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Editorial

It is now almost 15 years since the first PPN chipped lithics workshop in Berlin, when, among other things, the publication of *Neo-Lithics* was established by acclaim among the scholars attending the meeting. Within all the verbiage of the one-page editorial of the first issue (*Neo-Lithics* 1/94), the central theme was the importance of communication among all of the people working on Neolithic and Late Epipaleolithic chipped lithic issues so that timely exchanges of views, criticisms, and agreements could be reached, and in retrospect, it would appear that this fundamental goal has been achieved.

How things have progressed! The initial issue had a total of 5 pages, and the following issue proudly displayed a page 6 (although this included the title page, which was not counted in the first issue). In one sense, bigger was not necessarily better or desirable at the time, for postal costs were high and funds were low; readers might recall trying to cope with 9-pt font we used in order to reduce the number of pages and thus mailing costs. The printing format of the issues was also pretty cheap: merely photocopies on greenish paper.

The first couple of years admittedly faced challenges in terms of obtaining sufficient articles on chipped lithic topics for publication, and there were usually a few weeks

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Khirbet Hammam 2006: Preliminary Report of Continued Test Excavations

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Introduction

In 2006, test excavations were resumed at Neolithic Khirbet Hammam (WHS 149), Wadi al-Hasa, in an area described as the East Field. The two week field season ran from June 3-17. Excavations were directed by Jane Peterson with the assistance of Michael Neeley, Brett Hill, Jennifer Jones, Jordan Knudsen, and Abdallah al-Rawashdeh, our representative from the Department of Antiquities of Jordan. This constituted a second season of test excavation, following the initial subsurface tests carried out in 1999 (Peterson 2004). The 2006 excavations produced several significant research discoveries:

1) The estimate of the horizontal extent of the site was effectively doubled to 6-7 hectares.
2) Chronometric and technotypological evidence jointly indicate that the site has a complex occupational history with PPNA, MPPNB, and LPPNB components.
3) Mortuary traditions and use of exotic materials suggest that villagers in west-central Jordan were actively involved in manipulating the larger world of PPN symbolism and social practices to suit local needs.
4) Collections of lithic and organic specimens allow a multidimensional reconstruction of Neolithic lifeways.

Site Extent and Context

During the 2006 season we undertook intensive surface examination of the site to produce a detailed topographic map (Fig. 1). Earlier assumptions placed the site boundary, more or less, at the roadway. Below the road, much of the terrace becomes quite steep and preliminary exploration in 1999 noted sparse lithic artifacts on the surface. This year we examined the area below the road more systematically and identified both Neolithic-style wall segments and large boulder mortars. As a result of these observations the estimate of the horizontal extent of the site is between 6-7 hectares. This makes Khirbet Hammam a relatively large PPN site. Furthermore, we suggest that the site is unique because the terrace has been protected from the severe erosion that has dramatically truncated other sites in the region.

Geoarchaeological investigations by Brett Hill provide evidence to suggest why this area was attractive to early farmers. Hill notes that some of the most significant channel incision in the region postdates the Neolithic. He posits that the Wadi al-Hasa may have once been a landscape with large expanses of arable land in a broad, flat floodplain; an environment that built up rich sediments rather than scoured them away. This reconstruction corresponds with settlement chronology, Dead Sea sedimentation records, and isotopic studies of speleotherms (Hill 2006). Hill has identified a geological feature that may represent a preserved portion of this ancient floodplain, suspended some 50 meters above the Wadi Laban, a tributary of the Hasa. Future plans include collaboration with a quaternary geologist to core and date this feature. Makarewicz's recent excavations at el-Hemmeh – a rich and diverse PPN site less than 5 km from Khirbet Hammam – demonstrate the prehistoric settlement in the Hasa was quite dense (Makarewicz and Austin 2006).

Dates/Chronology

The 1999 excavations had identified a well-preserved and extensive LPPNB component at Khirbet Hammam based upon two AMS dates and a largely flake-based chipped stone assemblage with sparse naviform elements. Two additional AMS dates from the 2006 East Field excavations extend the LPPNB history of the site documenting an occupation that straddles the MPPNB/LPPNB boundary (Table 1).

In addition, two El Khiam points found this season suggest that there may have been a PPNA presence at the site. One was found during surface collection of Test

Tab. 1 AMS Radiocarbon dates from 2006 excavations at Khirbet Hammam.

Context	Material	Lab No.	Conventional Date BP	2 Sigma Calibrated Result
Trench 2 – Level 3	charcoal	Beta-221347	8310 +/- 40 BP	9450-9240 Cal BP
Trench 2 – Level 4	charcoal	Beta-223148	8440 +/- 40 BP	9520-9420 Cal BP

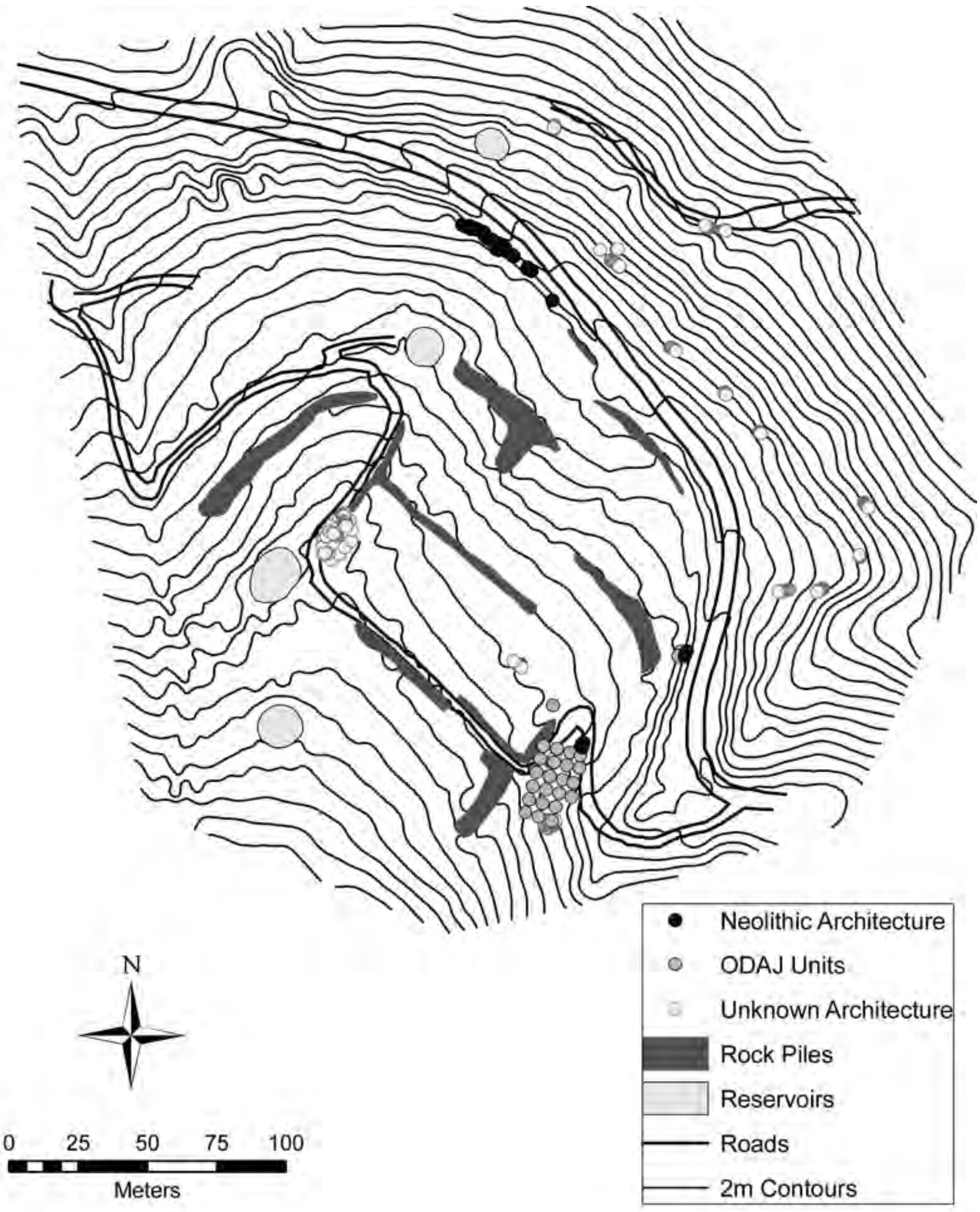

Fig. 1 Topographic map of Khirbet Hammam (prepared by Brett Hill).

Trench 2, the other in the highly disturbed Level 1 of Test Trench 3. Excavations have not reached the bottom of cultural deposits, so it is not possible to assess the presence of PPNA *in situ* remains.

Architecture

The East Field area was chosen for testing because it: 1) contained a relatively high density of surface lithics, 2) had visible Neolithic-style wall fragments, and 3) did not pose insurmountable logistic challenges for a short season. Surface collection of twelve 5 x 5 m units (300 m^2) provided the surface density data.

Test Trench 1 was a 1 x 2 m unit which straddled a wall fragment. The rock alignment turned out to be shallow, a single course, and was not associated with significant cultural deposits. We discontinued work after removing the overburden around the wall and a single 10 cm excavation level.

Test Trench 2 was a 2 x 2 m unit that was placed over another rock alignment. After removing the overburden a substantial wall made of two rows of roughly hewn limestone cobbles appeared. A single row of cobbles suggested a low, interior dividing wall. Test Trench 2 was excavated to a level of 1.4 m below the surface in arbitrary 10 cm levels (Fig. 2). The artifacts and features strongly suggest that the area east of the primary wall constituted interior space. The best preserved sections of the wall contained four courses of stone, with a basal course made of larger, more carefully shaped and faced stones. The first course rested on a packed, *huwwar* floor. The floor was compacted and well-preserved in some areas consisting of hard-packed dirt mixed with chunks of plaster. But in other areas the floor was disturbed and much more ephemeral.

The room fill was homogeneous in color ranging from brown (10YR 5/3) to grayish brown (10YR 5/2). The texture was fine loam, containing ash and charcoal inclu-

Fig. 2 Architecture in section from Test Trenches 2 and 3.

Fig. 3 Subfloor channel at Khirbet Hammam.

sions. Additionally, several large pieces of flat-lying ground stone were closely associated with this packed surface.

Test Trench 3 was a 1 x 2 m unit contiguous with the south wall of Test Trench 2, and extending one meter farther west. Unexpectedly, the double row wall diverged in this extension trench, one curving east, one west – forming two subrectangular structures that were built abutting one another. Contiguous, shared wall architecture has emerged as a hallmark of MPPNB and LPPNB in central and southern Jordan. One 10 cm subfloor level was excavated across Test Trenches 2 and 3. Substantial amounts of chipped stone materials demonstrate continued cultural deposits.

The subfloor explorations in our test excavations did not indicate any channel features. However, along the roadcut four subfloor channels were identified and documented (Fig. 3). Similar features have been described at Basta and Es-Sifiya.

Burial

Three large pierced, ground stone items were found *in situ* on the *huwwar* floor within Test Trench 2 (17 cm average diameter, 4 kgs). Directly beneath two of these ground stone specimens lay a human skull. The skull was highly fragmented, but the pieces remained tightly clustered, as if to suggest that they had been placed in a container that subsequently disintegrated. The fill directly associated with the skull contained a *Glycymeris* sp. shell bead. The method of skull removal is not clear from the remains.

The individual died at age 3 or 4 based on root development of the first premolar (Moorrees, Fanning, and Hunt 1963). The central and lateral permanent incisors, still developing beneath the gumlines, show evidence of hypoplastic bands. The presence of multiple enamel hypoplasias on multiple teeth is indicative of systemic stress that affected the child over a significant period of his/her short life.

Infants and juveniles are, on balance, underrepresented in Neolithic burials. The sample has been increasing in recent years with examples coming from central and southern Jordan (*cf.* Khirbet Hammam, Ghwair I, Ba'ja). Variation in burial treatment and demographic profile may represent regional variations in PPN mortuary programs.

Finds

Lithics

Chipped stone items came from controlled surface collection of twelve 5 x 5 m collection units as well as our three test trenches. The assemblage numbered 3,965 pieces. All stages of the lithic production sequence are present: cores, cortical flakes and blades, knapping debris, formal and informal tools, core trimming elements, and broken tools. While flake-based technology accounts for a large proportion of the debitage (73%), blade production is also a significant element.

Blades are highly preferred for both informal and formal tools. The most prevalent tool types are projectile points, sickles, and drill/perforators. Many are shaped with a nominal amount of surface retouch, although there are occasional examples of denticulated sickles and points with invasive, bifacial retouch. Blades also make up a larger part of the debitage assemblages as we descend stratigraphically from level 1 to 6 in Test Trenches 2 and 3. This suggests that the ratio is a chronologically sensitive monitor of chipped stone patterning. Lastly, the raw materials of choice for blade production come from high-quality bedded deposits rather than the local surface and wadi-bottom sources based on cortical differences.

Shell, Phytoliths, Spherulites, and Fauna

Aldona Kurzawksa completed an inventory on the shell from the site. Our small assemblage (n=46) contained both marine and freshwater specimens. Both types were culturally modified. In species proportions and modifications, the assemblage profile is similar to Yiftahel, Abu Gosh, and Jericho according to the analyst.

Grass phytoliths are present in samples submitted to Chantel White at the Geoarchaeology Lab at Boston University. Species identifications are forthcoming. Spherulites were present in low concentrations, and suggest that animal penning areas may be identified in future excavations.

Animal bone was well preserved throughout the excavation layers. Numerous, nearly complete elements were evident in and around the human burial. The material has been sent to Dr. Alex Wasse for identification.

Results from the 2006 field season add support to the conclusion that Khirbet Hammam is a significant Pre-Pottery Neolithic site, both in terms of its material culture and degree of site preservation. The Jordanian Department of Antiquities is applauded for taking the important steps of purchasing the site and providing site guards.

Acknowledgements. This research was funded by the Montana State University, Marquette University, and the University of Minnesota, Duluth. I would like to extend thanks to Fawwaz Khraysheh, Director-General of the Department of Antiquities of Jordan, Jihad Darwish, and Abdallah al-Rawashdeh. Special thanks also go to Barbara Porter and the staff at ACOR in Amman. And finally, my gratitude goes to the field crew for their hard work, insights, and teamwork.

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Field Report

Wadi Abu Tulayha and Wadi Ruweishid ash-Sharqi: An Investigation of PPNB Barrage Systems in the Jafr Basin

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Introduction

The first and second field seasons at Wadi Abu Tulayha, a small settlement site in the Jafr Basin in southern Jordan, have shown that it served as a LPPNB agro-pastoral outpost probably derived from the sedentary farming society to the west (Fujii 2006a, 2006b). Notable is a V-shaped, freestanding masonry wall *ca.* 120 m in total length that was adjacent to the outpost. A test sounding conducted in the first field season suggested that this elongate wall was used for a water catchment facility to collect seasonal runoff water of a tributary wadi. The question is its date. The previous reports tentatively assigned it to the same horizon as the neighboring LPPNB outpost on the basis of a series of collateral evidence. In order to revalidate this tentative dating, the third field season, conducted from March 25 through April 13 in 2006, suspended the main operation at the outpost and was devoted to the full-scale excavation of the barrage. As a result, further evidence to support the previous dating has been obtained. The investigation also newly located four smaller barrages: two at Wadi Abu Tulayha and the other two at Wadi Ruweishid ash-Sharqi. It follows that a total of five barrages (or two barrage systems) have been found in our research area. Their excavations proved that the initial agro-transhumants at Wadi Abu Tulayha LPPNB outpost used two distinct types of barrages for different purposes. This report summarizes the investigation results of these unique facilities and makes a brief discussion concerning their date, function, and archaeological implications.

The Site-setting of Wadi Abu Tulayha

The LPPNB agro-pastoral outpost of Wadi Abu Tulayha, or JF-0155 in our site registration code, is located in the northwestern part of the Jafr Basin, southern Jordan. Topographically, it occupies the eastern edge of a gently undulating flint-strewn desert (or *Hamada* in Arabic) that extends between the two major drainage systems in this area: Wadi Abu Tulayha to the east and Wadi Ruweishid ash-Sharqi to the west (Fig. 1). The environmental condition around the site is very harsh. Since the annual average precipitation is less than 50 mm (Jordan National Geographic Center 1984: fig. 114), the local vegetation is very poor, being limited to thorny shrubs dotted on wadi beds. Needless to say, no settlement exists; even local pastoral nomads are rarely encountered. The finding of the LPPNB outpost and its neighboring barrages was all the more unexpected.

The site itself belongs to the Wadi Abu Tulayha drainage system through a tributary wadi that flows eastwards across the southern fringe of the site (Fig. 2). Three barrages were found along the wadi (Fig. 3). The topography around them is divided into two with Barrage 1 in between. While a flat terrain including some small playas characterizes the upstream area where the outpost exists, a gently undulating topography marks the downstream area. Barrage 1 occupies the eastern edge of the upstream plain. Barrage 2 and 3, on the other hand, are situated in a slightly dissected downstream valley.

Wadi Abu Tulayha Barrage 1

Barrage 1 was located *ca.* 50 m southeast of the outpost, at the eastern edge of the upstream plain of the tributary wadi. As mentioned above, it was a roughly V-shaped, freestanding masonry wall *ca.* 120 m in total length and constructed with undressed or partly dressed limestone and flint cobbles available at the downstream wadi bed. Dry walling technique was used for the construction; no clear evidence for mortar was found except for wall segments at the converging point (see Fujii 2006b: fig. 15).

The Excavation

A total of six operation areas, Area A to F, were opened to explore the nature of this unique structure. To begin with, the extensive excavation at Area A revealed that the wall segment at the converging point was two rows (or *ca.* 0.5-1.0 m) wide and preserved up to a height of three to four courses (or *ca.* 0.3-0.5 m) (Fig. 4, 5). The construction materials were arranged in stretcher bond for the foundation course and in header bond for upper courses, respectively (Fig. 6). Small rubble and caly were packed into a narrow space sandwiched with the two outer walls. Nevertheless, such sturdy construction was limited to the central part of the conversing point and both wings were built in a simpler manner. The wall segment at Square L-21, for example, was reduced to a simple structure of a single row and course. The same is true of the south wing, where such technological simplification gradually became obvious as one came close to the distal end. The contrast in structure between the core and

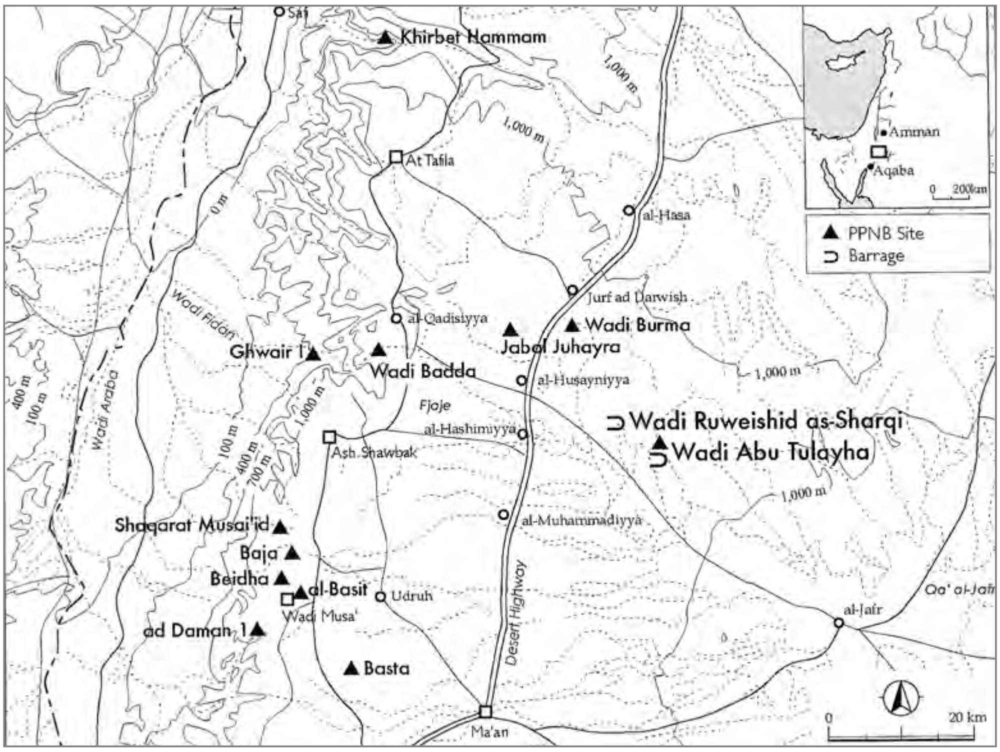

Fig. 1 The location of the two barrage systems and PPNB sites around the Jafr Basin.

