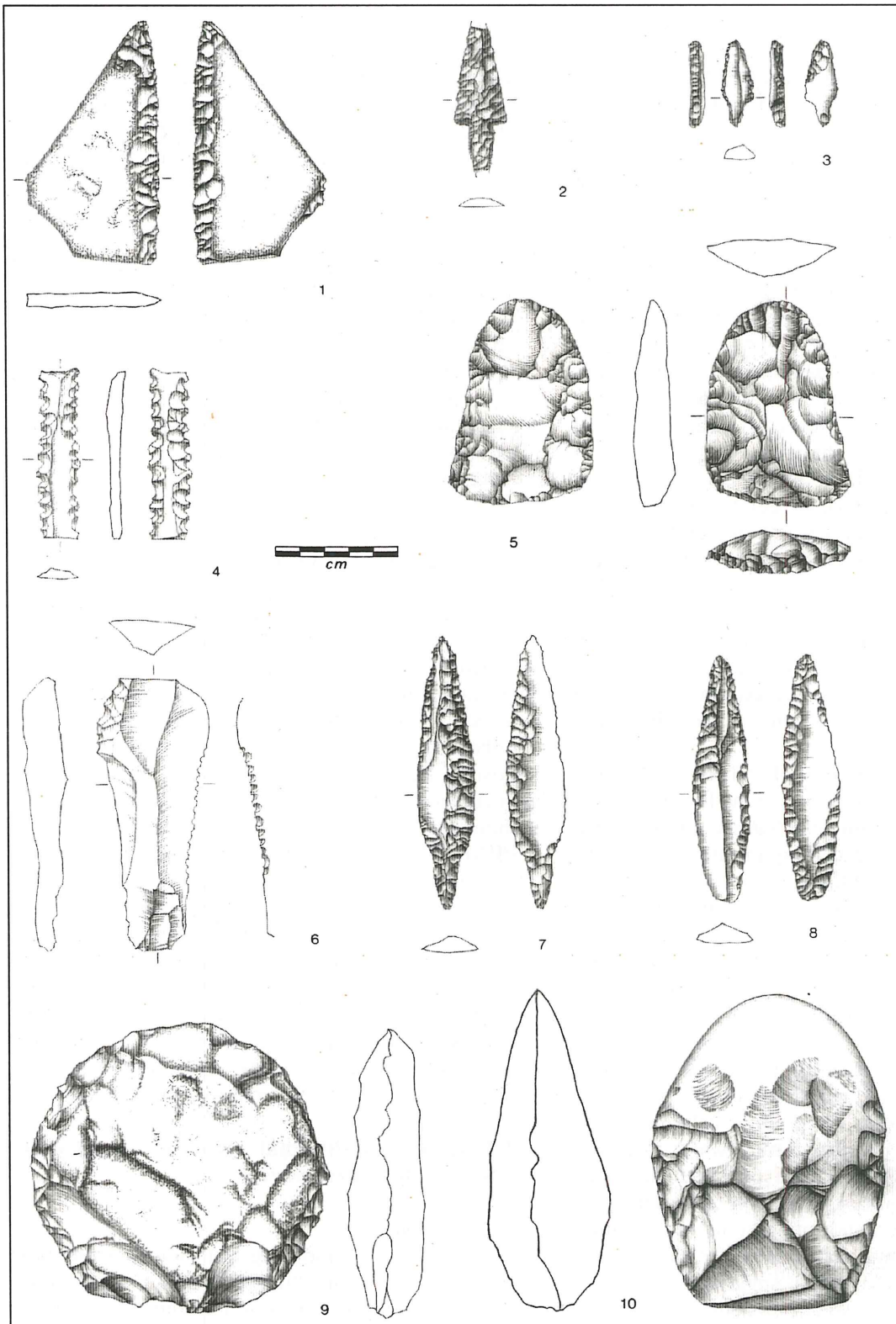
The three clay figurines were all fragmented. Two of them represented animal heads.