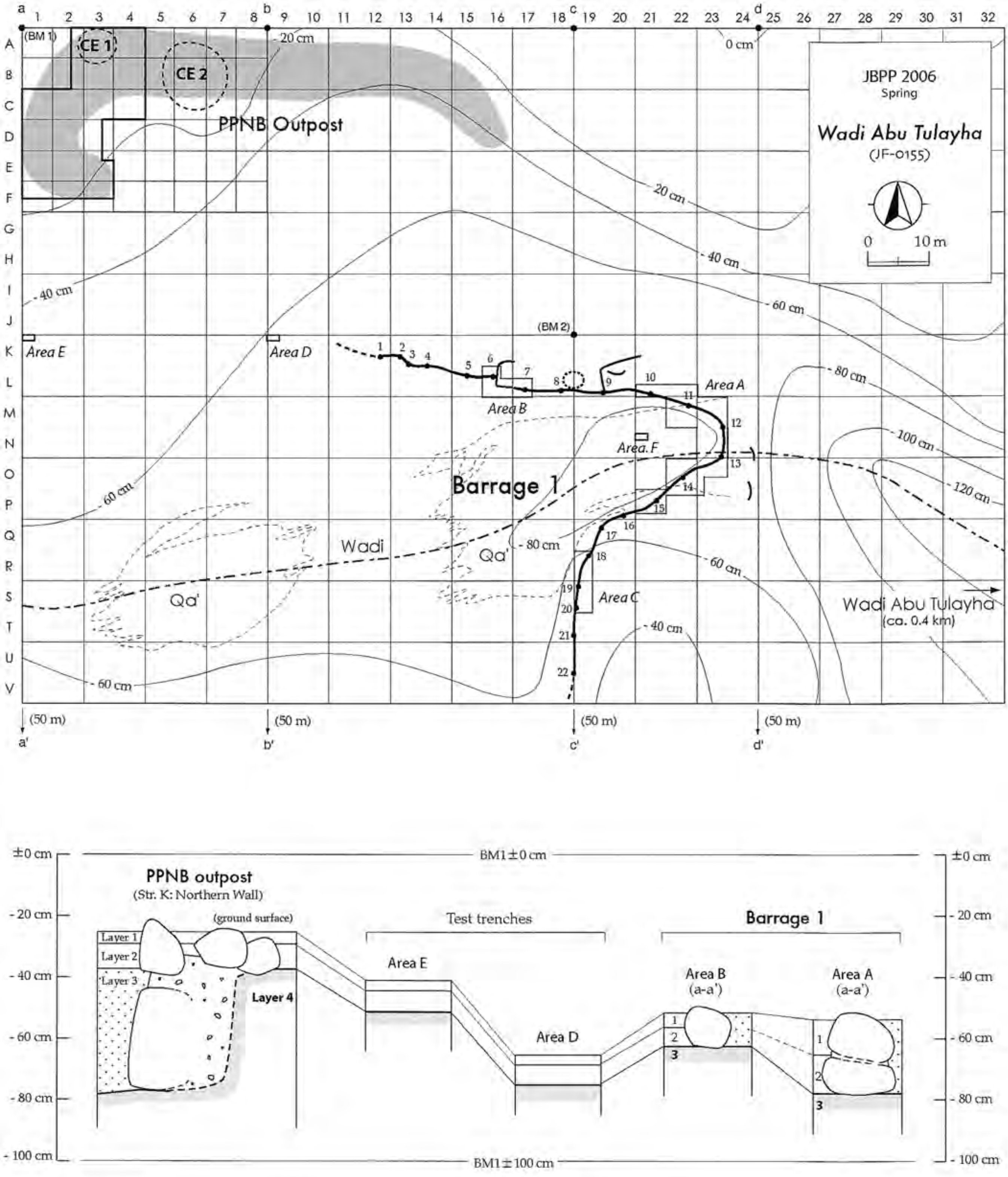

Fig. 2 The contour map and site stratigraphy of Wadi Abu Tulayha.

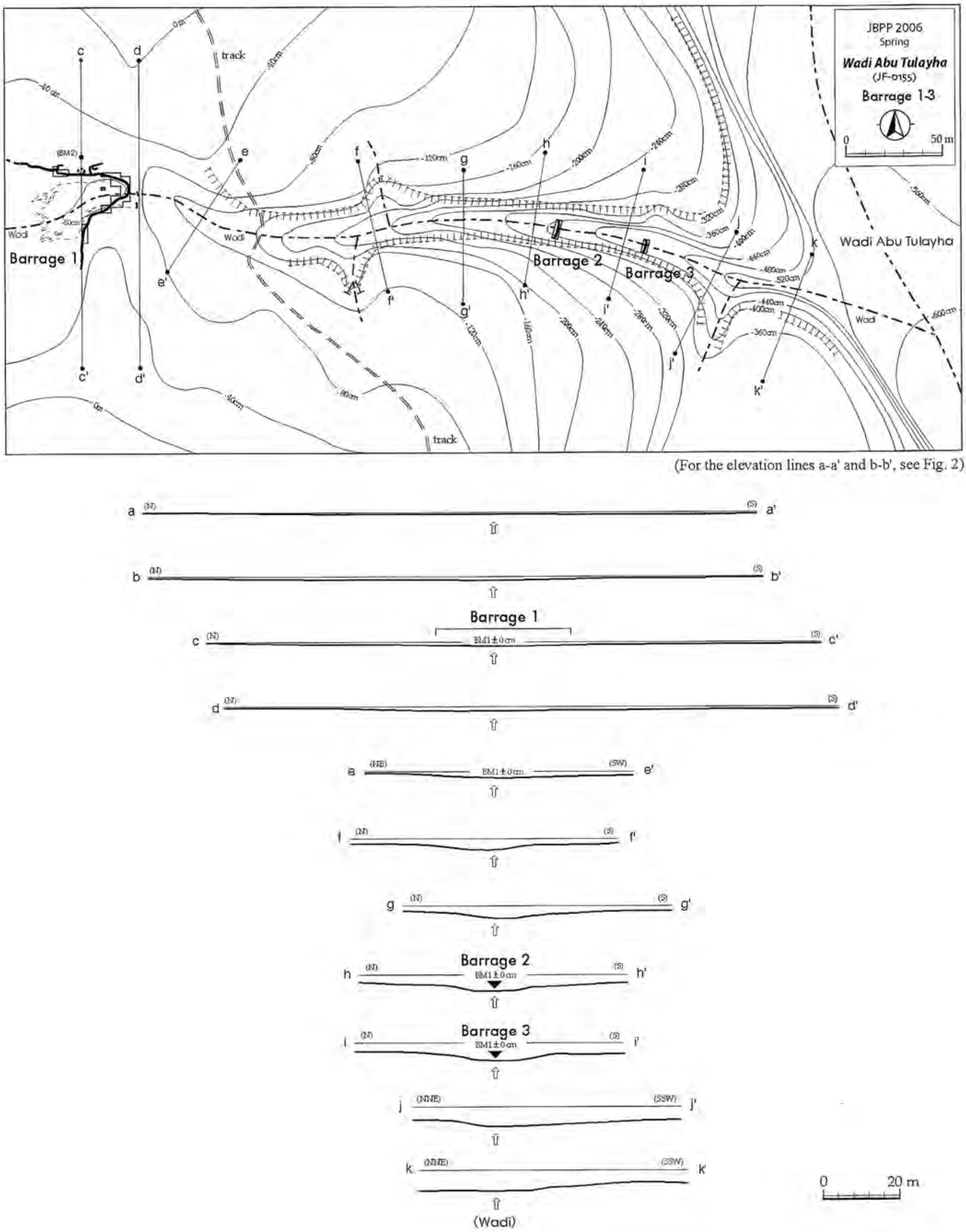

Fig. 3 The contour map and elevation of the barrage system at Wadi Abu Tulayha.

Fig. 4 Wadi Abu Tulayha Barrage 1: A general view (from SE).

peripheral parts probably mirrors the difference in sideways water pressure acting on them.

What interested us was a semi-circular protruded wall attached to the center of the converging point (Fig. 7). Unlike the other wall segments, it was constructed with larger limestone cobbles that were piled up consistently in header bond from the foundation course. Furthermore, it was protected with a dual support constructed with smaller rubble and upright slabs respectively, and a narrow space between the two was compacted with rubble and mud. These devices corroborate that the strongest water pressure acted upon this part. A bilaterally notched stone weight, a key to the dating of the barrage, was found at the right-hand corner of the protruded reinforcement wall (Fig. 9: 2).

In addition, a small oblong mound fringed with limestone slabs was found in front of the reinforcement wall (Fig. 4, 5). It was oriented west-to-east in its longer axis and equipped with an upright slab at both ends. It is therefore evident that it was an Islamic tomb. A Kuffic inscription and a dozen red-painted pottery sherds of the Umayyad or early Abbasid dynasty occurred from the surrounding loci, suggesting an early Islamic date for the tomb. It was probably constructed converting the construction material of the neighboring barrage. Notable is a clear stratigraphic gap between the two features, which demonstrates that Barrage 1 belongs to a period much earlier than the early Islamic period.

Area B and C, on the other hand, examined the north and south wings respectively. As a result, it turned out that both wings were very simple in structure, being constructed with a single row and course of limestone cobbles that were arranged in stretcher bond on the ground surface of those days (Fig. 8). In view of the scarcity of fallen stones, it leaves little doubt that the walls retain their original form. Such simple structure corroborates that the water pressure acting on both wings was much lower than that on the core wall.

Area F in front of the converging point was intended to investigate the nature of silty deposit in the flooded area. Since it was difficult to make a clear stratigraphic division, the sounding of this area was conducted based on an artificial layer system every *ca.* 5 cm. The sounding ended with a depth of *ca.* 0.5 m from the present ground surface or *ca.* 20 cm below the construction surface of the barrage. Dr. Kaoru Kashima, natural geographer of our team, tentatively claims that the construction of the barrage coincides with the sudden appearance of diatomous fossils in the silty deposit (Kashima pers. communication).

In addition, two isolated operation areas were opened between the barrage and the neighboring LPPNB outpost in order to explore the stratigraphic correlation between the two. The soundings proved that both of these were coeval in terms of site stratigraphy (Fig. 2).

The Finds

Despite the extensive excavation, the finds from Barrage 1 were very scarce, being limited to a few dozens flint artifacts, a handful of pottery sherds, a bilaterally notched stone weight, and three inscriptions only. To make matters worse, finds from the original context of the barrage were still more infrequent. This is no wonder, however, in view of the nature of the barrage as an extramural non-residential structure.

The flint artifacts contained a naviform core, a crest blade, a Jafr blade core, several retouched blades and flakes, and a backed bladelet. None of these occurred from the original context of the barrage. Besides, they vary in date from the Epipalaeolithic (the backed bladelet), through PPNB (the naviform core and crest blade), to the Early Bronze Age (the Jafr blade core). It is needless to say that these stray finds are useless for the dating of the barrage.

The vast majority of pottery sherds occurred collectively from fill layers at Square O-23, around the breach in the wall alignment. They fall into two groups: red-on-buff painted ware sherds and darkish plain or incised ware sherds. There is little doubt that the first group falls within the Umayyad or early Abbasid pottery repertoire. In light of the consistency of paste, wall thickness, and painted motif, it appears that the sherds derived from a single pottery, probably a deep bowl. The second group, on the other hand, included a shallow bowl made on a wheel and a pilgrim flask with a pair of perpendicular loop handles at the neck. It seems that both of these belong to the same horizon as the first group. All of these pottery sherds may have been washed out from the small mound tomb described above. The occurrence of the early Islamic pottery sherds from the upper fill layers provides a lower limit of the date of the barrage.

The only datable *in situ* find from Barrage 1 is the bilaterally notched limestone weight that was incorporated into the protruded reinforcement wall at the converging point (Fig. 9: 2). It was *ca.* 45 cm long and *ca.*

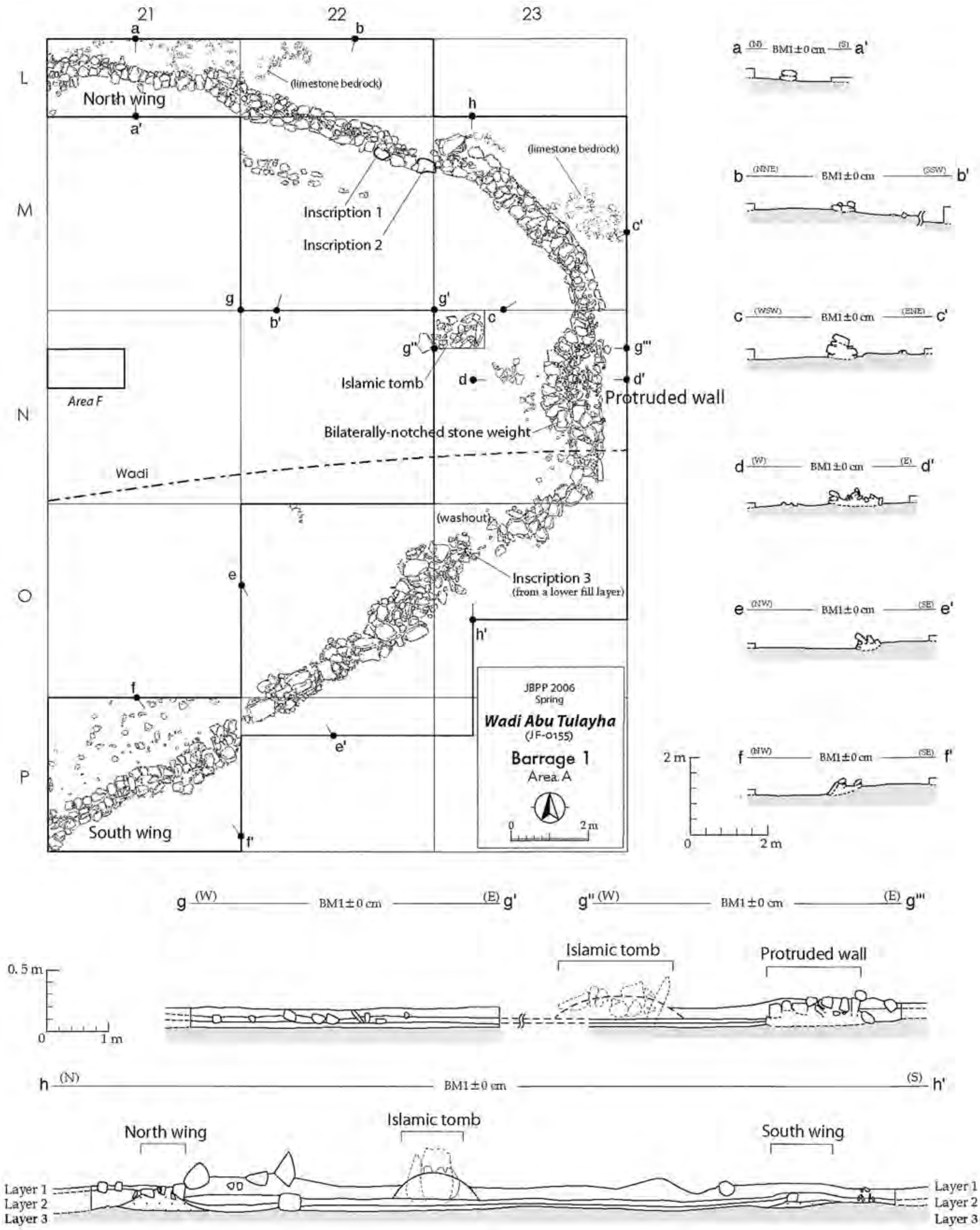

Fig. 5 Wadi Abu Tulayha Barrage 1: The plan and elevations/sections of the wall at the converging point.

35 cm wide, having a weight of *ca.* 25 kg. Parallel examples occurred from the neighboring PPNB outpost (Fig. 9: 1) as well as two barrages at Wadi Ruweishid ash-Sharqi referred to below (Fig. 9: 3, 4). Importantly, with the only exception of a stray find from Barrage 1 at Wadi Ruweishid ash-Sharqi, every barrage made it a rule to contain only one stone weight in the right-hand corner of the protruded reinforcement wall at the converging point. It is therefore most unlikely that the stone weight from Barrage 1 at Wadi Abu Tulayha happened to be incorporated into the wall as a converted construction material from the neighboring outpost. Rather, it seems more reasonable to assume that it was intentionally built in the key wall probably in hope of the safety and eternity of the barrage. It is highly suggestive in this respect that it is a heavy-duty tool for tying something down in combination with a rope. It is probably for this reason that it is much larger in size than the utilitarian goods from the outpost.

In addition, two Hismaic or Thamudic E inscriptions (Inscription 1 and 2) and a Kuffic inscription (Inscription 3) were recovered from either the north wing or the upper fill layer around the Islamic tomb, respectively (Fig. 5). Importantly, the Hismaic letters were inscribed only on the upper exposed surface of the construction materials; no letters were found on the reverse unexposed surface. This means that the barrage antedates the inscriptions, a suggestion that it can be dated to B.C. times. The occurrence of the Kuffic inscription from the lower fill layer also contributes to narrowing down the date of the barrage to some extent.

Wadi Abu Tulayha Barrage 2

Barrage 2 was located *ca.* 200 m east or downstream of Barrage 1 (Fig. 3). Unfortunately, it was poorly preserved; a semi-circular wall and a straight retaining wall attached to it barely survived at the southern edge. This barrage was different in many respects from Barrage 1 that was constructed along the same tributary wadi. First, while Barrage 1 was constructed at an upstream plain, Barrage 2 occupied a slightly dissected downstream valley. Second, while Barrage 1 was situated on a permeable silty sand layer, Barrage 2 occupied an impermeable stony terrain. Another remarkable difference is its smaller dimensions and simpler structure. While Barrage 1 consisted of an elongate, V-shaped wall *ca.* 120 m in total length and varied in structure depending on loci, Barrage 2 was both small in scale and simple in structure. These contrasts allow us to define this small barrage as a simple wadi barrier specializing in reserving drinking water.

The finds from Barrage 2 were limited to four flint artifacts, all of which occurred from the surface and fill layers. Since they are both heterogenous in nature and secondary in archaeological contexts, they are useless for the dating of this barrage. All we can say is that the exis-

Fig. 6 Wadi Abu Tulayha Barrage 1: A close-up view of the outer wall at the converging point (from N).

Fig. 7 Wadi Abu Tulayha Barrage 1: A close-up view of the protruded reinforcement wall (from W).

Fig. 8 Wadi Abu Tulayha Barrage 1: Area C and a general view of the south wing (from SW).

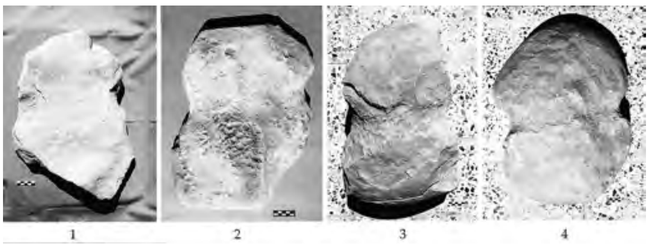

Fig. 9 Bilaterally notched stone weights: 1. Wadi Abu Tulayha LPPNB outpost; 2. Wadi Abu Tulayha Barrage 1; 3. Wadi Ruweishid ash-Sharqi Barrage 1; 4. Wadi Ruweishid ash-Sharqi Barrage 2.

Fig. 10 Wadi Abu Tulayha Barrage 3: A general view (from SW).

tence of the semi-circular protruded reinforcement wall is suggestive of a technological affinity to Barrage 1.

Wadi Abu Tulayha Barrage 3

Barrage 3 occupied a location *ca.* 50 m downstream of Barrage 2, sharing similar topographical conditions with the latter. As was the case of Barrage 2, it was constructed with undressed limestone cobbles *ca.* 30-40 cm long available at the wadi bed. The excavation showed that this barrage consisted of a straight front wall *ca.* 4 m long and a semi-circular rear wall *ca.* 2 m long, and that rubble was packed into a narrow space between the two (Fig. 10). Both walls were a single row wide and preserved to a height of a single course, but the volume of fallen stones scattered around them suggested that they were originally a few courses higher. It is also conceivable that the front wall was originally a few meters longer. This barrage can also be defined as a small wadi barrier specializing in reserving drinking water. The addition of the semi-circular reinforcement wall, though opposite in orientation, is reminiscent of the similar devices of Barrage 1 and 2. The masonry technique that large cobbles were arranged in header bond at the forefront was also in common with the two upstream barrages. These similarities hint at the synchronism or at least technological consistency among the three barrages that were constructed along the same tributary wadi.

Aside from a Jafr blade found in a lower fill layer, no artifacts were unearthed from this barrage. Thus nothing can be said about its date, except that the structural affinities noted above are suggestive of the synchronism with Barrage 1 and 2.

Wadi Ruweishid ash-Sharqi Barrage 1 and 2

The site of Wadi Ruweishid ash-Sharqi, or JF-0104 in our site registration code, lies *ca.* 7 km WNW of Wadi Abu Tulayha, again in the middle of *Hamada*. Two small barrages were found at this site (Fig. 11). As with the barrage system at Wadi Abu Tulayha, the barrage system at Wadi Ruweishid ash-Sharqi was also constructed along a tributary wadi and kept a moderate distance (*ca.* 0.4 km) from the main stream to the east. It is therefore likely that both barrage systems were constructed following the same standard in terms of topographical conditions. It should be added, however, that unlike Wadi Abu Tulayha, this barrage system was not accompanied with a neighboring settlement. In order to double-check the excavation results at Wadi Abu Tulayha, the last few days of the third field season was devoted to a brief investigation of this site.

Barrage 1

Barrage 1 was a small, slightly incurved, stone-built structure *ca.* 30 m in total length and located at an upstream flat terrain of the tributary wadi. It was simple in structure, being constructed with a single row and course of upright limestone boulders. In light of the scarcity of fallen stones scattered around the wall, it probably remained the same from the beginning. As was the case with Barrage 1 at Wadi Abu Tulayha, a small playa was formed in the center of the flooded area encompassed with the barrage wall.

No artifacts were recovered from the original context of this barrage. It is notable, however, that a bilaterally notched stone weight was found among scattered stones around the wall (Fig. 9: 3). It resembles the stone weights from Wad Abu Tulayha Barrage 1 and its neighboring PPNB outpost (Fig. 9: 1, 2), suggesting the synchronism with them.

Barrage 2

This U-shaped structure, *ca.* 60 m in total length, occupied a slightly dissected terrain *ca.* 150 m downstream of Barrage 1. The excavation at the converging point revealed that a retaining wall *ca.* 1.5-2.0 m wide and *ca.* 0.5 m high was constructed leaning against an anthropogenic embankment a few meters wide. Although the poor state of preservation made it difficult to clarify the original form of the wall, a protruded reinforcement wall similar to those attested at the Wadi Abu Tulayha barrage system was barely distinguished near the middle of the converging point. Again, a bilaterally notched stone weight was found incorporated into the protruded reinforcement wall (Fig. 12, arrow). It occupied the right-hand corner of the wall, the same position as the find from Wadi Abu Tulayha Barrage 1. In addition, traces of a washout were confirmed immediately beside the reinforcement wall, another episode reminiscent of Wadi Abu Tulayha Barrage 1.