3.2.6. Conclusions

The information collected with this campaign at al-Hasayyah was mainly concerned with site for-

mation processes, cultural sequence and topographic extension and layout of the settlement. The archaeological materials are now being analysed at Yarmouk University and at the University of Rome "La Sapienza".

The site was apparently occupied from the Pre-pottery Neolithic B phase to the Yarmoukian, although later, less consistent occupations, dating to the Chalcolithic, Roman and Islamic periods, can be hypothesised from the surface pottery scatters (Palumbo *et al.* 1996: 423, site 8; see also 2.4, this article). Each of these phases was characterised in the stratification by the deposition of a different soil, mainly related to the variations in intensity



25. Chipped lithic implements from al-Ḥasayyah: N 1-5, Yarmoukian; 6-10 PPNB.

and size of the disgregation of the rock outcrops. This might provide an important key for the reconstruction of the human occupation of the site and, more generally, of the region, as related to local variations in the climatic conditions.

The earliest occupation was directly established on the Middle Pleistocene fluvial terrace. After its end, the deposits were buried under a thick layer of medium sized angular stones. This layer partly sealed the PPNB occupation, partly penetrated and

mixed with the organic soil of the settlement. It was found with the same characteristics not only in both the eastern and western area of the site, but also at 'Ayn Ghazāl (Rollefson and Kafafi 1994: 11) and in the whole region, always in association with late PPNB deposits (Kafafi, pers. comm.). Since the PPNB sites of northern Jordan are all located on the slopes of wadis, the formation of this soil could correspond to an arid phase which produced a minute disgregation of the upstanding rocks. It is also probable that this phenomenon contributed to cause the temporary abandonment of these settlements all over the region. The same sites were soon re-occupied and a similar phenomenon affected the end of the Yarmoukian settlements, with the deposition of a thick layer of large rock slabs all over the area.

As was the case in most of the Yarmoukian sites, the organic materials recovered in the deposits of the upper level was not enough for any radiometric analysis. Two C14 dates, however, were provided for the lower level of both areas. The western area was dated to 7615±70 years bp (Rome-1227; = 6475-6420 BC cal.) and the eastern one to 7780±70 years bp (Rome-1228; = 6675-6485 BC cal.). The earliest occupation phase of the site seems therefore quite late in the PPNB development.

The detailed stratigraphy of al-Ḥasayyah is not easy to ascertain, not only due to the heavy damage caused to the site by modern human activities, but also because of the terraced organisation of the settlement in each phase. Most of the structures were at least partially dug into the natural slopes of the valley, or into the previous archaeological deposits. This is especially true for the Yarmoukian level, which appears to be characterised by a strictly terraced settlement. This arrangement would explain the apparently poor design of the architectural remains, which is in contradiction with the developed techniques employed, based on carefully shaped stone slabs and blocks. The main investment would have been in building strong terrace walls, while the dwellings placed on this kind of stone platforms could have been built in perishable materials. The stratigraphic position and topographic organisation of the two settlements seems to be the same in the two areas investigated, which suggests that in both phases the whole extension of this huge site was occupied at the same time.

Due to this site formation, with a thin archaeological layer being deposited on a terraced virgin soil, and being each time sealed with a layer of rock fragments, the information collected by the georadar and geoelectric application have been dif-

ficult to interpret.

Besides lithic and bone tools, pottery fragments and clay figurines, important findings from this campaign were the great quantity of animal bones and charred vegetal remains. These will provide a good picture of the economy of the groups at the key moment of its transformation from mainly agricultural to mixed farming and pastoral economies.

Compared to 'Ayn Ghazāl, al-Ḥasayyah appears to be a smaller, less well preserved, less spectacular and probably less complex PPNB settlement. It is quite possible, however, that these characteristics are due to the later chronology of this settlement. This is suggested not only by the two consistent C14 dates, but also by the lithic implements of the PPNB collection, which show compositional differences from the collection at 'Ayn Ghazāl.

The information from this site is important to define at a more general level some of the features put to light at 'Ayn Ghazāl. First of all, in northern Jordan, the PPNB settlements were established on the steep slopes of wadi valleys, with a terraced arrangement. Second, an alternation between periods of slope stability and accelerated slope erosion, ultimately linked to changing climatic conditions, is attested all over the region: the sites were all abandoned after the accumulation of heavy colluvial deposits. Third, they were most of the times re-occupied by the Yarmoukians. Therefore, the Yarmoukian settlement pattern parallels that of the PPNB. This suggests that there is either a continuation (testified at 'Ayn Ghazāl) between the two cultures, or a coincidence of economic and social strategies. This is a peculiarity of the az-Zarqā' basin, which confirms the suggestions, several times advanced by Z. Kafafi, that there is neither a cultural nor an occupation break between the Pre-pottery and Pottery cultures in this area, but rather a development with gradual adaptations to new environment and cultural conditions (Kafafi n.d.).

3.3. Khirbat al-Makḥūl (Site 4): Preliminary Site and Structural Survey

3.3.1. Introduction

This site is an imposing, yet ruinous, stone-built complex of over one hundred cellular components, situated upon a hilltop south of the village of as-Sukhna in Wādī az-Zarqā' (Fig. 26). A provisional chronological reference was acquired from the analysis of surface pottery (Peruzzetto ad Wilson in Palumbo *et al.* 1996: 416-419) and whilst the predominant wares recovered attest to activity at the site during the 9th-15th centuries, the presence



26. Plan of Islamic settlement of Khirbat al- Makhūl (site 4).

of Umayyad and Abbasid pottery allows the hypothesis of a greater antiquity for this complex.

A second phase of survey was conducted by Martin Wilson, Francesco Benedettucci, and Mohammed Hatamleh in 1996-97. This comprised a structural survey of the ruin and an exploration of its immediate hinterlands. The present section details the results of the structural survey.

The objectives of the survey were to explore the site's spatial chronological development and furnish sufficiently detailed data that would assist in the determination of its status and function within the setting of the historic environment.

The survey revealed that for the most part, the remains are likely to be of Islamic date. The varied construction techniques and differential survival of walls over the site indicated that at least three major phases of building had taken place. Semi-concealed walls at ground level to the north of the site, and others exposed in clandestine excavations elsewhere, attest to a complex and lengthy occupation.

3.3.2. Geographic and Topographic Location

On leaving the outskirts of the village of as-Sukhna by the south-east, one stands at the foot of Jabal al-Qul'umma ash-Sharqī, a north-south spur of Tilāl al-Batrāwī (تلال البتراوي), a high range of craggy limestone ridges that rise to the north above the city of az-Zarqā', at some 2-3km distance.

At this point between as-Sukhna and az-Zarqā' the ridges flank the course of the now semi-dry Wādī az-Zarqā'. The ruin of Makhūl is situated 1.6km from the village upon the summit of the aforementioned spur and is reached after a relatively moderate ascent on foot of ca.150m, which is likely to have been the only approach for pack animals. The site occupies the northernmost high point of the ridges, a naturally defensible position between 650m and 665m O.D., that affords commanding views of up to some 8km west and north-west along Wādī az-Zarqā' and northeast along Wādī aḍ-Ḍulayl. To the south and east however, the massif of the Tilāl al-Batrāwī noticeably obscures vision. The steep and rugged nature of the east and west slopes immediately below the ruin was undoubtedly accentuated by quarrying for building stone.

3.3.3. Historic Significance

The antiquity of the name Makhūl is obscure and the site has also been referred to earlier this century as Khirbat "al-Breitawi" (Glueck 1951: 209, 212). The precise motives for its construction can only be postulated at present, but for means of defense, protection, and control of movement, are

all believed likely. At this point Wādī az-Zarqā' and Wādī aḍ-Ḍulayl together form arterial east-west and north-south passages through the highland region. Walmsley has demonstrated from his study of the early Islamic geographers that throughout the first three centuries of Muslim history, the east-west course of these rivers probably marked the geographical division between two large military provinces (*ajṅād*) of ash-Shām (Walmsley 1987).