Again, finds were very scarce. Nevertheless, the occurrence of the bilaterally notched stone weight from none

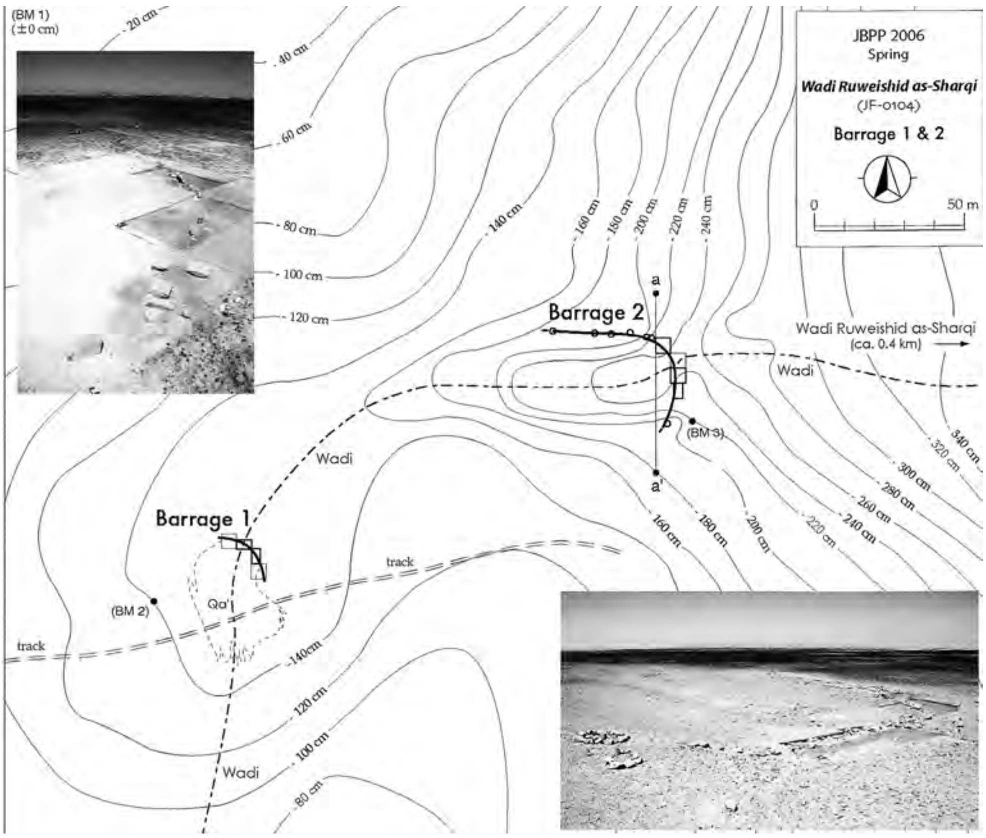

Fig. 11 Wadi Ruweishid ash-Sharqi: A contour map of the barrage system.

other than the right-hand corner of the protruded reinforcement wall strongly suggests the synchronism with Wadi Abu Tualyha Barrage 1. In addition, two C-14 dates were obtained: b.p. 1164±33 [NITA2-11306] from a small hearth found at the base of a pit-type tomb that was dug into (thus younger than) the wall of the converging point, and b.p. 1195±33 [NITA2-11305] from Hearth-01 that belonged to a lower fill layer. Both of these fall within the time range of the early Islamic period and warrant the dating of the barrage to pre-Islamic times.

Discussion

On the basis of excavated evidence, three major issues will be briefly discussed below: the date, function, and archaeological implications of the two barrage systems.

The Date

Barrage 1 at Wadi Abu Tulayha provides reliable clues to this issue. Available evidence – the stratigraphic correlation, the similarity in masonry technique, and the total absence of settlement sites within a radius of a few dozen kilometers around it – suggests that the barrage is roughly coeval with the neighboring LPPNB outpost. (Three C-14 dates – b.p. 8409±41 [NITA2-11406], 8464±51 [NITA2-11408], 8443±51 [NITA2-11409] – are now available for the dating of the outpost.) Of significance is the fact that the barrage yielded the bilaterally notched stone weight similar to those from the neighboring outpost. It seems that the co-occurrence of such distinctive artifacts corroborates the synchronism between the two. In addition, a series of collateral evidence – the existence of Hismaic inscriptions inscribed on the exposed surface of construction materials, the occurrence of early Islamic pottery sherds from fill layers, and the clear stratigraphic gap between the barrage and the early Islamic tomb – also supports the dating suggested above.

Barrage 2 and 3 at Wadi Abu Tulayha, on the other hand, are difficult to date due to the deficiency of reliable evidence. The only clue is the technological affinity to Barrage 1. The existence of a semi-circular reinforcement wall, coupled with the frequent use of header bond technique at the forefront, seems to indicate that both of these were constructed concurrently with Barrage 1. It seems that the total absence of settlement sites around these two barrages (with the only exception of the PPNB outpost beside Barrage 1) is also in favor of the assumption suggested above.

The dating of Wadi Ruweishid ash-Sharqi Barrage 1 and 2 is less troublesome, because the occurrence of the bilaterally notched stone weights suggests the synchronism with Wadi Abu Tulayha Barrage 1 and therefore its neighboring PPNB outpost. This is particularly the case of Barrage 2, because the distinctive stone weight was unearthed from none other than the right-hand corner of the protruded reinforcement wall. Two C-14 dates from Barrage 2 also warrant the chronological assignment of this barrage to pre-Islamic times.

To summarize, Wadi Abu Tulayha Barrage 1 and Wadi Ruweishid ash-Sharqi Barrage 2 can be positively dated

Fig. 12 Wadi Ruweishid ash-Sharqi Barrage 2: A close-up view of the protruded reinforcement wall at the converging point (from S).

to the LPPNB period. Barrage 1 of the latter system is also probably assignable to the same horizon on the basis of the occurrence of the distinctive stone weight. On the other hand, Barrage 2 and 3 of the former system are difficult to date, but a series of technological affinities noted above seems to imply the synchronism with Barrage 1 that was constructed along the same tributary wadi. Taking together, it is highly likely that the two barrage systems can be dated to the LPPNB period.

The Functions

Again, Wadi Abu Tulayha Barrage 1 provides a good starting point. In light of its location across a wadi and the V-shaped profile opening toward the upper course, it is apparent that this unique structure served as a barrage to collect seasonal runoff water of the tributary wadi. Both the extension of walls following contour lines and the contrast in structural strength between the upstream and downstream walls also support the functional identification suggested above. It is also notable that despite the difference in elevation of foundation stones between the upstream and downstream walls, the elevation of the uppermost course is less different from each other. (Given that the wall of the converging point was originally a few courses higher, one might even say that the elevation of the uppermost course was almost unified.) In addition, the attachment of the protruded reinforcement wall to the converging point can also be reasonably understood as an essential device to bear strong sideways water pressure acting on the core part. Thus it is safe to say that Barrage 1 was constructed as a water catchment facility.

The question is its specific use. Was this large barrage used for reserving drinking water or other purposes? A series of circumstantial evidence casts doubt on the first use and is in favor of the latter. To begin with, the location of the barrage at the flat, permeable terrain is incompatible with the use as a reservoir. This is particularly the case of barrages in the Jafr Basin, because it is (and probably was) characterized by the poor precipitation and the large evaporation rate. Thus, the use for an irrigation facility seems more likely, first because the frequency of reaping and grinding tools at the neighboring coeval outpost is suggestive of the existence of a crop field nearby, and second because it is most unlikely that the annual precipitation in the Neolithic Jafr Basin was sufficient to make dry farming possible, as suggested by the total absence of coeval settlement sites other than the outpost at Wadi Abu Tulayha. This functional identification, if accepted, would explain the reason why the barrage occupied, of all locations, the flat and permeable terrain at the eastern edge of the upstream plain, and why it was designed so as to produce a shallow extensive flooded area. It also provides a key to understanding the seasonality of the outpost. It is precisely because it falls on the harvest season of cereal crop probably cultivated inside the barrage that the outpost was used from spring to early summer (Fujii 2006a, 2006b). A series of floral analyses, now in progress, would hopefully provide specific evidence for the cereal cultivation based on the primitive basin-irrigation facility.

Barrage 2 and 3, on the other hand, can be defined as simple wadi barriers specializing in reserving drinking water. The evidence comes from their location at a slightly dissected (thus easier to store water) valley in the lower course. It is also highly suggestive that, unlike Barrage 1, they occupied a stony impermeable terrain including an exposed limestone bedrock layer. Their simpler yet sturdier structure is also consistent with the use as a cistern.

Given these, it follows that the PPNB outpost at Wadi Abu Tulayha used two distinct types of water catchment facilities for different purposes. While the larger barrage constructed at the flat permeable plain in the upstream area was probably used for basin-irrigation, the two smaller barrages constructed at the gently sloping, impermeable valley in the lower course served, most likely, as small cisterns for both the inhabitants of the neighboring outpost and their livestock. It seems that the combination of these two distinct types of barrages first enabled the seasonal yet relatively long stay at the outpost established in the harsh environmental conditions.

Things are slightly different at Wadi Ruweishid ash-Sharqi, where the smaller barrage was situated in the upper course and the larger barrage was located in the lower course. Nevertheless, in view of the location at a flat permeable terrain, there is little doubt that Barrage 1, albeit smaller in scale, was used for a basin-irrigation facility. The frequency of gap between construction materials is also incompatible with the use as a reservoir. The use of Barrage 2, on the other hand, is difficult to specify because of its eclectic nature. It is most unlikely, however, that such a large reservoir was constructed in the middle of *Hamada*, independently of a settlement. In light of the structural affinities to Wadi Abu Tulayha Barrage 1, the use for a basin-irrigation facility seems more likely. (It should be added that the dissection inside the barrage is likely to have been vitalized after the washout of the converging point.)

A question now arises: why was the barrage system at Wadi Ruweishid ash-Sharqi able to specialize in irrigation facilities only? Suggestive in this regard is the fact that unlike the Wadi Abu Tulayha barrage system, it was not accompanied with a neighboring settlement. It is probably for this reason that the barrage system at Wadi Ruweishid ash-Sharqi was lacking in reservoirs and, instead, specialized in irrigation facilities. It is intriguing to hypothesize that it served as an enclave field for the transhumants who made a round trip between a parent settlement to the west and the LPPNB outpost at Wadi Abu Tulayha.

Archaeological Implications

In conclusion, the archaeological implications of the two barrage systems found in the Jafr Basin will be briefly discussed. To begin with, the existence of the barrage system at Wadi Abu Tulayha corroborates the multiple subsistence strategy of the neighboring LPPNB outpost. It is now evident that the outpost was based on hunting (evidenced by the occurrence of wild animal bones and various hunting weapons), short-range transhumance (evidenced by the existence of domesticated sheep and goats among faunal remains), and basin-irrigated agriculture (suggested by the existence of the barrage system as well as the frequency of agricultural utensils). Conversely, such a mixed, risk-diversifying type of economy first made it possible to establish and maintain the outpost in the middle of *Hamada*. This is not to say, however, that the basin-irrigated agriculture using the barrage was always successful. In view of the harsh environmental conditions of the Jafr Basin, the crop field may often have changed into a mere pasture for their livestock especially in a dry year. Nevertheless, the frequency of agricultural implements at the neighboring outpost suggests that a substantial harvest was expected in a usual year. To put it the other way around, the decrease in yield point and/or the loss of yielding stability may have led to the abandonment of the fixed outpost and the consequent pastoral nomadization.

The barrage system at Wadi Abu Tulayha also highlights the careful land choice of the PPNB transhumants. Interestingly, they chose neither the main stream whose seasonal runoff water was difficult to control nor minor wadis where sufficient water flow could not be expected. What they chose instead was the medium-scale tributary wadi that meets the two conflicting conditions: the ease of water control and the predictability of a certain degree of water flow. The same is true of the Wadi Ruweishid ash-Sharqi barrage system, which was also constructed along the moderate-sized tributary wadi with a relatively extensive drainage area. Nevertheless, the existence of irrigated arable land is not the only requirement for the maintenance of an agro-pastoral outpost in the arid periphery. Another requirement, namely, the procurement of drinking water for both the inhabitants and their livestock, should also be fulfilled. Thus the wadi concerned must be enough wide and flat to satisfy the first condition and, at the same time, enough narrow and more or less sloping to meet the second requirement. In this light, the wadi choice of the LPPNB transhumants at Wadi Abu Tulayha makes sense, because the upstream plain provided extensive arable land and the slightly dissected downstream valley was suitable for the construction of cisterns. This in turn explains the reason why they did not locate themselves along the tributary wadi of Wadi Ruweishid ash-Sharqi.

Concluding Remarks

The 2006 spring field season of the Jafr Basin Prehistoric Project has shown that two barrage systems operated in combination with a LPPNB agro-pastoral outpost established by initial transhumants. This probably means that the irrigated agriculture as well as simple water management dates back to the 7th millennium B.C. The existence of the two barrage systems in the Jafr Basin, coupled with the finding of a small wadi barrier at Wadi Badda (Fujii 2007c), similar features at Ba’ja (Gebel 2004), and terrace walls at Dhra’ (Kuijt *et al.* 2007), highlights that the study of the Neolithic water management has already entered a stage of in-depth discussion based on specific evidence.

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Field Report

Renewed Excavation of the PPNB Site of Beisamoun, Hula Basin

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Introduction

The Hula Basin, located in the northern part of the Jordan Valley, enjoys a moderate Mediterranean climate. This region has played an important role in the prehistoric occupation of the central Levant since its rich ecosystem offered people the possibility of long-term occupation of one area. As part of the central Jordan Valley, it would have served as a conduit for East-West and North-South migration/exchange of populations and/or materials. Thus, the Hula Basin is particularly suitable for exploring environmental exploitation systems and cultural as well as biological transmission over time as well as between groups inhabiting the same region. The site of Beisamoun in the Hula Basin is a key PPNB location that can provide important information on these issues.

The major occupation phase at Beisamoun dates to the Pre-Pottery Neolithic B but Pottery Neolithic and Bronze Age deposits are also present, as attested to by archaeological finds and recent rescue excavations conducted by one of us (H. Kh.).

Since the early 1950s the area of the PPNB site was extensively investigated as fish-breeding ponds were dug into the underlying Neolithic settlement and partly destroyed the archaeological layers. The subsequent drainage of these ponds enabled A. Assaf (Curator of the Mayan Baruch Museum of Prehistory of the Hula Basin) to collect a large PPNB assemblage and to demarcate the extent of the site to an area of 10 ha. In 1969, a French team supervised by M. Lechevallier (CNRS) began mapping the structures discernible at the bottom of the different ponds, and this was followed in 1972 by a 70 m^2 salvage excavation (Lechevallier 1978). This area yielded a rectangular structure with a well preserved plaster floor. It was associated with several graves, numerous artefacts and, among other unexpected findings, two plaster skulls. No radiometric dating was undertaken.

During the summer of 2007, a two-week long exploratory field season was held from 24 August to 7 September in order to test a large area at the north-western part of the site (at the location of the modern fish pond number 11). A surface of 3000 m^2 was mechanically cleaned. Within this area, one sector of 76 m^2 was excavated from 0.20 m to 0.50 m in depth (Sector E) and three long trenches were opened (Trenches 1, 2, 3).

Sector E Stratigraphy

Four levels were recognized in Sector E:

• Level 0 (from 10 to 30 cm deep) comprises a black, modern sediment very rich in archaeological finds dating to the PPNB. This level is superficial in the south-western part of the sector but deepens towards the north-eastern side.

• Level I is a brown-greyish sediment, rich in finds and contains the uppermost stone structures.

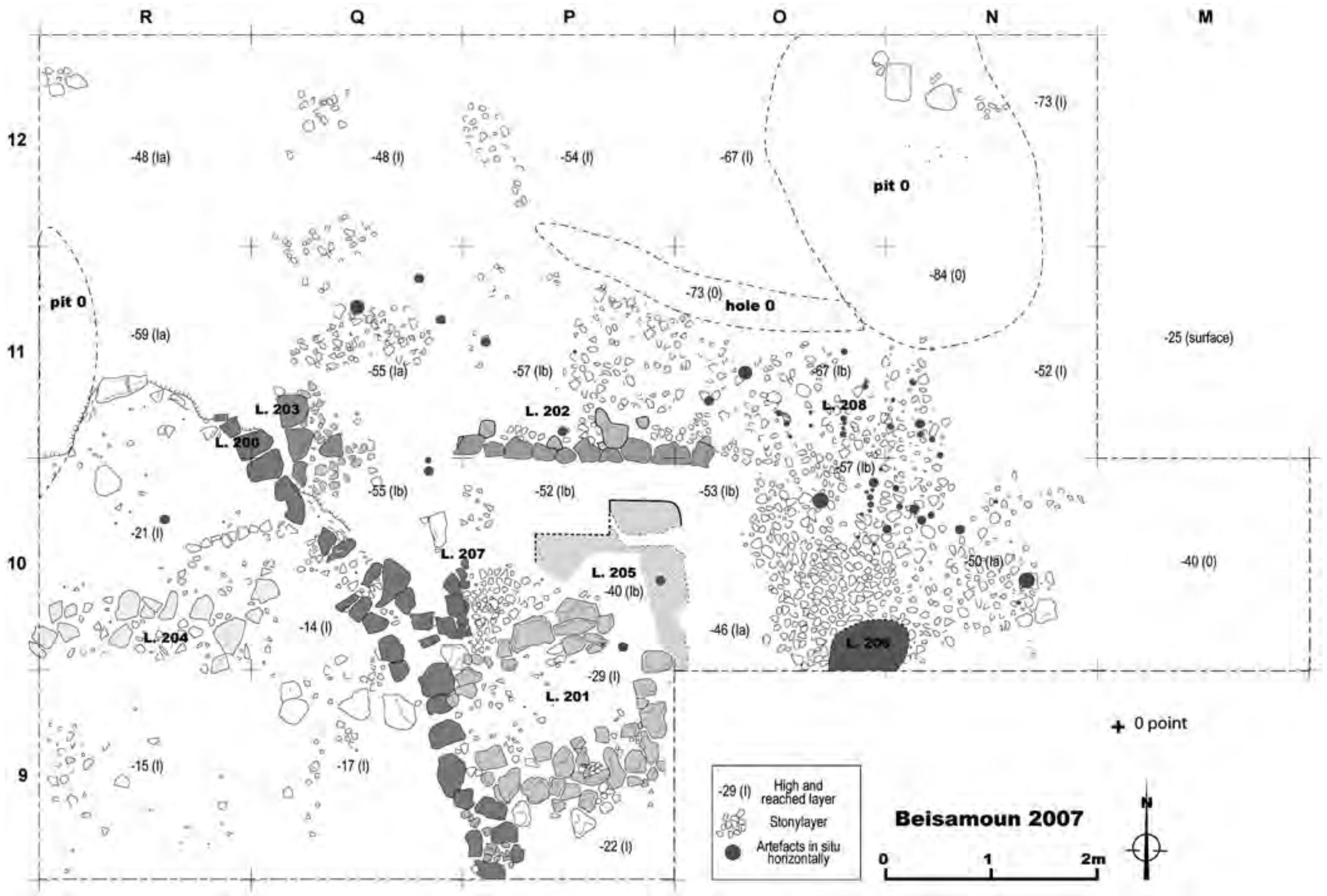

Fig.1 General map of the 2007 season at Beisamoun, Sector E (drawing: Marjolaine Barazani, CRFJ).

• Level Ia is a fine-grained brown-yellowish sediment, relatively poor in finds but has yielded the second level of structures. It is underlain by the earlier occupation layer,

• Level Ib, which was found at the end of the excavation season, under a floor level associated with Layer Ia that covered a large area of the sector. This is a fine-grained sediment similar to that found in Layer Ia but very compact and richer in charcoal and ochre specks. Six charcoal samples from Layers I, Ia and Ib have been submitted for dating.

Within these levels, nine loci were recognised and partly excavated (Fig. 1). At least two phases of construction were recognized, and both probably relate to the very end of the PPNB.

From the earlier occupation layer found so far, we have exposed five loci. Three of them are segments of walls:

• Locus 203 is a wall comprising two rows of stones oriented NNW-SSE. This wall was exposed for one meter and then underlies Locus 200.

• Locus 202 is oriented east-west and is made up of stones and mud bricks. It is preserved for 2.4 m in length.

• Locus 207 is a wall of two-courses oriented perpendicularly to the previous one.

• Locus 205 is a sort of platform made of a 20 cm thick, hard calcified white material showing a stair pattern on its west side and a curved pattern on the north-east edge (Figs. 1 and 2). A bloc-sample of this locus was taken and is being examined by F. Berna (Boston University). It may represent the remains of a poorly preserved plaster floor. Its northern limit is strictly parallel to wall 202, probably part of the same structure.

• Lastly, Locus 208 is a stony area strewn with numerous items discovered in a flat position, on or between the stones. They are the testimony to an unplastered floor level.

Four loci are part of a second phase of occupation.

• Locus 200 is a wall of two-ranges, oriented NW-SE, and currently exposed only for 5.30 m (Figs. 1 and 3).

• Locus 201 is an oval structure made of two or three rows of stones adjoining wall 200.

• Locus 204 comprises two rows of stones which are visible on the surface of the excavated area.

• Lastly Locus 207 is an oval pit that penetrates Layers I and Ia, destroying part of floor 208.

Both phases of construction are directly on top of each other, suggesting that there was no major interruption in occupation between them. We have investigated the later

Fig. 2 View of Loci 202 and 205 from the east, Sector E.

Fig. 3 View of Loci 200 and 201 from the south, Sector E.

period less than the earlier one. This may appear as a paradox but, in fact, the later structures are preserved only in the SW corner of Sector E, an area enlarged only during the second week of the excavation.

Tools

Preliminary observations of the flint assemblage from the 2007 season at Beisamoun (more than 7000 artefacts) indicate that the flint industry is domestic and most of the knapping activities took place on-site, which is typical of large, permanent sites. This conclusion is based on the variety of the lithic material (cores, waste, debris and tools) and of the chipped stone technologies (blade, bladelet, flake and bifacial tools). Despite the stratigraphic distinctions, the flint assemblage seems to be homogenous in raw material acquisition and mode of production. Technologically, the high frequency of bidirectional blade technology that is characteristic of the PPNB (*e.g.* Abbès 2003; Khalaily 2006) is noteworthy. The assemblage also includes a classic naviform blade technology made on high quality purple flint. As for the tools, two types of sickle blades are present: sickle blades that display fine denticulation, mainly on the ventral face and high luster on their working edges, together with deep denticulated sickle blades that have been shaped on bidirectional products; a few unpolished axes and long Amuq points that have been shaped by pressure retouching were also recovered.

Based on these techno-typological observations, it is possible to attribute the assemblage to the later stage of the PPNB period. This attribution is also based on the appearance of bladelet technology and standardized tools such as deep denticulated sickle blades and pressure retouched Amuq points that are characteristic of the Early PN Yarmukian culture (Rollefson 2003; Gopher *et al.* 2001).

Knapping industries are also represented by fine-grained basalt cores and flakes as well as obsidian pieces. Fourteen of them were collected during this season (three blade fragments, four bladelet fragments and seven debris). All belong, *a priori*, to the same raw material, a homogeneous, grey translucent obsidian with small black inclusions.

Fragments of grinding stones, numerous mullers, a few bowls, and discoidal items made out of limestone or vesicular basalt, were also found.

Twenty-three artefacts manufactured from animal elements (bone and antler) were found. Most of them derive from Level Ia. Two main tool categories were recognised in the sample – pointed tools and cutting ones. Most are made of bone. Metapodials were selected for awls and ribs for flat knives. Obvious technical reasons have guided these choices. Several techniques have been recognized – percussion, sawing, shaving, grinding – while at least two methods of debitage were practiced: fracturing and bipartition. These technical choices are usual in PPNB contexts, and some are inherited from the Natufian (Le Dosseur 2006). A bigger sample is needed to discuss the possible unique features of the Beisamoun bone tool kit.

Fauna

The new excavations at Beisamoun have yielded a small (*ca.* 400 bones from Layers I and Ia) but interesting sample of well preserved animal bones, the majority of which comprise remains of what have tentatively been identified as wild species: *Bos* cf. *primigenius, Sus scrofa* fer., as well as *Gazella gazella*. The caprine *(Ovis/Capra)* remains comprise a minority of the identified finds (Table 1). The majority of caprine bones are undetermined as to species, but goats, and no sheep, have been positively identified to date. At least one slightly twisted goat horn core of an animal, tentatively identified as *Capra* cf. *hircus*, was found in Layer I, but the status of the caprines from the other layers cannot be absolutely determined at this stage of the analysis.

The low frequency of caprine remains found in this sample is unusual for PPNB assemblages from the south-

Table 1 Fauna species identified at Beisamoun.

	Ducos Surface		Davis Excavation		This Study Layer I		This Study Layer Ia	
Species	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%)**
Gazelle *(Gazella gazella)*	38	4.0	11	14.5	4	8.0	7	16.0
Bezoar goat *(Capra aegagrus)*	22	2.0	-	-	-	-	-	-
Capra sp.	-	-	41	52.5	2	4.0	-	-
Mouflon sheep *(Ovis orientalis)*	34	3.5	-	-	-	-	-	-
Caprines *(Capra /Ovis)*	77	8.0	-	-	7	14.0	-	-
Aurochs *(Bos primigenius)*	-	-	1	1.0	23	46.0	18	41.0
Domestic cattle *(Bos taurus)*	475	49.0	-	-	-	-	-	-
Hippopotamus sp.	3	0.3	-	-	-	-	-	-
Donkey *(Equus* cf. *asinus)*	5	0.5	2	2.5	-	-	-	-
Boar/Pig *(Sus scrofa)*	188	19.5	21	27	14	28.0	19	43.0
Fallow deer *(Dama mesopotamica)*	11	1.0	-	X	-	-	-	-
Medium mammals	107*	11.0	-	-	-	-	-	-
Wild cat *(Felis silvestris)*	-	-	2	2.5	-	-	-	-
Total	*960#*	*100*	*78*	*100*	*50*	*100*	*44*	*100*

* Includes Ducos's small ruminant and small bovid categories (Ducos 1978: 264)
# Total is 960 and not 962 as noted in Ducos (1978: Table 4)
x = present, no number specified

ern Levant, since by the MPPNB caprines comprise 40-50% or even more in other Jordan Valley assemblages (Horwitz and Ducos 2005). The high cattle frequencies in the new Beisamoun sample closely resembles the PPNC assemblages from Hagoshrim and Tel Te'o in the Jordan Valley, where cattle frequencies comprise 30% or more of the identified fauna relative to frequencies of caprines and gazelles, and the LPPNB sites in this region with frequencies of circa 25% cattle (Horwitz and Ducos 2005). These researchers have suggested that such high proportions indicate that by the PPNC in the southern Levant, cattle were domesticated or in the course of this process. A cursory examination indicates that in size and robusticity the Beisamoun cattle are similar to wild forms, but this is a feature that needs to be examined in greater detail.

The new Beisamoun assemblage differs in the range of taxa represented and their relative frequencies compared to the samples previously recovered from this locality and analyzed by Davis (1978) and Ducos (1978) (Table 1). These differences may stem from the smaller size of the new sample, differences in past human activities undertaken in this particular part of the site, or even chronological differences between the assemblages.

Botanical Remains

Soil samples from Layers I, Ia and Ib were checked for botanical remains (Fig. 4). Within Layers I and Ia, palynomorphs reflect a humid and poorly oxygenized milieu of fossilization of the different identified micro-remains. This might be a result of recent botanical pollution during the time of the fish-breeding ponds. In contrast, Layer Ib shows a spectrum typical of dry conditions, with a high proportion of Chenopodiacae in the pollen spectrum. However, very few taxa were identified in this layer and this result may be due to differential preservation of the fossils rather than a testimony to a dry climate. These first botanical samples taken at Beisamoun cannot as yet be interpreted in terms of palaeoenvironment, but this issue will be pursued as micro-remains preservation improves as the excavation of the archaeological layers deepens.

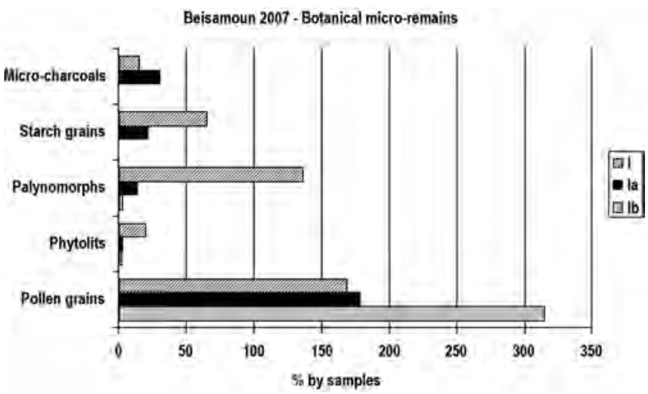

Fig. 4 Percentage of botanical micro-remains in three soil samples from Sector E, Layers I, Ia and Ib.

Trenches

Besides the exploration of Sector E, we also opened three long trenches (0.6 m wide and 10-15 m long) using a mechanical excavator. Two of them are oriented north-south (Trenches 1 and 2) and the third one is oriented east-west (Trench 3). They have provided a long archaeological sequence with at least three different stratigraphic units preserved from 0.20 m to 1.20 m depth. This occupation sequence seems mainly to be associated with the Late PPNB. Like Sector E, the sub-units I, Ia, and Ib are also present in the trenches, except in the east side of Trench 3 where the stratigraphic sequence differs. Four thick walls were found in Trench 2 parallel to each other, oriented east to west. In Trench 3 one wall and two very well-preserved plaster floors were discovered. At the base of all trenches, a dense black organic layer was found, probably the deposit of the now extinct Hula Lake.

Conclusion

Recent excavations in the Levant have reshaped our knowledge of the Late PPNB, in particular the megasite phenomenon. However, in the western part of the Jordan Valley and in the Jordan Valley itself, the end of the PPNB is still unclear. The results of the first season of renewed excavations at Beisamoun demonstrate the preservation of a promising and undisturbed part of a LPPNB village. This is an excellent opportunity to clarify the issue of the end of the PPNB in this central area of the Levant.

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Ba‘ja 2007. Two Room and Ground Floor Fills: Reconstructed House-life Scenarios

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Introduction

Field observations made during the 7th season of excavations carried out under the directorship of H.G.K. Gebel in the LPPNB site of Ba‘ja near Wadi Musa, Southern Jordan, brought us the insight that extensive large-scale exposures of the LPPNB architecture provide only a limited understanding of the use of its vertical space. Instead, the excellent preservation of the Ba‘ja architecture (up to 4.5 m in height) and stratigraphy often reveal valuable contextual insights. The excavation of the deeper stratigraphies of two buildings in Area B-North (Unit of BNR17 and BNR22/23) provided unexpected information about the general settlement development and the history of house use in particular. In this article the combined analysis of architectural findings, stratigraphy, finds and other aspects from both buildings is presented in order to promote a better understanding of the two-storied LPPNB architecture and of the specific formation processes and scenarios of house-lives.

Architectural Findings (M.K.)

The architecture in Area B-North is characterized by (at least) two-storeyed buildings, already described elsewhere (Gebel 2006; Gebel, Hermansen and Kinzel 2006; Gebel and Kinzel 2007; *cf.* also for the definitions of terms used in this contribution). Hitherto it was impossible to isolate individual house units, if such existed at all architecturally in the later parts of occupation. However, by combining the general thoughts on passageway analyses provided in Kinzel 2004 and the recent findings in Ba‘ja we are now able to describe single units (room associations) as a part of complex structures. The two examples featured in this article belong to two different house units, which have no recognisable connection. Both represent “central room” features with their ground floor structures. In Ba‘ja, a ground floor could have had a very shallow elevation. Ground floors near the bedrock could be crawl or pit-like spaces established by substructure-type walls (Gebel and Kinzel 2007) which evened out the inclination of the bedrock and supported the first floor. The general layout in Area B-North is based on a cellular concept using “angled (or bent) walls”, “buttresses”, “tongue walls” and “modular units”.[1] This very flexible system allows for plenty building modifications in already existing structures.

Unit BNR17

Room 17 is approximately 3 x 3 m and signifies an upper “central room”. It is characterized by two opposed buttresses on the northern and southern walls (Fig. 1). These buttresses rest on the solid “supporting structure grid” of the ground floor (BNR17:105,113). The “supporting structure grid” was built on cultural deposits and abuts bluntly against Walls B22:10-11; B32:7,18; B33:5 and B23:3-5, confining Room 17; Walls B23:5 and B22:10 were founded directly on the bedrock. The “central room” and its ground floor structures belong to a building unit south of Room 17, at least with Rooms 7-10. The Wall Opening B32:13 in the southern part of Room 17 and next to the Buttress B32:7 was blocked later.

Room 17 is defined by the already existing walls of the surrounding structures. It seems that parts of the eastern Wall B22:10 and the southern Walls B32:7 and 18 were rebuilt at the same time as the “supporting structure grid” and the “central room” were inserted. The upper part of Wall B22:10 was built more irregularly than its lower parts. Even the stone material is more cobble-like and not well dressed. However, it could be also part of a later maintenance or repair of the wall.

The small ground floor Cells 17.1, 17.2 and 17.3 are isolated and only accessible from above. Unfortunately, the findings offered no hints on the question: were these accessible by (floor) openings, and how were they built and covered? The small ground floor cells are an example for the above-mentioned crawl or pit-like spaces. BNR17.1 and 17.3 are only 50 to 60 cm deep (Fig. 2a, 7).

The findings of Room 17 indicate that there were several building events, including building lot preparation, construction, changes of space and function, and several events of dilapidation and deconstruction (*cf.* below, “Stratigraphy” and “Reconstruction of House-life Scenarios”).

Unit BNR22/23

Room 22/23 measures some 2.5 x 3.0 m and represents part of a ground floor (Fig. 1). It is surrounded by the

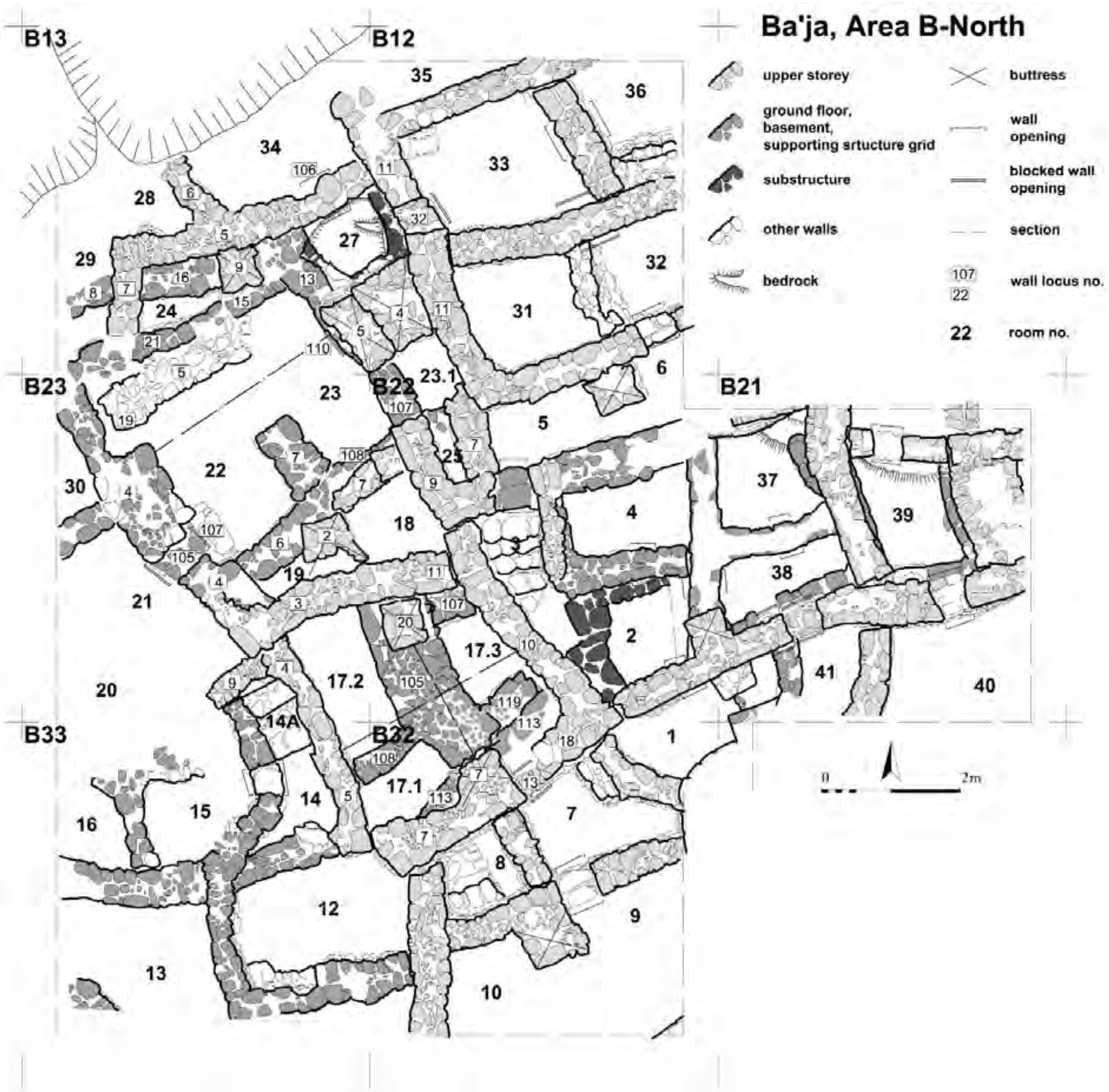

Fig. 1 Ba'ja, Area B-North: Ground plan. Scale 1:100 (M.K., C.P.).

following walls: in the west by Wall B23:4, in the south by Walls B23:6 and BNR23:108, in the east by Walls BNR23:109 and B13:13, and in the north by Wall B13:6. The space is divided by the tongue wall B23:7 into Rooms 22 and 23. The tongue wall abuts bluntly against Wall BNR23:108 but connects with Wall B23:6 in the west. In the ground floor, cobble-faced walls of undressed lime- and sandstones were used. Probably ground floor walls were not plastered in their lower wall parts. The ground floor walls (*e.g.* B23:6-7 and BNR23:108-109) supported the upper storey's ceiling. The maximum ground floor height was about 1.30 m.

The upper storey "central room" covers the ground floor Rooms 22/23, 27, 19, and 23.1, and measures approximately 3.8 x 5.5 m; it is characterized by two interior opposed (twin) buttresses (B13:9 and B23:2), and another pair of twin buttresses (B12/13:5-4 and B23:4) constructed more massively than the others. The function of the latter buttresses isn't clear yet. From the "central room", Room BNR18 was separated by the small Wall B22/23:7, built on top of Wall BNR23:108. The walls of the "central room" were built of dressed sandstone slabs set irregularly with inserted wedge stones. Its walls were plastered with lime and mud plaster. Wall Opening BNR22:105 connected the Rooms 22 and 21 and was blocked later. Wall Opening BNR23:110 was also blocked when Buttress B12/13:4 was erected, which interrupted the connection to Room 23.1. Wall Opening BNR27:104 still connected the "central room" with Room 34 in the north. Via the Wall Opening B12:32 in Wall B12:11 (which seems to be partly blocked), the "central room" belonged to a room sequence which included Rooms 33 and 36. In an earlier stage, there was a connection to Rooms 31 and 32. In addition, they were connected to the "central room" which existed above the ground floor rooms BNR2-6 and 37-38. The function of

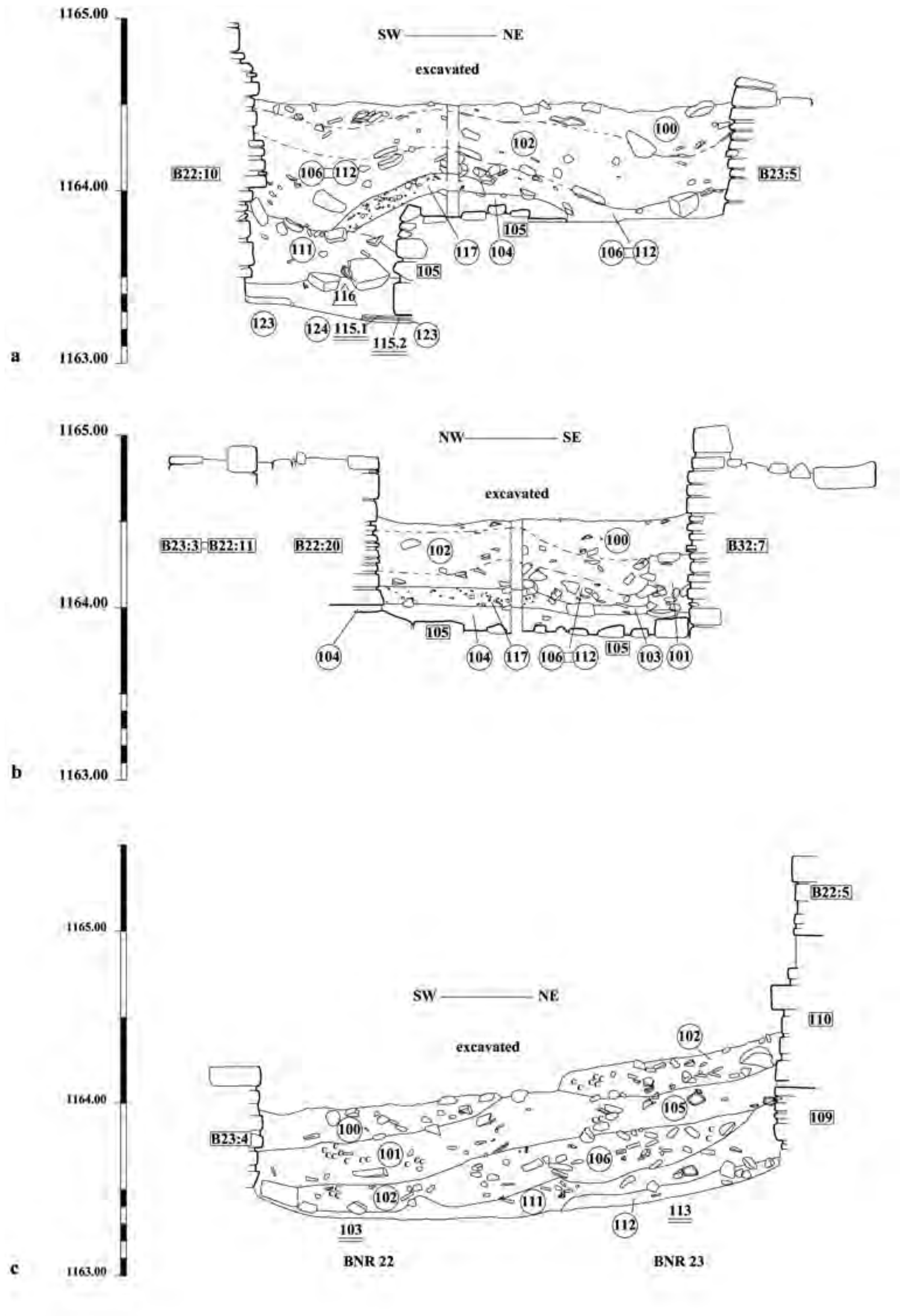

Fig. 2 Ba'ja , Area B-North: Room fill sections of Unit BNR17 (a-b) and BNR22/23 (c), Scale 1:40 (C.P., A.M.H.).

structure B22:7,9 is unclear yet. Walls 7 and 9 run parallel N-S for 1.5 m at some 25 cm distance only. It could be the foundation for a wooden/ mud stair construction leading up to a second storey or the roof. The Room 22/23 situation shows clearly the use of two-storeys, and a complex re-arrangement during its use and after.

The Stratigraphy (C.P.)

Unit BNR17

The stratigraphy of BNR17 is clear (Figs. 2a-b and 3). Most of its confining walls are founded considerably deeper than the floors and the interior "supporting structure grid". Where the foundation has been reached by the excavation, walls rested directly on the bedrock (B23:5 and the lower part of B22:10). The northern wall (B23:3=B23:4=B22:11) must also have had a bedrock foundation, as indicated by the stratigraphic sequence. Only the southern Wall B32:7 was founded upon cultural debris (BNR17:122=125).