It is therefore probably significant that a site such as Makhūl should be strategically situated immediately south of the east-west confluence of the rivers where all movement along the wadis to the north could be easily observed. Under the Umayyad administrative organisation Makhūl would have been located within the Jund Dimashq, separated from the Jund al-Urdunn to the north. By the later 4th/10th century the site would have been within the district of Filastīn, the administrative boundary with al-Urdunn unchanged.

It is also significant that less than 3km away to the east along the Wādī aḍ-Ḍulayl, the Darb al-Ḥajj was reached at a point between 'Ammān and Damascus, whilst az-Zarqā' beyond the Tilāl al-Batrāwī to the south was a principal centre on the pilgrim route. It is therefore assumed that not only a considerable volume of traffic passed below Makhūl in the early Islamic period, but the proximity to a main route and principal centre would have influenced the prosperity of this locality.

The characteristics and layout of the complex together with its preferred location indicates that a prime consideration for its construction was to provide multiple accommodation that gave a level of protection. One possibility is that Makhūl provided shelter to travellers, merchants and pilgrims, whilst another working hypothesis is it housed a garrison of local militia, as, undoubtedly, the policing of this district would have been of paramount importance.

3.3.4. Layout of the Site

The Complex: The site (Fig. 26) encompasses some 6,500m² and comprises at least 110 individual and largely interconnected cellular structural components — rooms, passageways and courtyards. The majority of these cells are ranged in concentric rows that follow the hilltop contours between 655m and 661m, producing a roughly elliptical plan and covering approximately 4,550 m². These cells largely share an outer curtain wall that stands upon a perimeter 'platform' wall, the latter built of large roughly hewn limestone ashlar and believed to have been the remains of an earlier structure.

For ease of recording and description the site was divided into discrete collective spatial units, or 'structural agglomerations', according to their appearance in plan, structural characteristics and position upon the hillside. Individual structural components were allocated a unique numerical identifier. Where subsequent divisions were apparent, an alphabetical affix is used. A description of the characteristics of each individual component (i.e. cell, passage, open area, and courtyard) was made with regard to its dimensions, trajectories of entry, construction, significant features and aspect. Walls are assumed to be bonded unless otherwise indicated.

The survey data was collected from non-invasive survey which meant that archaeological visibility and accessibility was sometimes impaired by overburden or collapsed superstructure. It was not always possible to determine whether external apertures represented doors or windows. The state of preservation and extent of clandestine disturbance was also recorded, the latter often revealing archaeological stratigraphy to a depth of up to ca. 1.5m.

The following collective spatial units have been designated (individual components bracketed):

- i) Northern access (55; 108-9);
- ii) Inner, west and south, exterior (1-19; 101);
- iii) Inner west interior (20-8; 31-9; 100);
- iv) Inner east (29-30; 41-54; 58-9);
- v) Outer east (60-84);
- vi) Outer west (85-99);
- vii) Central (102-7);
- viii) Outer northeast (56-7).

The individual structures within each concentric agglomeration suffer from differential erosion whilst those in better state of preservation are where the longitudinal axis is perpendicular to the hill contour. It is possible that most roofs were of vaulted construction, but the evidence for such was only positively identified in four structures (26, 29/30, 41 and 60).

i) Northern access: A large recumbent slab of limestone marks the threshold of the main gateway. This is ca. 2.5m in width and set within the remains of an otherwise low and featureless perimeter wall of large limestone blocks. Beyond this point to the south there is an open area of exposed bedrock and hill-wash that slopes gently upwards to the centre of the site.

On entering the complex there are faint indications at ground level, of two semi-circular projections (108-9) located either side of the main ac-

cess (55), which may have been towers or guardrooms. These structures are not thought to relate to the majority of extant superstructure at the site. Indeed, the general lack of fallen superstructure both in this area and on the slope to the northeast seems to suggest that building stone was put to re-use at the site. The remains of the perimeter wall and traces of numerous walls at ground level in this area (54) are believed to be contemporary with the towers.

ii) Inner, west and south, exterior: The site is enclosed to the west by a row of interconnected, predominantly rectangular cells, arranged in an arc from north to south around the hillside. The majority of them have their long axes along the 660m contour of the hill. The outer wall of this group for the most part stands upon the perimeter platform wall that in this area appears to be set within a recess in the hillside. The walls of each cell generally survive to a height of less than 1m to the north and ca. 1.5m to the south. They lack the solidity of rubble-core construction that is found elsewhere on the site. The bonding of walls suggests that much of this group represent a single episode of design and construction. Despite the poor state of preservation, in plan there is a general regularity of construction that contrasts with the piecemeal appearance of other structural groups on the site.