After erecting the Walls B23:5, B23:3 and the lower part of B22:10, the space between – which later became Unit 17 – was an open space. Its sloping bedrock triggered the natural accumulation of gravel deposits (BNR17: 126) against Wall B23:3. Above, cultural layers (BNR17: 122=125) rich in charcoal and ash were deposited. These deposits either represent hearth dumps from the adja-

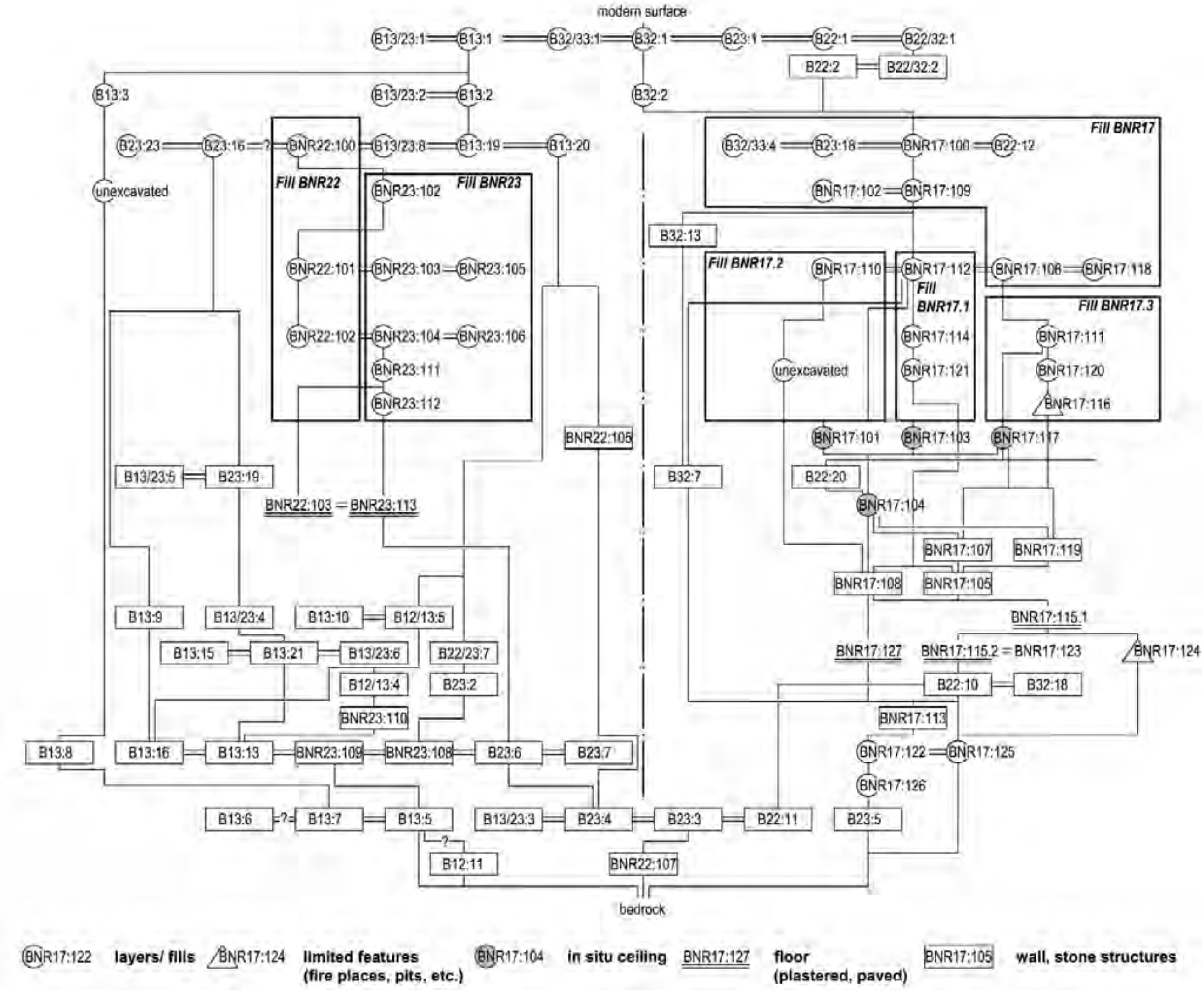

Fig. 3 Ba'ja , Area B-North: Stratigraphic chart for Unit BNR17 and Unit BNR22/23 (C.P.).

cent dwellings and/or have intentionally been inserted to create a levelled building area. After an unknown period of time, the southern adjacent building or at least its northern outer wall (BNR17:113) was built. Some time later the space of Unit 17 was integrated into the southern building. Interestingly, all preserved plaster floors (BNR17:127, 115.2, 115.1) extended onto the walls BNR17:113 and B22:10 but are stratigraphically clearly older than the interior "supporting structure grid" (BNR17:105, 107, 108 and 119). The plaster floor sequence consisted of two red stained plaster floors (BNR17:115.1 and 115.2) in Room 17.3, and only one in Room 17.1. Probably the stratigraphic sequence is more complex than illustrated in Fig. 3. It seems quite possible that further building events are hidden by the exceptionally massive Wall BNR17:105. Its original thickness might have been enlarged after the second plaster floor (BNR17:115.1) was inserted into Room 17.3. The upper storey was erected after this "supporting structure grid" had been constructed in the former open space. This is clearly demonstrated by the embedded ceiling materials Locus BNR17:103, 104 and 117 upon which the Twin Buttress B22:20 was built.

From this point on Unit BNR17 served as part of a larger dwelling which extended further south. Both were connected by a small wall opening in the upper storey. It was blocked later by stones (B32:13) as a consequence of the abandonment of Unit 17. This abandonment was probably caused by a fire that caused the roof to collapse. This is indicated by the large quantities of ashes mixed with roof and wall collapse materials (BNR17:106), covering directly the *in situ* ceiling in the western part of Unit 17. This ashy material continued into the room fills of Room 17.1 (BNR17:112) and Room 17.2 (BNR17:110). In the eastern part of Unit 17 it gradually shifted into unburned dilapidated roof material (Fig. 4a). The roof ceiling material itself was sealed off by several layers (BNR17:102,100), mainly consisting of compact clayish material mixed with disintegrated lime/ plaster and wall stones. These may also represent collapsed roof material intermixed with the material of dilapidating walls. Even if there are no clear borders

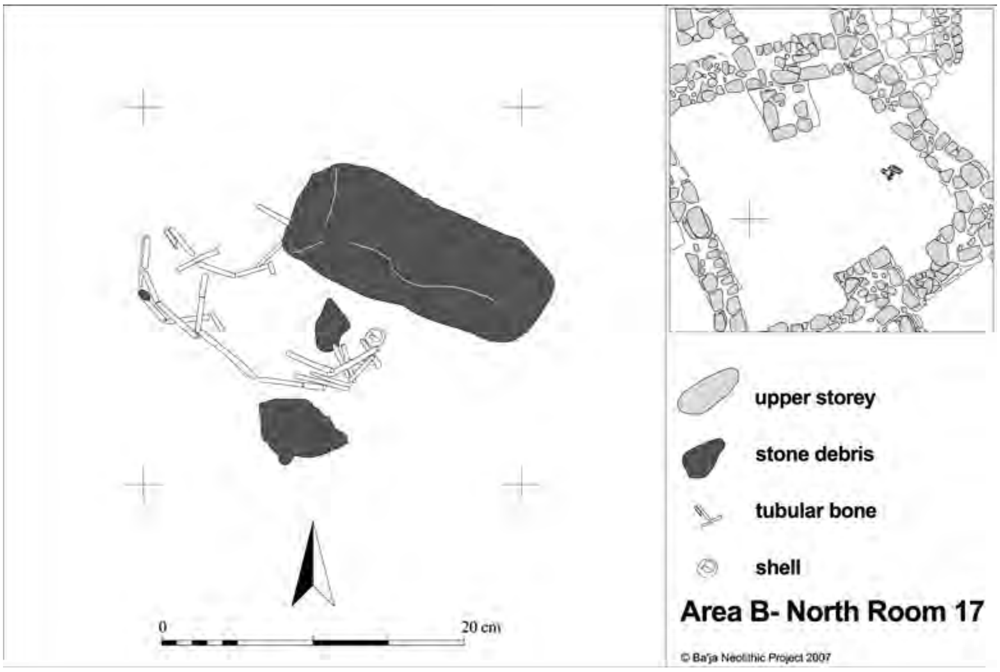

Fig. 4a Ba'ja, Area B-North. Bone necklace *in situ* (BNR17:118). Scale 1:5 (C.P.)

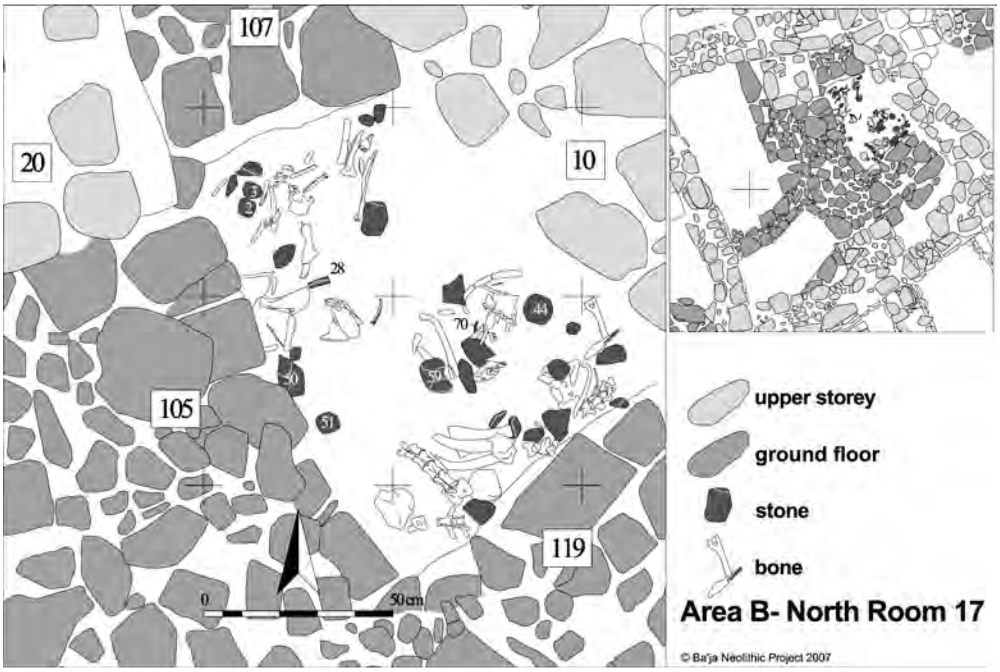

Fig. 4b Locus BNR17:116 in Room BNR17.3. Scale 1:20 (C.P.)

between Layers BNR17:100, 102, and the unburned part of BNR17:106, a roof collapse in several stages is suggested as an interpretation. However, the *in situ* find of an entire and articulated bone necklace (BNR17:118) near the border of BNR17:106 and BNR17:102 suggests a fast collapse of the roof after the terminated use of Room 17.

The stratigraphy of both Rooms/Spaces 17.1 and 17.3 provide a similar pattern. Above the plaster floors special find associations were attested, some of which still reflect their primary contexts; the finding BNR17:116 in Room/ Space 17.3 rested 3 cm above the floor, separated from it by a thin sediment layer (Fig. 2b and 4b). Above, it was followed by collapsed ceiling material (BNR17:111 and 114). Artefacts like grinding tools were embedded particularly in its lower part, with a tendency to concentrate near the room/space corners.

Unit BNR22/23

(based on the field records by Anne Mette Harpelund)

The stratigraphy of the dwelling associated with the Rooms 22 and 23 is not finally clear yet (Fig. 2c and 3) since only the southern parts of the Rooms 22 and 23 have been excavated. Furthermore, the northern part of this building witnessed several modifications, difficult yet to interpret in terms of their stratigraphic sequence. The alteration of the original ground plan by the blockage of several wall openings (*e.g.* BNR22:105 to west, B12:32 to east) makes the stratigraphic understanding even more

Table 1 Fill assemblages of Unit BNR17 (artefacts of 2007 only).

		Stone Industries											Bone Industries		
		Grinders (complete/*fragment*)					**Stone Rings**					**Chipped Stone**	**Worked Bones**	**Small Objects**	**Samples**
Room: Locus	**volume in m²**	grinding slabs/ saddle shaped	Grinding slabs with depression	handstones	pestles	handstones/ pestles	Stages 1-2	Stage 3	Stage 4a	Stage 4b	Stages 5-6				
17:100	1.289	1/1	0	2/4	0	0	2	0	0	5	24	unspecific workshop refuse 4 borer 1 celt 1 fanscraper 1 Byblos-point 1 Jericho-point 2 pyramidal cores	1 awl	1 Mother-of-Pearl (MOP) ring, fragm. 1 MOP fragm. undet. 1 bead-like limestone pendant 1 sandstone slab, fragm.	
17:101	0.027	0	0	0	0	0	0	0	0	0	1	unspecific workshop refuse			
17:102	2.276	2	0	5/5	0	0	9	0	2	12	55	specific workshop refuse 3 borer 1 knife/ spearhead 1 celt 1 scraper 1 sickle blade 1 serrated blade 1 Amuq-like point 2 Jericho points 3 celt preforms 2 pyramidal cores 1 bidirectional core	1 spatula 1 spatula, fragm. 2 awls 2 awls, fragm. 2 needle-like awls, fragm. 1 needle, fragm.	1 MOP ring, fragm. 1 grooved stone	1 piece of "greenstone" 1 fossil bivalve wall plaster (red)
17:106= 17.1:112	2.764	2/3	2/1	9/10	0/1	1	26	1	8	7	68	specific workshop refuse 2 borer 3 microborer 7 celts 2 endscraper 1 tanged knife 1 serrated blade 2 Amuq-like point 1 Byblos-point 3 Jericho-points 1 celt preform 3 pyramidal cores 2 bidirectional cores	1 necklace (=BNR17: 118) 2 rings, fragm. 1 awl 2 awls, fragm. 3 needle-like awls 1 needle-like awl, fragm. 1 needle, fragm. 1 raw form	1 MOP ring, fragm. 1 MOP pendant, fragm. 1 MOP fragm. undet. 1 stone weight 1 small stone weight, fragm. 1 limestone palette 1 stone spheroid	1 piece of haematite 1 fossil shell wall plaster (red)
17.1:109	0.346	0	0	0	0	0	2	0	1	0	7	unspecific workshop refuse 1 celt		1 MOP fragm. undet.	
17.3:111	0.294	0	0/1	0	0	0	0	0	0	2	4	unspecific workshop refuse 1 Amuq-like point		1 stone bowlet	1 fossil bivalve
17.3:116	0.170	1/3	0	2/5	0	0	3	0	0	0	1	unspecific workshop refuse 1 scraper 1 Amuq-like point		1 stone weight, fragm., (red pigment attached) 1 "greenstone" bead, fragm. 1 *Conus sp.* bead 1 *Nerita sp.* (?) bead	2 pieces of "greenstone" 1 piece of haematite 1 piece of azurite (?) wall plaster (red)
17:118													1 necklace (ca. 49 tubular bones, 1 shell bead)		
17.3:120	0.051	1	0	0	0	0	1	0	0	0	0	unspecific workshop refuse 2 borer			
17.1:121	0.209	0	0	0	2/1	1	2	0	1	3	7	specific workshop refuse 1 borer 1 multiple burin 1 cortical scraper 1 sickle blade 3 Amuq-like point 1 pyramidal blade core			
		7/7	2/2	18/24	2/2	2	45	1	12	29	176				

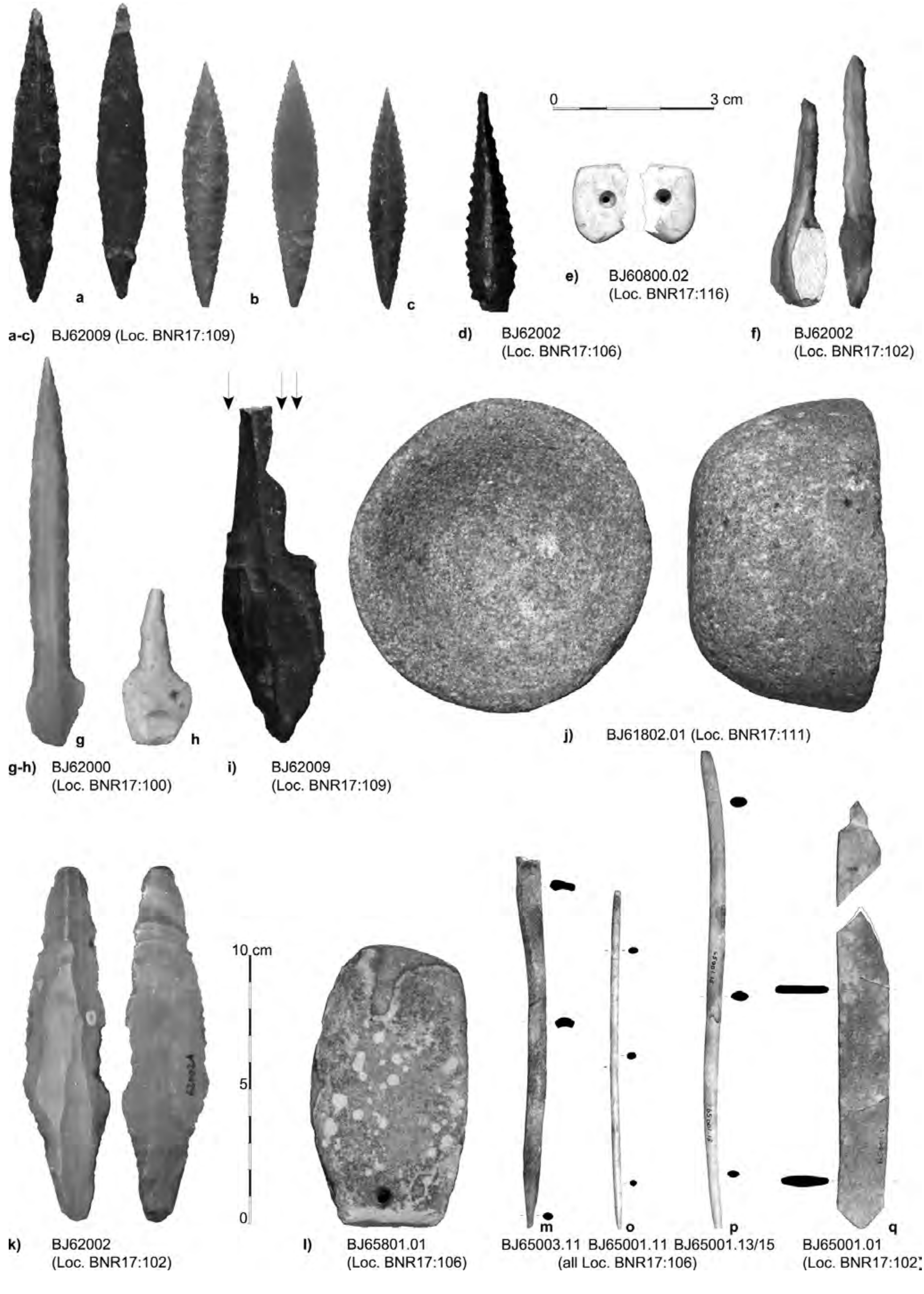

Fig. 5 Ba'ja , Area B-North: Selected artefacts from the fill assemblages of Unit BNR17. a-d: projectile points (arrowheads), e: cuboid "greenstone" bead, f-h: borers, i: burin, j: stone bowlet (limestone), k: knife/ projectile point?, l: perforated palette/ weight (limestone), m-p: needle-like bone awls, q: bone spatula (scales a-j: 1:1, k-q: 1:2) (C.P.).