The near-uniformity of the cells suggests they were some type of accommodation. It is notable that where doorways were identified, the access to particular cells was restricted, indicating divisional and spatial requirements (e.g. domestic, social, functional). Access to many rooms within this group is *via* an inner agglomeration of cells (iii) appended to the east walls. Most room interiors are completely obscured by collapsed superstructure, although a few internal features were identifiable. These include several small niches in walls and an oven or hearth in the northeast corner of room 5.

Two main thoroughfares (101=23 and 101) breach this agglomeration providing a link between the western outer agglomeration (vi) and the centre of the site. A further two apertures, possibly doors, are visible in the outer walls to the north east (4 and 7), perhaps providing access from the steep hillside at each of these points.

iii) Inner west, interior: A row of predominantly rectilinear cells is attached to the inner walls of the above agglomeration (ii) and situated in a recessed area of the hillside. The walls are much denuded and room interiors are filled with erosion products. Each cell is of smaller dimensions than those

which stand upon the perimeter platform wall in group (ii). At the northern extent of this group is a small near-circular structure (31), a possible *ṭābūn*, which has a diameter of ca. 1.6m.

A large open area or courtyard (36) serves as a thoroughfare between the outer agglomeration (ii) and the central area (vii), whilst a very small cell (100) towards the southwest corner of the courtyard might have been a gatehouse alongside the western passageway (10). On the east side of this courtyard, low traces of walls protrude from erosion-derived overburden and suggest that a further inner agglomeration may be concealed (37-39). At the southern extent of this group (24) a continuation of cells is believed to exist. Scant traces of walling can be observed at ground level, once again set in recesses in the hillside.

iv) Inner east: This group of structures is very irregular in plan, especially when compared to the opposite agglomerations to the west (ii and iii). It lacks regularity and has the appearance of piecemeal development. It is believed that earlier structural components are incorporated in a later complex.

Many of the structures in the southeastern part of this group are of substantial construction with walls surviving in some cases up to five or six courses and up to 1.5m. Traces of barrel-vaulting survive in at least three of the structures (26, 29/30 and 41). The state of preservation is variable and it is notable that those in better condition have their long axes perpendicular to the contour. One large cell (27) and a smaller adjoining cell in a recess (28), have much lower floor levels than those of their adjoining cells (26 and 29). Wall abutments are notable and indicate an earlier construction date for cells 29 and 30. A great deal of clandestine activity in this area has exposed buried walls and revealed archaeological deposits up to 1.5m in depth.

The superstructures of the eastern and north-eastern part of this group are extremely denuded (i.e. 44-54), with extensive traces of walling at ground level. Many walls are believed to belong to an earlier phase of occupation. The evidence revealed in large clandestine pits (e.g. 46 and 49) supports this view.

Access to the central agglomeration (vi) from the outer agglomeration to the east, is via a series of passageways (40, 42, 43, 75, and 77). A small free-standing structure (41) with evidence of a vaulted roof may have served as a gatehouse.

v) Outer east: This group is located on the steep slope to the south and east. The majority of its southernmost components (70-84) exhibit an ap-

proximate regularity in their rectilinear layout, which seems to indicate a single phase of construction. They form two concentric arcs that were attached to the perimeter platform wall, with access to the interior of the complex via a passage way (77). At the southern extreme of this group there is a small two-celled structure (82/83) which has a semicircular west wall. Its function is uncertain.