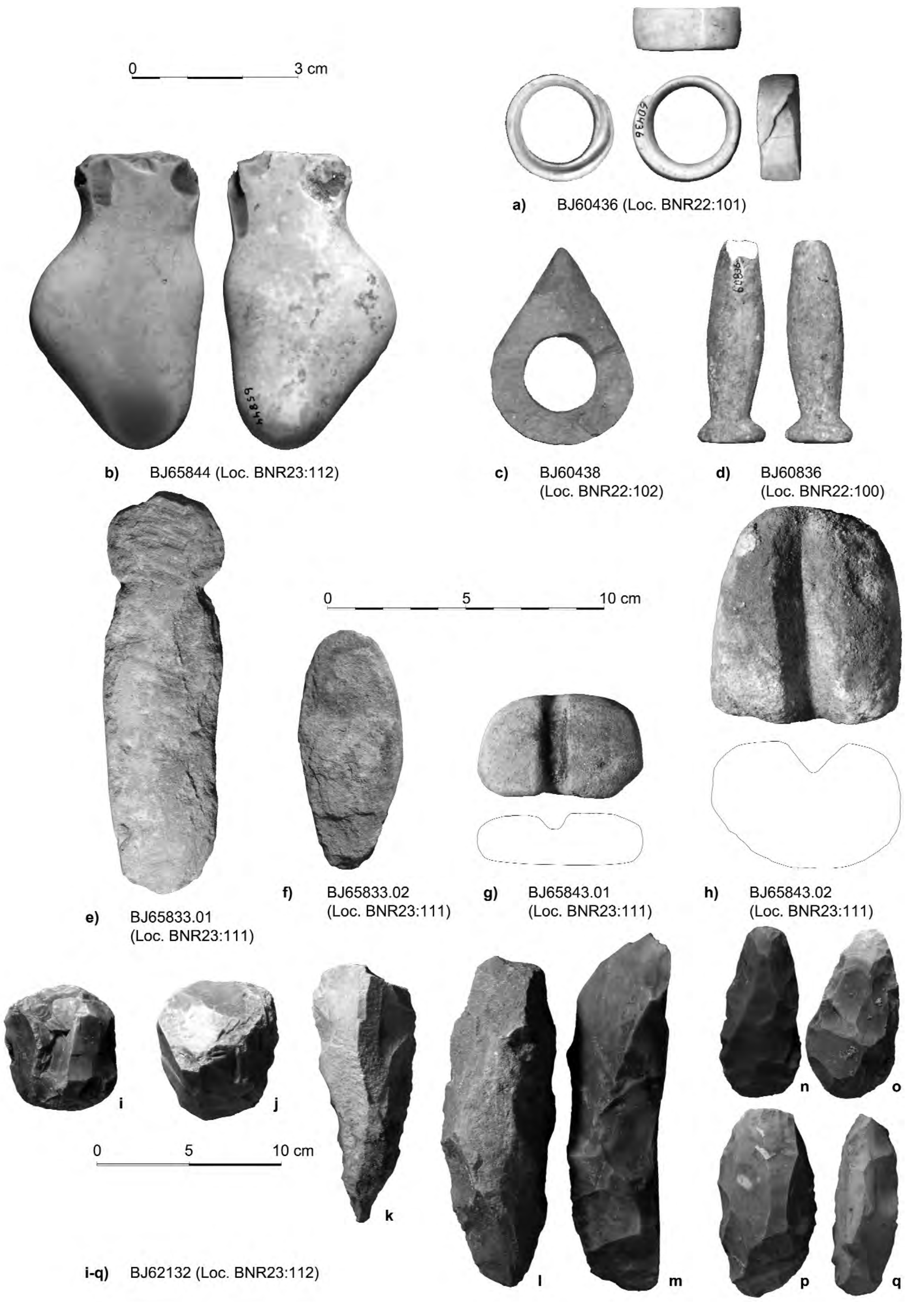

Fig. 6 Ba'ja , Area B-North: Selected artefacts from the fill assemblages of Unit BNR22/23. a: shell ring (*Conus* sp.?), b: *Flintkind* with traces of red pigment, c: paillette or fastener? (sandstone), d: ear ornament? (soft limestone?), e-f: (waisted) sandstone palettes, g-h: "grooved stones" (limestone, white sandstone), i-j: knapping? stones/hammer-stones, k-m: heavy-duty tool performs, n-q: celts (scales a-d: 1:1, e-h: 1:2, i-q: 1:3) (C.P.).

complicated. Thus, the following description refers to the ground plan of the latest occupation and to Rooms 22 and 23 in particular.

The oldest architectural remains are represented in Wall BNR22:107 and must belong to a building extending further east. It served as a foundation for the western confining wall B23:4. Wall B23:4 joins with Wall B23:3 which already represents the southern confining wall of the upper storey. Even if we have no stratigraphic connection between Walls B23:4=3 and the northern limit of the building (B13:5=7), we assume that all signify one building incident. Most of the interior ground floor walls (B13:16, B13:13, BNR23:108, BNR23:108, B23:6) join each other and thus are contemporary.

Plaster floor BNR22:103=BNR23:113 extended onto the confining walls (B23:4) as well as against the initial ground floor walls (B23:6=BNR23:108=BNR23:109, B23:7). Its surface indicates an intensive use. It might have already belonged to the initial phase of building, but its relation with the later inserted Walls B13:21=15 and B23:19=B13/23:5 cannot be explained without excavating the northern halves of the rooms. Even the time of the construction of the easternmost Buttress B12/13:4 is difficult to determine. It seems to have been built on the ground floor Wall B13:13 and abuts against the eastern outer Wall B12:11. However, we assume that the blocking (BNR23:110) of the wall opening is contemporary with the erection of the buttress.

The construction of the northern Buttress B13:9 followed the insertion of Wall B13:21=15; we assume that the eastern Buttress B12/13:5=B13:10 in front of its predecessor (B12/13:4) was contemporaneous. The southern Buttress B23:4 either belongs to this stage or already existed in the initial phase.

The last modifications probably are the Wall Reinforcements B23:19=B13/23:5 for Wall B13:21=15, and the Blocking BNR22:105 of the wall opening in the west. The room fill material is less clear than in adjacent Unit BNR17, and consisted of a sequence of several layers, all slightly sloping to west. They show the gradual dilapidation of the roof, ceiling, wall plaster and of the walls as well (Fig. 2c).

After the Neolithic occupation an intensive (probably Nabatean) agricultural use is attested for the entire Ba‘ja intramontane plateau. The site was terraced (*e.g.* B22:2=B22/32:2) by recycling Neolithic wall stones, and its topsoil cleared from stones.

Room and Ground Floor Fill Assemblages (C.P.)

According to LaMotta and Schiffer (1999: 20), house floor assemblages can be the result of different processes of accretion and depletion occurring during the "life history of a domestic structure". The life history of a structure is characterized by events of habitation or use, abandonment, and post-abandonment. House floor assemblages neither compellingly reflect room activities nor can it be expected to discover all activities once carried out to be represented in the assemblages.

Due to the excellent preservation in the Ba‘ja architecture, primary function/use evidence from different activity levels (ground floor, upper storey, and roof) are locally preserved as secondary or even tertiary contexts, mostly represented by the fills in the room stratigraphy. In this sense, we must understand the Ba‘ja fill assemblages as house floor assemblages in the above mentioned sense.

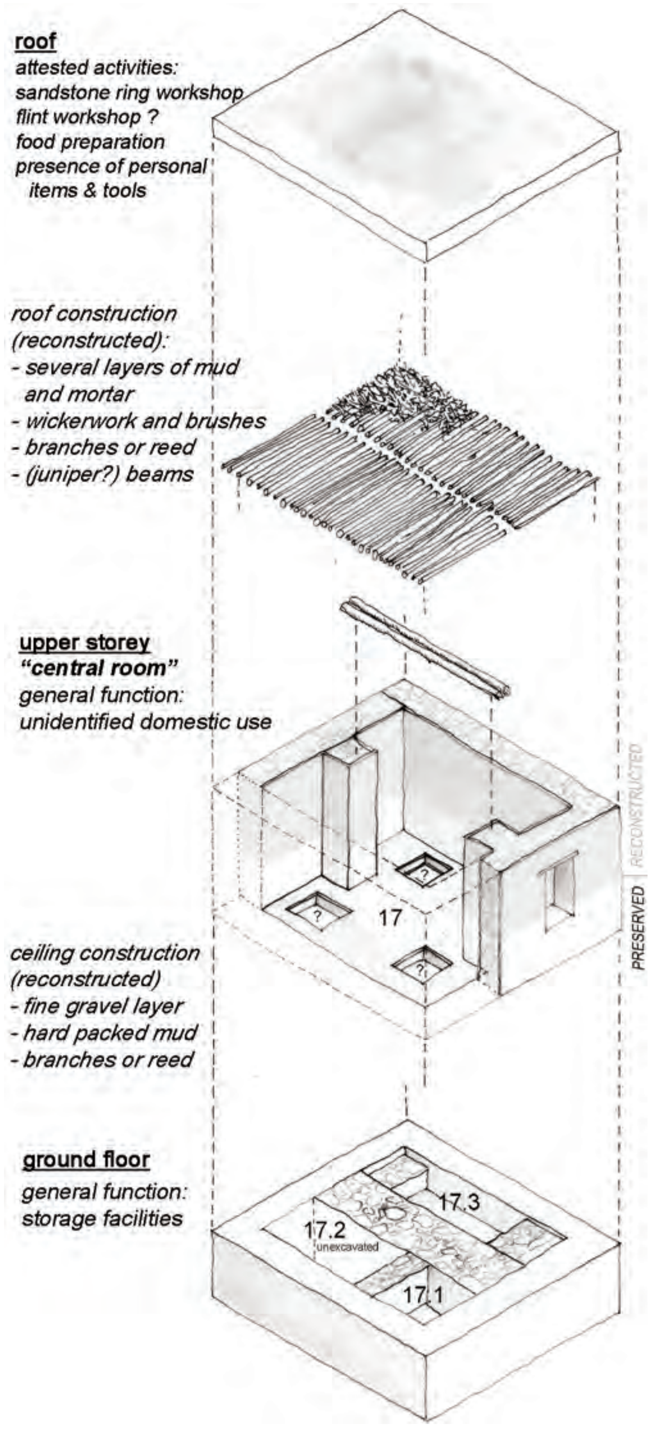

Fig. 7 Ba'ja , Area B-North: Reconstruction of Unit BNR17 (M.K.).

Unit BNR17

The room fills contained an unexpectedly high number of finds. In particular, two findings (BNR17:116 and BNR17:118) offer valuable information about the abandonment and the post-occupational formation processes occurring in Unit 17. BNR17:118 is a complete bone necklace that was embedded within collapsed roof and dilapidated wall material. Some 50 tubular (bird?) bones and one shell bead were found *ca.* 0.30 m from the western confining wall (B22:10) (Fig. 4a). Most of the tubular segments of the necklace were found articulated, indicating its almost intact state at the time of deposition. We thus conclude that the roof collapse took place shortly after the room's abandonment.

The rapid abandonment of Unit BNR17 is supported by Locus 116 of Room 17.3 (Figs. 2b and 4b). Upon a red-stained plaster floor (BNR17:115.1), but separated

Table 2 Fill assemblages of Unit BNR22/23 (artefacts of 2007 only).

		Stone Industries											Bone Industries		
		Grinders (complete/*fragment*)					Stone Rings					Chipped Stone	Worked Bones	Small Objects	Samples
Room: Locus	volume in m^2	grinding slabs/ saddle shaped	grinding slabs with depression	handstones	pestles	handstones/ pestles	Stages 1-2	Stage 3	Stage 4a	Stage 4b	Stages 5-6				
22:100	0.932	0	0	2/*4*	1	0	1	0	6	2	23	specific (?) workshop refuse 1 serrated blade 1 Jericho-point 1 undet. point		1 polisher 1 *Nerita sp.* bead 1 small *Conus sp.* bead 1 Mother-of-Pearl (MOP) fragm. 1 "ear ornament" 1 flint bowl, fragm.	1 fossil *Nautilus* (?) shell plaster
22:101	0.658	0	0	5/*2*	0	0	0	0	3	6	27	specific (?) workshop refuse 1 celt 1 pick/ adze 1 Amuq-like point 1 celt preform		4 polisher 2 MOP fragm. undet. 1 *Nerita sp.* bead 1 sandstone bead 1 stone vessel, fragm. 1 shaped limestone piece	1 stone with copper 1 piece of hæmatite
22:102	0.621	0	1	1/*3*	0	0	2	0	2	0	23	specific (?) workshop refuse 1 celt 5 celt preforms	1 needle fragm.	1 apex bead of small *Conus sp.* 1 *Nerita sp.* bead 1 sandstone paillette	1 piece of "greenstone" 1 clam, fragm.
23:100	0.442	0	0	0	0	0	0	1	1	3	2	unspecific workshop refuse		1 MOP fragm. undet. 1 cowrie-shell bead/ paillette	
23:101	0.104	0	0	0	0	0	0	0	1	3	0	unspecific workshop refuse		1 sling ball	plaster pigment mineral
23:102	0.152	0	0	3/*4*	0	0	1	0	1	8	2	unspecific workshop refuse 1 celt preform	1 awl 1 awl, fragm.	1 polisher (*Handschmeichler*) 2 MOP ring, fragm.	reddish pigment from sandstone?
23:103= 23:105	0.812	0	0/*1*	1/*8*	0	0	1	0	2	7	10	specific (?) workshop refuse 2 celts 1 pyramidal core	2 spatulae fragm. 1 awl 1 awl, fragm.	1 ring made of *Conus sp.* 1 MOP fragm., moon shaped 1 cowrie-shell bead/ paillette 2 stone vessel, fragm. 5 sling balls 5 polisher	1 piece of "greenstone"
23:104= 23:106	0.568	0	1	2/*4*	1	0	0	0	2	3	5	unspecific workshop refuse 1 celt 1 projectile preform	1 spatula, fragm. 2 awls 1 awl, fragm. 1 needle, fragm.	1 MOP ring, fragm. 1 sandstone palette, fragm. 1 *Nerita sp.* bead 3 sling balls 1 polisher 1 polisher (*Handschmeichler*) 1 polisher (*Handschmeichler*) with red pigment	
23:111	0.657	0	0	6/*2*	0	0	1	1	3	1	21		1 spatula, fragm. 1 awl, fragm.	2 polishers 6 sling balls 2 grooved stones 2 sandstone palettes 1 *Nerita sp.* bead	1 fossil snail 1 marine shell, fragm.
23:112	0.615	0/*1*	0	2/*3*	1	0	1	1	2	1	7	specific workshop refuse 5 celts 3 celt preforms 1 bidirectional core 3 pyramidal cores	2 awl, fragm. 2 needle-like awl, fragm. 1 needle, fragm. 1 bone disc	1 polisher 4 sling balls 3 *Flintkinder* 1 *Flintkind* with red pigment 2 sandstone palettes 2 MOP ring, fragm.	plaster 1 bivalve 1 bivalve, fragm.
		0/*1*	2/*1*	22/*30*	3	0	7	3	23	34	120				

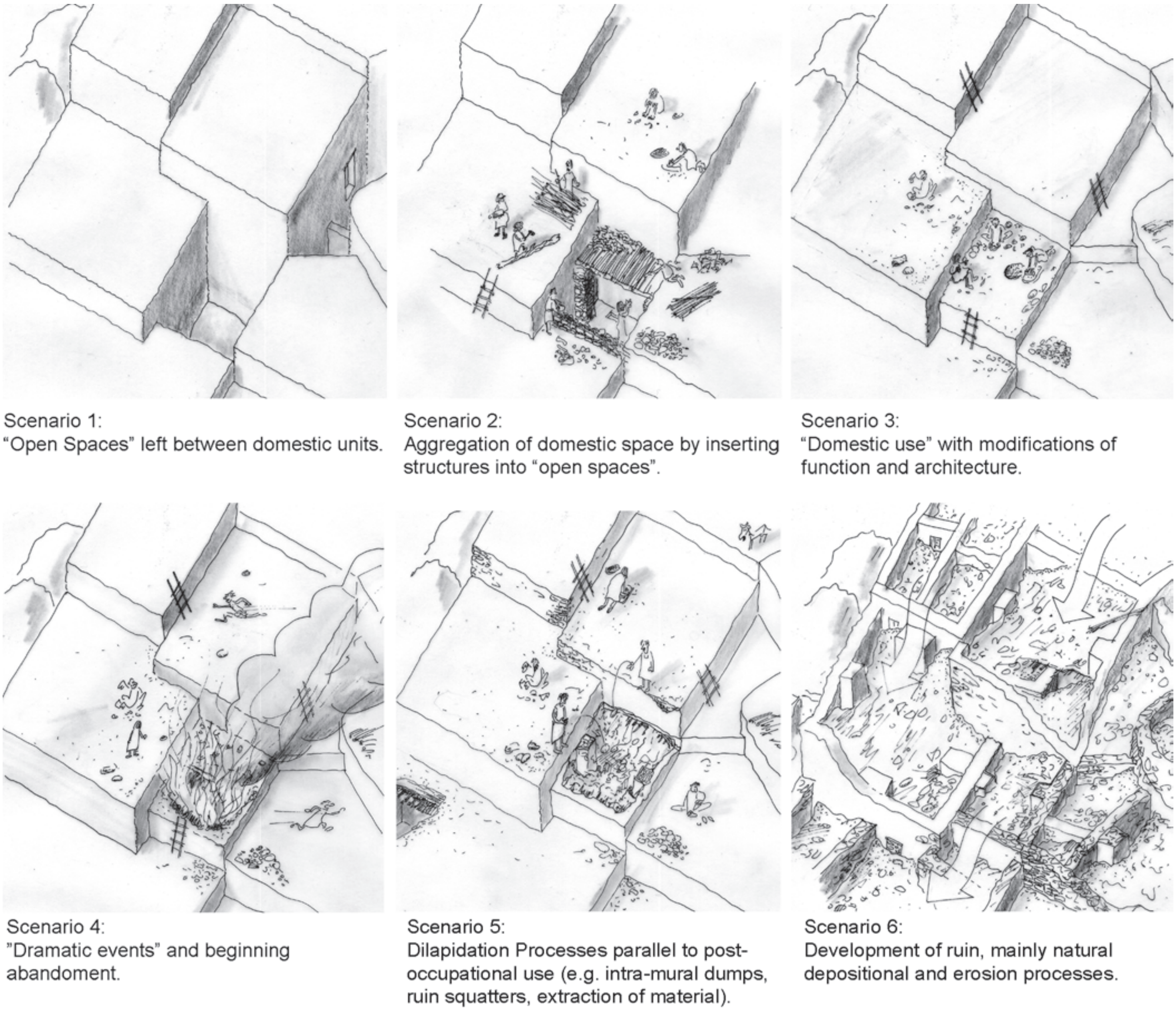

Fig. 8 Ba‘ja, Area B North: General house-life scenarios (M.K.).

by some three cm of sediment, a large quantity of animal bones was found. In the southern third of the room, where the ceiling was preserved *in situ* (*cf.* Fig. 2b), vertebrates were found articulated while in the other parts the bones were randomly distributed and partly fragmented. Complete (Fig. 4b: 44 and 51) and fragmentary (Fig. 4b: 2 and 3) hammerstones; an exhausted bidirectional core (Fig. 4b: 50); a piece of haematite (Fig. 4b: 28), two of “greenstone”, one of azurite (?); one almost complete sandstone ring (Fig. 4b: 70); a fragment of a “greenstone” bead (Fig. 5e); two shell beads; and the fragment of a perforated stone tool (stone weight?) (Fig. 4b: 59) were found in the bone accumulation. There was a tendency for size sorting, where smaller chipped stone debris was found between and underneath the bones. Furthermore, several heavier grinding tools (*cf.* Table 1) overlaid the bone accumulation. We consider this finding as the result of a collapsed organic shelf-like installation, which served for different kinds of storage. The size-sorted artefacts let us assume that at least parts of them may have arrived from the upper floor level. We expect that during the collapse of the ceiling the smaller artefacts penetrated through small holes and air pockets and ended up underneath the bone material, while the larger grinding tools came to rest upon the bones.

In general, the finds of Unit 17 are well preserved and show a relatively low fragmentation (Table 1, Fig. 5). Damaged and complete ground stone tools are represented in nearly equal numbers. The highest numbers were found for handstones (18 complete/24 fragments) and saddle shaped grindings slabs (7/7). All other types are infrequently represented. The stone ring industry is classified according to production stages (Gebel and Bienert *et al.* 1997: 252 ff.). As expected, the most fragile Stages 5 and 6 (n=176) are most frequent. Interestingly, the most robust Stages 1 and 2 (pre-shaped sandstone raw disks) are represented by the second high-

Table 3 House-life scenarios of Units BNR17 and 22/23.

Scenarios	Unit BNR17 (incl. BNR17.1, 17.3)	Unit BNR22/23	Scenarios
1) Pre-occupation	a) Steep slope bedrock relief prevents soil formation and sediment accumulation, instead bedrock is shaped by fluvial and aeolic agents	Similar to Unit 17?	1) Pre-occupation
	b) Structures to the south, west and east created a sediment trap: Unit 17 served as open space (Fig. 8: Scenario 1), in which surfaces were levelled by mainly fluvial sediment accumulation against wall B23:5 containing few artefacts of secondary origin	a) Erection of outer walls and ground floor	2) Habitation
	c) Deposition of ashy and charcoal rich material, use as dump area for hearth refuse	b) Maintenance of architectural elements; modification of spaces, function and use	
2) Habitation	a) Construction of a ground floor and upper storey as an expansion of the building S of Unit 17 (Fig. 8: Scenario 2)		
	b) Maintenance of architecture; modification of spaces, function and use		
	c) At its final state: Use of Room 17.3, possible also Room 17.1, for storage; the upper storey as living (?) area; and the roof as workshop area (stone ring workshop, food processing activities, presence of personal items and tools) (Fig. 8: Scenario 3)		
3) Abandonment	a) No intentional abandonment: probably fire incident ends occupation as dwelling (Fig. 8: Scenario 4)	c) At its final use: Use of roof as workshop area (celt workshop? sandstone rings workshop?, food processing?); use of ground floor for storage?	
	b) Rapid collapse of roof, recycling of burned roof beams?		
	c) Ruin served after blocking of Wall Opening B32:13 as a dump area of mainly primary contexts (stone ring workshop refuse, food preparation, chipped stone refuse, dumping of broken personal items/ tools) (Fig. 8: Scenario 5)	a) More of an intentional abandonment: clearing of rooms by extracting personal items, tools of value; leaving of "low-value" and bulky artefacts (e.g. hammerstones, celt preforms and sling balls) and lost personal items	3) Abandonment
		b) Continuous decay and collapse of roof, ceiling, and wall tops, dilapidation of wall plaster, decay of organic remains, recycling of beams?	
		c) Contemporary to 3b?: Ruin served as a dump area of mainly primary contexts (stone ring workshop refuse, chipped stone/ bifacial refuse, food preparation, chipped stone refuse, dumping of broken personal items/tools)	
	Events parallel to 3c: tumbling of exposed wall tops, dilapidation and collapse of ceiling, decay of organic remains, disintegration of wall mortar and wall plaster		
4) Post-occupation	a) After general abandonment of the domestic area natural agents filled the ruin (erosion and redeposition of adjacent architecture and sediments until surface closure), a process interrupted by ruin squatters (Fig. 8: Scenario 6)		4) Post-occupation
	b) Nabatean agricultural use (terracing and field clearing from stones)		

est numbers (n=45). None of them was broken. The fragments of Stages 3 (n=1), 4a (n=12) and 4b (n=29) are infrequently or occasionally represented. During Stage 3, the craft person already started to engrave the raw disc in order to remove an interior disk: such fragments show the traces of engraving, but the interior disc is still connected. In Stage 4, the interior disc (Stage 4b) has already been removed, creating a stone ring preform (Stage 4a). Finally, the stone ring preform was thinned by grinding (Stage 5) and occasionally painted (Stage 6).