As one progresses towards the east slope there is a marked irregularity of construction and layout (60-68) which is likely to have been the result of piecemeal development. Probably the earliest structure on the outer east slope is an apparently single-celled substantial structure (60), aligned perpendicular to the contour. This building has two layers of barrel-vaulted coursework visible to a height of ca. 1.5m. The majority of cells are clustered around a small courtyard (64). These may only be accessed from either the interior of the complex via room 71, or from the east slope via room 66. At the northern extreme of this group are the denuded remains of a semicircular wall, possibly similar to structure 82/83.

vi) Outer west: A group of 14 cells straddle the 654m contour to the southwest. Its piecemeal appearance indicates that it may have been a later appendage to the main complex that stands on the perimeter wall above it. Most walls are of rubble core construction. Access to the main complex is believed to have been via a passageways along its western side (98-10).

vii) Central: The central building complex of approximately 447m² comprises three barrel-vaulted structures and a single vertical-walled structure, arranged around a courtyard. Large clandestine excavations indicate stratigraphic horizons. The complex appears to be situated partly upon the natural bedrock to the north and northeast and partly upon the rubble and deposits of earlier occupation to the south. The walls stand generally up to three to four courses of medium-sized ashlar facing (e.g. 0.4 x 0.3m) and have rubble core. It is thought likely that a mosque comprised an integral part of this group of structures and that one of the barrel-vaulted structures (103) is a likely candidate; however, the density of rubble overburden denied the location of any diagnostic architectural features such as a *miḥrāb*.

viii) Outer northeast: An isolated rectilinear building is situated on the northeast slope some 8m from the perimeter wall. It comprises two interconnecting cells with near-equal floor space. Each cell has an external doorway, 0.8m wide. Its rubble core walls

are of irregular ashlar coursework and stand to a height of 1.55m. The interiors are featureless.

Associated Features

The site was served by two external, and one possible internal, cisterns. Those outside the complex were carved into the limestone bedrock at the foot of the escarpment to the north and south at ca. 100m distant (251600E/169755N and 251690E/169525N). Each of these comprised a large funnel of ca. 6m diameter with a vertical shaft, ca. 1m in diameter, falling to an underground reservoir. In close proximity to the cisterns are the ground-level remains of small rectilinear structures, which may suggest some form of protection. The internal cistern comprises a large limestone cavity just beyond the main gate, but it is otherwise featureless.

The foundations of occasional, single cell structural remains are encountered on the lower approaches to the complex to the north and west. Many of these are believed to be funerary structures, but guard or lookout posts cannot be precluded. The ridges to the south and east carry a number of similar much denuded remains.

4. GENERAL CONCLUSIONS

The soundings at Palaeolithic site 330 and at the Neolithic village of al-Ḥasayyah have confirmed their great scientific potential, and their further study will certainly provide precious information on human evolution and adaptive behaviour.

Further study will also be dedicated to the Dawqara formation, which is confirmed as being fossiliferous in nature, and of great antiquity.

The potential of the regional survey to provide precious information on settlement distribution and typology has been demonstrated over and over again and future campaign will continue this activity, possibly with the addition of limited soundings or shovel tests to clarify the existence of actual archaeological deposits, especially in areas where the threat of destruction is immediate.

The Bronze Age and Iron Age periods deserve further study and they will be investigated further. The same will be done for the Classical periods, with a combination of survey investigations and soundings.

A limited programme of soundings is to be conducted at Khirbat al-Makḥūl as well. Its objectives will be to attempt to determine the site's character, its periods of construction and occupation, and to provide a stratified ceramic sequence that is much needed to enhance our knowledge of the early to middle Islamic periods in northeastern Transjordan.

Finally, we intend to develop suggestions and ideas for the protection of a heritage that, while not

immediately exploitable for economic ends such as tourism, has nonetheless great scientific importance and the opportunity to raise the interest towards a depressed region of Jordan, and to develop a sense of community and pride for a long and rich cultural past. We plan to work with local communities and administrators in the attempt to raise interest and establish protection measures and include them into the development and management plans of this region. Our objective is to create awareness and suggest tools and actions that can serve as example for other communities in the region, which are still struggling to find an identity following their sudden and uncontrolled development.

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