The chipped stone tools consist of a high number of projectile points (n=16), borers (n=15), and celts/ celt preforms (n=14). A moderate number of scraping tools (n=6) was found. Two serrated blades and one each for a burin, knife/spearhead, tanged knife, and sickle blade were also found. Beside the tools, a high number of cores (n=11) was present. Worked bones mainly consist of awls (4 complete/4 fragments), needle-like awls (3/3), needle fragments (2), bone spatulae (1/1), and two fragments of bone rings. Other finds are rare and are mainly fragmented items.

Unit BNR22/23

The distribution of finds in Room 22 and 23 provides a different pattern (Table 2, Fig. 6). The fragmentation rate of the artefacts is clearly higher. The assemblage of ground stone tool consists – as in Unit BNR17 – of predominantly complete (n=22) and fragmented (n=30) handstones. Other grinding tools are rarely attested (grinding slabs with depression, pestles, each n=3, and one fragment of a saddle shaped grinding slab) or absent. The most significant difference within the stone ring industry – as compared with BNR17 – is the considerably lower number of raw discs (Stages 1 and 2, n=7). The numbers of discarded products of Stage 3 (n=3), 4a (n=23), and 4b (n=34) are slightly higher, whereas the numbers for Stages 5 and 6 discards (n=120) are comparable with Unit BNR17. The chipped stone tools are dominated by celts, celt performs, and picks/adzes (n=19). Projectile points are limited in frequency (n=4), including one fragment and one preform. With the exception of one serrated blade, other tool classes/types are absent.

The most remarkable finds – beside the celts – are polishers (n=16) and small spheroids/pebbles (n=19). The latter are believed to represent sling ball collections (Gebel, in prep.). Apart from these, *Flintkinder* (small flattish flint nodules <5 cm) were found: they can bear traces of red pigments (Fig. 6b) and most likely functioned also as polishers.Worked bones mainly consist of fragmented items. Beside one bone disc, only the more robust smaller awls are represented as complete tools (n=4).

Some concentrations of finds/find categories are conspicuous. In Unit 17 ground stone tools, stone ring raw discs and refuse, most of the chipped stone tools and other complete personal items were mixed within the dilapidated roof material. The necklace was clearly deposited close to the upper edge of layer BNR17:106. Only a few tools were found on the preserved floors of the substructure. With some certainty the bone layer of BNR17:116 represents a primary deposition in Room 17.3 (Fig. 4b). Most of the small coloured/pigment minerals also come from this same layer, but there is some doubt about assigning them to the same context. Their presence may represent a similar phenomenon as proposed for the smaller chipped stone refuse (sorted in from a higher level). The celts, celt performs and grinding tool fragments in the find assemblages might also not represent exclusively earlier use contexts, but partly may derive from walls/wall caches as attested well in LPPNB architecture (*cf.* Gebel 2002).

The distribution patterns of BNR22 and 23 indicate a concentration of celts/celt preforms in the dilapidated ceiling/roof material (BNR23:103=105=BNR22:101, BNR23:104=106= BNR22:102), with one cluster directly on the Floor BNR23:112. The latter consists of finished celts and celt preforms associated with hammerstones (Fig. 6i-q). Sling balls are regularly distributed in all loci of Room 22 and 23, and polishers are predominant in BNR23:103=105=BNR22:101. All other artefact categories are distributed without a discernible patterning.

The quantity of items left during abandonment (or what Schiffer calls *de facto* refuse) depends on several factors. Amongst others, the "rate of abandonment, the portability and the replacement costs" (= remaining value of an artefact) are claimed to play a major role (*e.g.* Cameron 1993; Schiffer 1987: 89ff). It is assumed that a rapid and unplanned abandonment would leave more usable/repairable artefacts than a slow and planned one: valuable and more easily portable items are expected to be rarer in the latter case. Furthermore, it is suggested that activity-specific tools and items are more likely to be abandoned. This might explain the concentration of stone ring raw discs in Unit 17, the cluster of celts on the floor in BNR23, and partly the grinding stones in both units. The higher artefact density and their lower fragmentation degree in Unit 17 are interpreted as manifesting rapid and unplanned abandonment.

Reconstruction of House-life Scenarios
(C.P., M.K.)

The combined information from Units BNR17 and BNR22/23 offers many insights into their house-life history. However, we must be aware that any reconstruction – whether architectural or behavioural – cannot be more than a snapshot of one moment in a living house. As far as they are attested, the scenarios of Units BNR17 and 22/23 are presented in Table 3.

Based on the analysis of Units BNR17 and BNR22/23 and on the site's general stratigraphical events (*cf.* Gebel and Bienert *et al.* 1997: Table 2) we were able to reconstruct some general house life scenarios (Fig. 8 illustrates only those scenarios for which evidence was found):

- The occupation of B-North took place gradually, and in its beginning open spaces were still left between the domestic units (Scenario 1).
- Various (demographic, social, and economic) processes may have resulted in a horizontal and vertical aggregation of the domestic space, by inserting structures into the open spaces so that the entire settlement area became occupied by domestic units without leaving space for passages etc. between the houses (Scenario 2).
- The living structures became subjects of permanent modification of function and layout (*e.g.* alteration of ground plans by blocking of wall openings). Furthermore, the living space underwent spatial re-organization by large-scale in-filling and natural impacts (*e.g.* Gebel and Kinzel 2007: 29-30) (Scenario 3).
- Likewise, the termination of occupation was a slow process: attested are dramatic events (like fire), but we

also must assume intentional abandonment as well (Scenario 4).

• However, the missing re-occupation is interpreted as part of the general decline process specific to Ba‘ja, or even the regional "collapse" of the permanent LPPNB occupation. Dilapidation processes took place parallel to progressive abandonment. Post-occupational uses (intra-mural dumps, ruin squatters, extraction of materials) are well attested within the abandoned buildings (Scenario 5).

• After the entire abandonment of the settlement, mainly natural depositional and erosional processes covered and levelled the ruin (Scenario 6), before surfaces became subject of deflation, agricultural activity, or of excavation.

Perspectives

With our progressive understanding, the recent discoveries at Ba‘ja allow us to recognize a greater complexity of house-life and post-occupational processes. The excellent preservation of the two-storeyed Ba‘ja architecture is a continuously promising source for the reconstruction of the various house-life scenarios, and for a practical understanding of Early Neolithic village life. Excavation results such as those from Units BNR17 and BNR22/23 provide snapshots of individual house life events (stages of use/habitation, abandonment and post-occupation) to be found mainly in Ba‘ja's lower stratigraphy. They let us explore the architecture and its use in four-dimensional terms, an approach otherwise rarely applied due to poorer conditions of preservation. The fine-scale understanding of the LPPNB architectural and spatial formation processes, connected with contextual analysis, will help to reconstruct also the use of its vertical space (ground floor, upper floors, roof), a dimension for which Ba‘ja more and more turns out to be an essential site.

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Note

[1] In contrast, in steep-sloped Area F bulkhead-structures were chosen: Long parallel walls run downslope, with cross-walls inserted between them to create a cellular ground plan layout which follows the slope inclination (*cf.* also Bienert and Gebel 2004: 124 for Area D). For steep slopes this bulkhead-system is more appropriate than the concept of "anguled/bent walls" as used in Area B-North.

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Contribution

Obsidian Assemblage of Mezraa Teleilat: Evidence of Cultural and Chronological Continuation from Late Pre-Pottery Neolithic to Pottery Neolithic

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Understanding the cultural and chronological transitions from the Pre-Pottery Neolithic B (PPNB) to the Pottery Neolithic (PN), which date between 8,500 and 8,200 cal. BP, has been a problem in Near East archaeology. Most Pre-Pottery Neolithic sites were either abandoned or were less intensely occupied towards end of the PPNB due to a number of reasons that archaeologists have puzzled over. Fortunately, recent archaeological discoveries in the Levant and northern Mesopotamia have provided invaluable data to help resolve some of these problems. A few sites, such as Mezraa Teleilat, Akarçay Tepe, Tell Halula in Middle Euphrates Valley, Çayönü in Upper Tigris area, and 'Ain Ghazal in Jordan, among hundreds of Neolithic excavations in northern and southern Levant, provide convincing evidence for a continuous occupation from PPNB to PN. Mezraa Teleilat in the Middle Euphrates Basin in southeastern Turkey is one of the most promising sites and has great potential to illuminate the enigmatic PPNB-PN transition based on its following attributes: chronologically continuous occupation; large exposures with many buildings (*ca.* 5000 m^2); careful excavation methods and recording carried out at the site; richness of flint and obsidian artifacts; proximity to raw material resources from the Euphrates and other varied ecological zones; and a gateway between the Levant, Mesopotamia, western Anatolia, Cyprus and, hence, access to the Neolithic groups that lived in these areas. All these qualities make Mezraa Teleilat's flint and obsidian assemblages worthy of study[1]. This paper originates from a much broader perspective based on the author's Ph.D. thesis, but it intends to describe a narrower artifact assemblage, namely the obsidian assemblage, found in LPPNB, Transitional, and Pottery Neolithic contexts. The goal of this paper is to

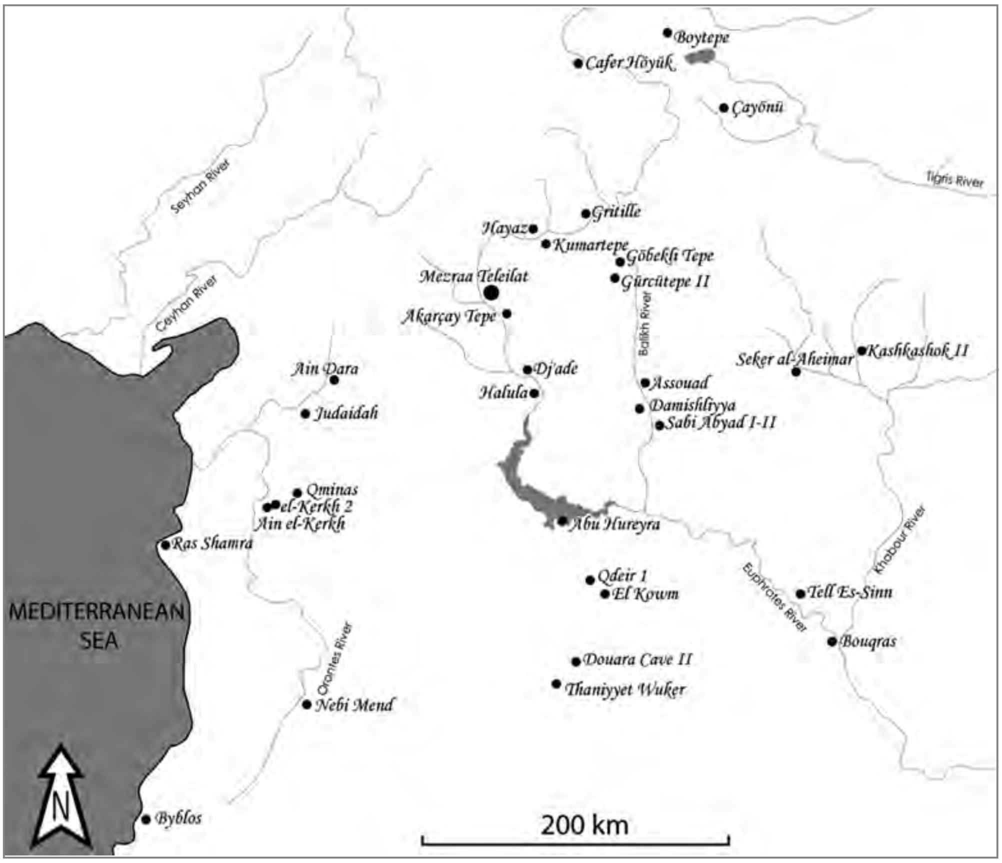

Fig. 1 Location of Mezraa Teleilat (courtesy of Ferran Borrell Tena).

bring attention to the Neolithic obsidian assemblages of Mezraa Teleilat, which have only recently been investigated and, hence, are not well known in the broader scholarly community.

Mezraa Teleilat

The mound of Mezraa Teleilat is located on the lower left bank of the Euphrates River in Mezraa Köyü, 5 km south of the Birecik district in the Şanlıurfa province (Fig. 1). Because of serious destruction to the site by both human and river-related activity, the actual size of the mound is not known. The present-day dimensions are approximately 350 m N-S by 170 m E-W (Karul *et al.* 2004; Özdoğan 2003). Excavations were run within the M.E.T.U. TAÇDAM – GAP Kargamış Project under the scientific direction of M. Özdoğan from the Department of Prehistory, Istanbul University and under the direction of the Directorate of the Şanlıurfa Museum. So far about 5,000 m^2 have been excavated. The Neolithic occupation of the site dates from 9,324 uncal. BP to 7,760 uncal. BP. Stratigraphically, three major Neolithic phases (with sub-phases) have been distinguished at the site based on changes in architecture and pottery types. The chronological sequence of the Neolithic, from oldest to youngest, is as follows: Phase IV (LPPNB); Phase III (LPPNB-PN Transition); Phase II (PN) (see Özdoğan 2003: 513 for complete chronology with sub-phases). The radiocarbon dates for Phases III and IV fall within a rather short time span between *ca.* 8,000-7,900 B.P. (*ca.* 7000- 6500 cal B.C.). Furthermore, overlapping dates between phases indicate occupational continuity at the site.

Obsidian Assemblage of Mezraa Teleilat

Obsidian as an imported resource was utilized less in all phases at Mezraa Teleilat compared to flint. However, its frequency changes from phase to phase. A total of 966 obsidian pieces were studied, which make up only 4.95% of the entire lithic assemblage (19,498 pieces of flint and obsidian). Almost half of the obsidian belongs to the Transitional phase (444 items; 45.96%). The PN layers are relatively richer in obsidian (271; 28.05%) compared to Phase IV layers (151; 15.63%). Hypothetically, the number of obsidian pieces might be affected by sampling size and/or unequal recovery within phases of the mound, but it is clear that Phase IV layers yielded less obsidian than other phases when volumes are compared. In other words, it is possible that less obsidian was used in Phase IV than in the following phases.

Different types of obsidian have been identified according to macroscopic features, such as color, texture, type of inclusions, and transparency (as judged by transmitted light, particularly under sunlight). A sourcing analysis has not yet been undertaken. The following types have been defined: 1- colorless (very translucent); 2- opaque very shiny black; 3- opaque black; 4- translucent green; 5- semi-translucent green; 6- opaque green; 7- cloudy gray; 8- translucent brown; 9-semi-translucent brown; 10- opaque very shiny brown. According to macroscopic characteristics, East Anatolia's Van and Bingöl sources were in greatest demand by Mezraa Teleilat inhabitants, although Central Anatolian obsidians were also occasionally used. A peralkaline obsidian that is characterized by a green tinge under transmitted light is related to East Anatolia's peralkaline Bingöl A or Nemrud obsidian sources (Maeda 2003: 172). The colorless transparent obsidian was probably obtained from Cappadocia; although East Anatolian sources also include colorless obsidian, and chemical source analysis from the contemporary and neighboring sites of Akarçay Tepe and Tell el-Kerkh indicate that the colorless obsidian originated in Cappadocia (Maeda 2007, personal communication). Black and brown obsidian

Table 1 Mezraa Teleilat: Distribution of obsidian types by phase.

Obsidian type	IV		III/IV		III		II/III		II		Grand Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Colorless	3	1,99	6	6,45	32	7,21	2	28,57	13	4,80	56	5,80
Opaque shiny black	4	2,65	3	3,23	14	3,15	0	0,00	7	2,58	28	2,90
Opaque black	4	2,65	1	1,08	5	1,13	0	0,00	5	1,85	15	1,55
Translucent green	50	33,11	32	34,41	169	38,06	1	14,29	138	50,92	390	40,37
Semi-translucent green	51	33,77	33	35,48	124	27,93	1	14,29	64	23,62	273	28,26
Opaque green	10	6,62	6	6,45	62	13,96	2	28,57	14	5,17	94	9,73
Cloudy gray	11	7,28	2	2,15	16	3,60	1	14,29	22	8,12	52	5,38
Translucent brown	3	1,99	0	0,00	2	0,45	0	0,00	1	0,37	6	0,62
Semi-translucent brown	1	0,66	1	1,08	5	1,13	0	0,00	1	0,37	8	0,83
Opaque shiny brown	14	9,27	9	9,68	15	3,38	0	0,00	6	2,21	44	4,55
Total	*151*	*100*	*93*	*100*	*444*	*100*	*7*	*100*	*271*	*100*	*966*	*100*

might have been brought from Bingöl, based again from sourcing analysis at Akarçay Tepe and Tell el-Kerkh, although brown and black obsidian are also available from Cappadocian sources. The cloudy gray brown may have been brought in from either region.

Green obsidian is striking in its predominance, regardless of whether the green obsidian is grouped separately or together with other types (see Table 1 and Chart 1). The total number of green obsidian pieces is 757 (78.36%) in the entire assemblage, while other types of obsidian account for only 209 pieces (21.63%). The most highly represented type in the entire collection is translucent green (390; 40.37%) and semi-translucent green (273; 28.26%). Identification of particular knapping strategies and workshops from East Anatolian sources is currently not possible, though characterization of Cappadocian obsidian is well-known, despite problems in the geochemical identification of some of the sources within the area. What is problematic in the field is determining Bingöl sources and distinguishing Bingöl obsidian A from Nemrut obsidian, both of which have similar chemical signatures. While all Nemrut Dağ obsidian is peralkaline (Poidevin 1998: 141), Bingöl sources exhibit a complex chemical structure. Bingöl A obsidian contains peralkaline like that of Nemrut Dağ, while Bingöl B obsidian is calco-alkaline (Cauvin *et al.* 1986; Poidevin 1998: 136-38, 188-191). Elemental discrimination of peralkaline obsidians is frustratingly difficult, and for this reason the Bingöl A/Nemrut Dağ obsidian types cannot be separated geo-chemically from each other (Poidevin 1998: 141).

Technological Analysis of Debitage

Obsidian debitage clearly demonstrates that the occupants of Mezraa Teleilat did not knap obsidian, which is quite different when compared to the *ad hoc* nature of the flint assemblage. There is an almost complete absence of cores, core trimming elements, flakes, chips, chunks, and pieces with natural surfaces in all phases, suggesting that bladelets and blades were imported to the site as finished products or blanks. The absence of cortex on almost all obsidian pieces (except 12 specimens; Fig. 2: 13) indicates that the pieces were carefully prepared by craft specialists and imported. Those that do have cortex seem to have originated from East Anatolian sources based on the green, black, and cloudy gray colors; in contrast, none of the Cappadocian obsidian arrived in Mezraa Teleilat with cortex. Blades and bladelets demonstrate an overall homogeneity and standardization in raw material type, cross-section, profile, state of recovery, knapping rhythm, and size throughout the entire Neolithic occupation, which is in sharp contrast to the majority of flint artifacts.

Debitage is strikingly dominated by one element, the unipolar bladelet (Chart 1 and Fig. 2: 1-3). Unipolar bladelets are represented by 715 pieces, which make up 74.02% of the total obsidian assemblage. These are followed by unipolar blades, which are only about one-sixth as abundant (167; 17.29%). A few bipolar blades/bladelets (Fig. 2: 10), including upsilon types, were also found, but account for less than 1% to the entire assemblage. There were only three core trimming elements (Fig. 2: 6-7); one is a core tablet, while the other two are crested blades. Side-blow blade flakes (SBBFs) are rare elements of the obsidian assemblage at Mezraa Teleilat (Fig. 2: 8, 9, 14, 15). SBBFs are represented by only three pieces in the sampled assemblage, but many more are present in the rest of the collection. Despite the very rare representation of SBBFs, they should to be mentioned here because they are important markers of the Pottery Neolithic in certain parts of the Near East, as

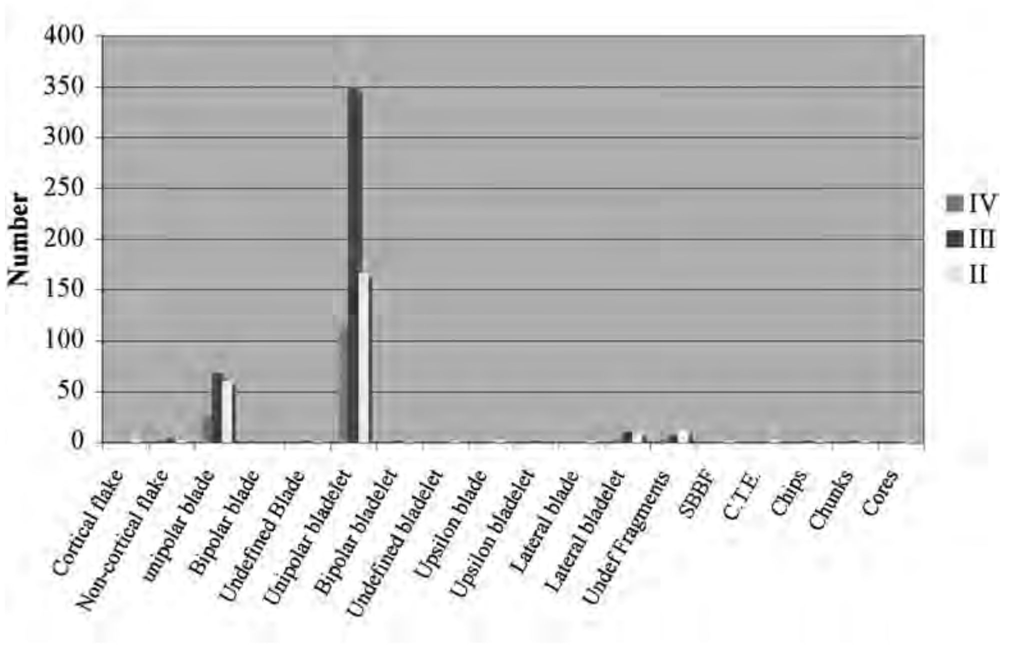

Chart 1 Mezraa Teleilat: Distribution of obsidian debitage by phase.

well as providing a good line of evidence for the distribution area of Anatolian obsidian. There is no consensus among lithic specialists whether they are tools or not. Neither functional nor technological analyses of SBBFs are well known. These unusual artifacts and their distribution patterns as cultural and spatial markers have been completely ignored until recently (Nishiaki 2000). Mezraa Teleilat's SBBFs are commonly made from green obsidian and this fact highlights their affiliation with eastern Anatolian obsidian sources and knappers. They are found in PN layers and their lengths range from 0.3 cm to 0.5 cm; width 1.2 cm to 1.5 cm; thickness 0.1 cm to 0.3 cm. These sizes match well with the size of blades found at the site, indicating their removal from blades.

With two exceptions, cores are completely missing. The exception is a broken part of an exhausted core of translucent green obsidian, with two regular bladelet scars on the working surface. Another unipolar bladelet core, which comes from outside of the sampled assemblage of this study (Fig. 2: 4), is both rare and worthy of mention. This exhausted core was found in a recovery unit which could not be assigned a definite phase in the site stratigraphy but which surely derives from Neolithic layers of a deep sondage. Like the other core, this one is also of semi-translucent green obsidian. A wide and highly oblique striking platform inclines on the back of this core; on one side is a retouched crest, while the other side retains its natural surface and angular corner. The end of the core is both narrower and curved and was knapped

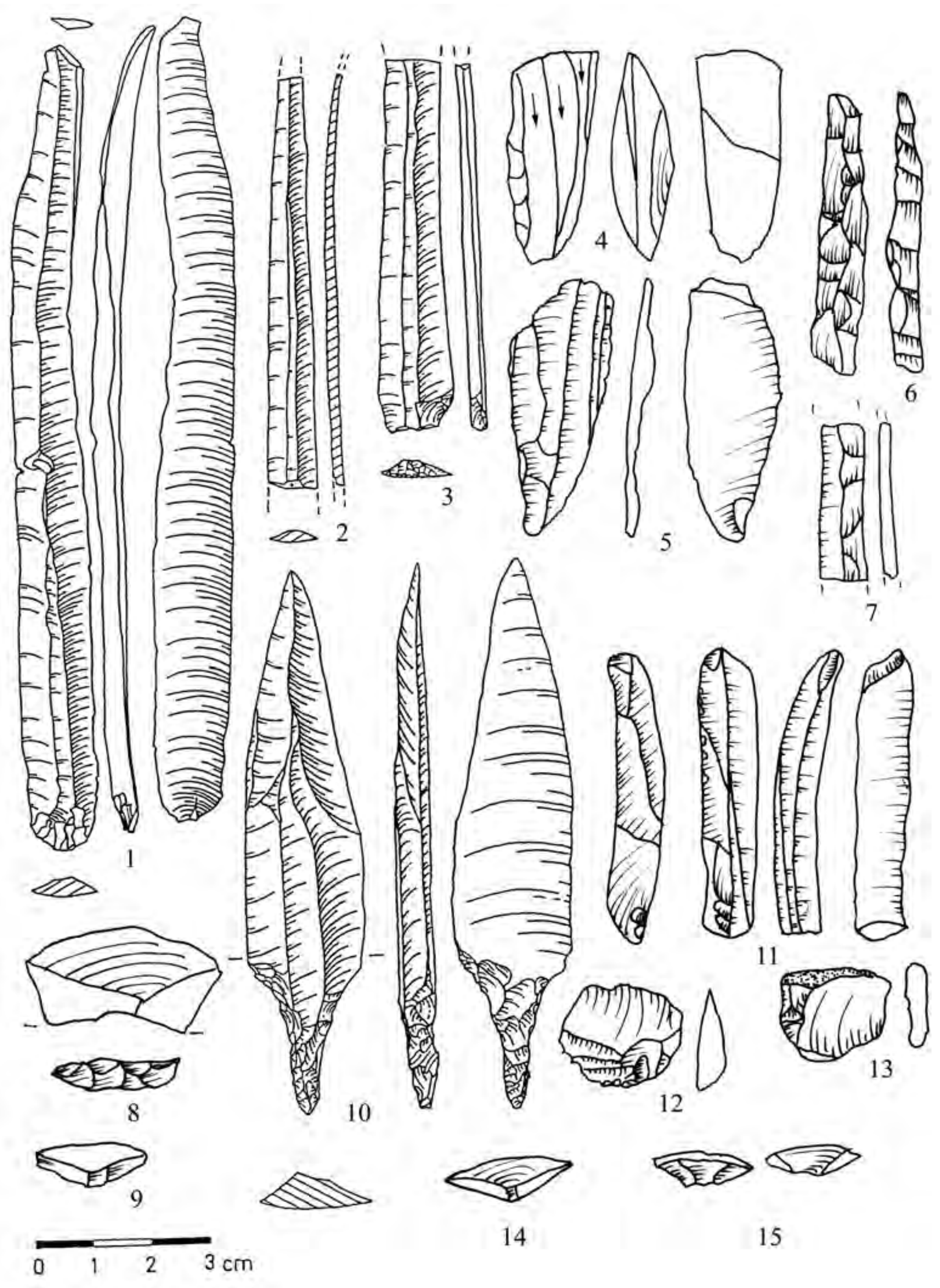

Fig. 2 Mezraa Teleilat: Obsidian blade and bladelets (1-2); truncation (3); exhausted unipolar prismatic bladelet core (4); lateral blade (5, 11); crested blades (6-7); SBBFs (8, 9, 14, 15); projectile point (10); and flakes (12, 13) from all Neolithic phases.

until its limit was reached. It is 3.4 cm long, 1.4 cm wide, and 1 cm thick. Three bladelet scars on the flaking surface are similar to the bladelets at the site in terms of technological attributes, size, form, and color.

Both cores and blanks indicate a wide application of the pressure technique by skilled craftsmen as indicated by their precise regularity and parallelism on the surface and the lateral edges and ridges of the blanks and their negative scars on the cores, evenly diffused thickness, and a pronounced small bulb as well as ground butts on the few available proximal parts. Other indications include a punctiform or linear butt, curved profile (especially on the distal end) and absence of an impact point on proximal pieces (Binder and Balkan-Atlı 2001; Inizan *et al.* 1999).

The majority of blades and bladelets are not found intact. Blanks do change in length from phase to phase, however, largely due to the high number of broken pieces, as breakage tends to snap longer pieces while not affecting their width as significantly. Width is found to be more or less similar and fewer differences occurred in the thickness of the blades and bladelets. The minimum and maximum sizes of complete pieces are as follows: Unipolar blades: L=2.1-6.8 cm; W= 1.2-2.6 cm; T= 0.3-0.8 cm; Unipolar bladelets: L=1.8-6.5 cm; W=0.8-0.9 cm; T= 0.1-0.2 cm (one is 0.8 cm). A couple of blades and bladelets from outside of the sampling are *ca.* 11 cm.

No significant change has been observed in cross-sections of unipolar blades and bladelets across phases. Trapezoidal cross-sections predominate (85.91%), while triangular sections are also represented (14.08%), and a few polygonal cross-sections also show up, indicating, perhaps, that the choice of blank was maintained as a tradition at Mezraa Teleilat. Profiles of the blanks also demonstrate a high standardization and continuity in all phases. Bladelets and blades with a straight profile show up the most frequently (69.06%); those with a convex profile are represented by 25.16% in the study. Irregularity in the blank profile is scarce.

Although the majority of blade and bladelets lack their proximal end, those found intact indicate two different core reduction strategies. Some blanks with linear or punctiform butts were detached from a flat core platform, possibly indicating a bullet or cylindrical pressure core. On the other hand, some bladelets and lateral blades with a straight butt are evidently oblique. In addition, they have a convex profile and/or are twisted on the proximal end. These types of blanks might have been struck from a pyramidal core with a highly oblique platform that inclined towards the core's back.

Interestingly, the state of recovery of blanks shares a common pattern in every phase. 79.36% bladelets were snapped on their distal parts. Snapped distal ends are very high in all phases, strongly suggesting an intended breakage of the distal end in accordance with user demand, perhaps for hafting of the Corner Thinned Blades (CTBs) since snapped ends are commonly associated with them and with truncations (Fig. 2: 3), or because of inefficiency of distal parts for particular tool functions.

The knapping rhythm (*i.e.*, order and direction of detachment from a core) of blanks shows at least two different major knapping strategies in all phases. Most common knapping rhythms are, respectively, 1-2-3 (subsequent removal from one side to the other side) and 2-1-2 (from the center to the sides). The 1-2-3 knapping rhythm was maintained through the Neolithic at Mezraa Teleilat, primarily used in Phase III and II. However, it dropped off noticeably in Phase II, perhaps indicating a change in blank selection or distribution. In Phase IV the 1-2-3 rhythm falls behind the preferred 2-1-2 blades. Both knapping rhythms seem to be neglected on pressure-flaked pyramidal cores. Substantial amounts of blade and bladelets bear 1-2 order on their ridges. Such blanks are often produced in an earlier stage of flaking, and it is therefore difficult to ascertain whether they are part of a 2-1-2 type of rhythm or part of an independent knapping strategy. The rare 1-2-3-4 blades point to a completely different knapping strategy. According to their size, form, profile, butts, and color they were knapped from cylindrical or pyramidal cores by a pressure technique. A core tablet, studied in this assemblage, is evidence of their detachment from cylindrical or bullet-shaped cores. As an aside, it should be mentioned that ideally, the rhythm of knapping is best understood by analyzing all elements of the *chaine opératoire*, establishing the relation between the rhythm and the raw material, butts, and distal attributes, along with refitting. However, the lack of cores and core trimming elements at the site presents a less than ideal set of elements with which to reconstruct the *chaine opératoire* and thus prevents a complete understanding of the above-mentioned rhythmic patterns. Furthermore, analysis of knapping rhythm is not yet common in the discipline, and there is a general lack of site-specific data with which to compare one site or one region with another site or region.

But with the above caveat in mind, the relative frequency of the knapping rhythm differs between unipolar blades and bladelets. While unipolar blades were primarily detached by the 1-2-3 rhythm, unipolar bladelets were removed with a 2-1-2 rhythm. The 2-1-2 order was almost never used in unipolar blades, while unipolar bladelets were occasionally detached with 1-2-3 order. This shows two different knapping strategies, or, in other words, two different one specific to blades and the other to bladelets. Current data also indicate different core reduction strategies, even within the unipolar blade and bladelet assemblages. However, this needs to be supported with further analysis of a larger sample. While blade and bladelet cores were also produced by the 1-2 rhythm, it is uncertain as to whether this indicates a distinct knapping strategy, since 1-2 rhythm blanks can be struck from any type of blade or bladelet core. The size of cores may also be a factor. The core mentioned above, which fits well with many bladelets, shows a 1-2 order in its last stage of knapping. Further analysis is therefore essential to test the purpose of a 1-2 rhythm.

According to the comparison of raw material type and knapping rhythm, the Cappadocian (?) translucent colorless obsidian and eastern Anatolian green obsidian display different core reduction strategies. Green obsidian and colorless obsidian are commonly associated with the 1-2-3 and 2-1-2 rhythm reduction strategies. The difference comes with the 1-2-3-4 rhythm; colorless obsidian does not display evidence of this technique (except for one example), while green obsidian does. The lack of 1-2-3-4 colorless obsidian blanks at Mezraa Teleilat could be additional evidence of an eastern tradition of bullet-shaped or cylindrical cores where eastern Anatolian and Armenian obsidian were widely used (Wilke 1996). In other words, 1-2-3-4 rhythmic blanks of Mezraa Teleilat were probably not produced in Central Anatolian workshops, but in workshops in the eastern wing of the Near East. Further analysis of knapping rhythm, raw material and debitage analysis from Mezraa Teleilat and other sites will help elucidate the nature of obsidian blank and tool production, their associations with particular raw material sources and workshops, and the circulation of tools and raw material across the greater Near East.

Besides the application of pressure flaking, the use of direct percussion was also observed in the assemblage. A few bladelets and large blades display crash or impact marks on their butts. These blades were most likely knapped by direct percussion, which is also indicated by their large bulbs and butts. A few blade fragments with undulation on the proximal part might be elements of another operational sequence – perhaps the lever technique.

In short, the analysis of knapping rhythm points to at least two different *chaine opératoires:* the unipolar pressure technique using 1-2-3 rhythm and 2-1-2 rhythm. Also, it points to the mastery of craftspeople in the shaping of cores and maintaining the same knapping rhythm. No doubt, the pressure technique – serial, precise, and fast – provided more fruitful blank production through its standard and precise end products. The reason for producing different kinds of blanks might have been related to different needs, the suitability of raw materials, and/or cultural tradition. The current data is not extensive enough to determine whether these different *chaine opératoires* were used by different obsidian ateliers.

Discussion and Conclusions

In conclusion, obsidian was an indispensable material for the Mezraa Teleilat residents throughout the Neolithic period. Over time, there is a notable increase in obsidian in the Transitional phase compared to PPNB, and a subsequent decrease in PN. In other words, its frequency rises and falls through time. What is striking is that consumption of green obsidian continues through all phases. Most of the obsidian was imported from East Anatolia's obsidian sources, while Central Anatolian obsidian was rarely present. The Neolithic inhabitants sought two specific types of obsidian from eastern sources – not black, gray, or brown, but green obsidian, particularly the translucent and semi-translucent types. Since Phase IV, these two types were most widely used obsidians and in demand at Mezraa Teleilat. A slight shift in quantity and importance from the translucent green to the semi-translucent green obsidian occurred after Phase IV. This may be due to either a bias in archaeological recovery or possibly a shift in cultural preference or availability of sources. These two obsidian types were most likely imported from either Bingöl A or Nemrud Dağ. While the distance between Mezraa Teleilat and Bingöl is approximately 332 km (206 miles), the Nemrud Dağ source is around 420 km (261 miles), Central Anatolian sources are *ca.* 337 km (209 miles) away. It is not known why the eastern Anatolian obsidian was favored from LPPNB onwards, particularly the peralkaline green obsidian in the Levant, while the Cappadocian obsidian was more popular in earlier times. It should be noted, however, that no serious counting or chemical laboratory analysis has been done to differentiate eastern from Cappadocian obsidian in many prehistoric sites. Since both East and Central Anatolian obsidian were distributed widely and intensively within the Neolithic, it seems that neither distance nor the geographic advantage or disadvantage of certain routes could be the sole factor in its distribution. The LPPNB shift in obsidian sources could instead be due to a shift in worldview and/or political relations, perhaps a result of populations who were experiencing societal, economic, and symbolic changes at the end of the Neolithic.

Current data do not allow us to determine whether obsidian was knapped at the site. Neither can we decide whether specialists in obsidian production were present at Mezraa Teleilat since many elements of debitage are lacking. Hence, it is likely that obsidian arrived in the form of highly standardized finished products, acquired by either direct or indirect means of exchange/trade. However, it should also be emphasized that some knapping areas may yet exist in unexcavated portions of the mound. We simply do not know whether knapping was practiced on the site until we find the missing pieces of the *chaine opératoire*. Other sites contemporary with Mezraa Teleilat, such as Akarçay Tepe (Arimura *et al.* 2000; Borrell Tena 2007), Tell Kashkashok (Nishiaki 2000), Tell Sabi Abyad (Copeland 1996), and Tell el-Kerkh (Arimura 2007) in northern Syria show a predominance of unipolar bladelets and an almost total lack of other debitage products, and it therefore seems plausible to conclude that obsidian was not likely knapped on these sites. Yet the presence of one or two core trimming elements (Fig. 2: 6-7) and flakes (Fig. 2: 12-13), while statistically insignificant, may convey hints of some on-site knapping. Evidently the Neolithic people of Mezraa Teleilat were dependent on specialists to manufacture standardized blades and bladelets – and possibly tools such as the identical corner thinned blades that were used over a large area during this time. Who were these specialists? How was obsidian circulated to Mezraa Teleilat and other neighboring sites? What was the mechanism of obsidian trade? We simply do not know. Using ethnohistorical accounts, we assume that obsidian was circulated by local or non-local seasonal itinerant merchants/specialists who were active as few as several decades ago in Turkey and Cyprus, and who plied their trade by fixing and producing blades for threshing sledges (Ataman 1999; Whittaker 2000). A possible contribution of hunters who might have visited Mezraa Teleilat or contact between hunters, pastoralists, and farmers in certain zones for circulation of goods and ideas may also be imagined (Bar-Yosef 2001).

Detailed technological and macro-specific analyses of obsidian raw material indicate that core reduction strategies were strictly maintained throughout the Neolithic and, based on this long-term stability, formed a technological tradition. Obsidian was brought to Mezraa Teleilat predominantly as unipolar bladelets and blades, and these finished products were highly standardized in terms of size, form, and raw material. In short, patterns of obsidian raw-material usage and obsidian technological attributes lend support to an interpretation of continuous occupation at the site and a culturally shared tradition of lithic manufacture and procurement that stretched from the Late Pre-Pottery Neolithic to the Pottery Neolithic at Mezraa Teleilat.

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Note

[1] The author of this paper studied the Neolithic flint and obsidian assemblages of Mezraa Teleilat for her Ph.D. research with special consideration given to raw material usage, technological and typological analysis, as well as a functional and spatial analysis (Coşkunsu 2007).

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Contribution

Soils and Paleosols at Ba'ja

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Introduction

At the 13th "Cura Aquarum" conference held in Petra, Jordan, March 31 – April 9, there was a chance to visit Ba'ja and the ongoing 2007 excavations. During this excursion, the paleohydrology of the site was discussed in the light of a possible incision of the *siq* since the LPPNB, while a "playa-like sterile sediment" under the deepest foundations of the settlement awaited the visit of an interested soil scientist. In this sediment, soft and friable stage I calcium carbonate nodules and the structure of the "playa" made immediately clear that it is in fact a paleosol (probably dating to the Late Pleistocene or Early Holocene according to the calcium carbonate nodule development) which was built over and preserved by the LPPNB megasite (Figs. 1 and 2).

Fig. 1 Excavating the paleosol under the foundations of Ba'ja.

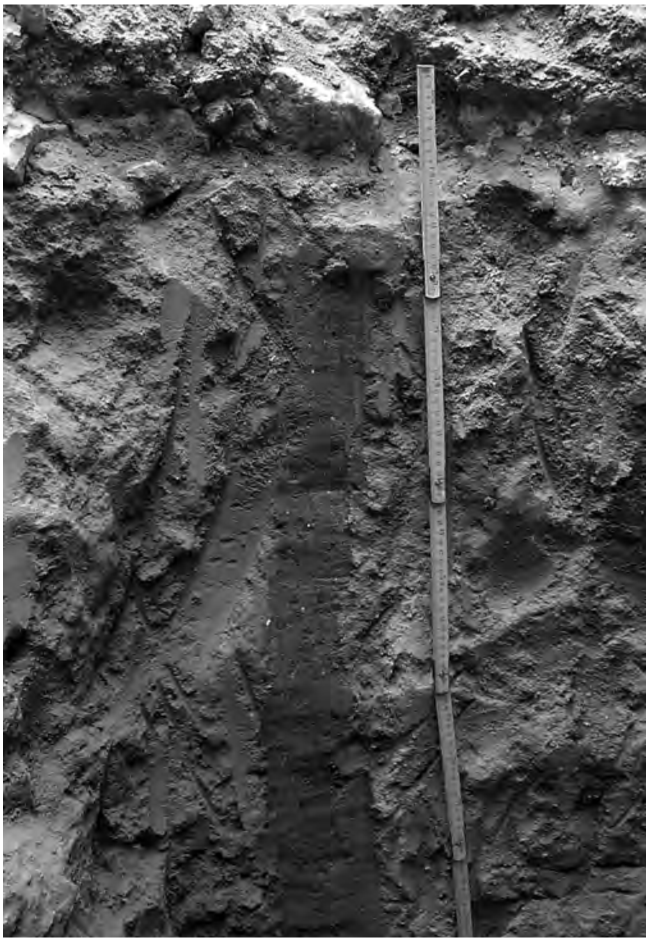

Fig. 2 Close-up to the paleosol, showing its well-developed structure and calcium carbonate nodules.

The actual soils in the vicinity of the site differ from this paleosol: a rough survey found that their structural stability is lower, pointing to a lower clay content, and no calcium carbonate nodules could be observed. The site of Ba'ja is located in a strongly dissected sandstone area, exposed at the foot of a plateau of chalk and calcareous rocks, and far away from freshwater sources (Fig. 3). It is in fact well-hidden in the rugged sandstone terrain which hosts little soil cover and vegetation, so the presence of such a large site seems an enigma in the light of the limited resources available today.

The foundation walls of the settlement cut the buried soil off and thus preserved environmental information dating to the time of its construction, but it remains to be determined to what degree the paleosol is representative for the area or related to the paleorelief. In this part of Jordan, most soils including the paleosol rest on sandstone, and their particle sizes are dominated by sand – an important difference to soils in the north of Jordan, which formed on limestone and basalt, and are dominated by clay[1]. Considering this, the sandstone soils would add a third source rock, and the excellent preservation of the Ba'ja paleosol made it a most promising test site that could immediately be sampled thanks to the support and interest of the Ba'ja team.

Fig. 3 Looking down to the rugged sandstone cliffs in which the site of Ba'ja is located. In the background the limestone plateau.

Soils and Environmental Change

Comparison of paleosols with current soils allows interpreting differences with regard to environmental changes. In this context, soils are ideally investigated using *catenas* and chronosequences: while the first allow describing how material was moved (and how soil development is related to the relief and source rock), the latter allow us to date changes. Soils are well-suited for reconstructions of paleoenvironments, the impact of man, and climate changes, especially if combined with other proxies such as oxygen isotopes from speleothems (Bar-Matthews *et al.* 1998) or lake levels such as from the Dead Sea (Migowski *et al.* 2006)[2].

Conditions are usually not ideal in the sense that chronosequences and *catenas* are mostly incomplete, so research can make only relative statements based on a comparison of the available soils. But the more differentiated the investigated area is with regard to soil properties, parent materials, source rocks, position in the relief, dating, and land use, the more precise statements can be made. While the available data of sandstone soils in the vicinity of Ba'ja are still limited, they already allow for some conclusions regarding possible scenarios of environmental change by embedding them into the evidence and methodological frame available from the north.

A simple field test revealed that the sandy soils harden without further additives, and could have been used for making *e.g.* mortar: soaking them in water and drying them in the sun created surprisingly solid lumps. Samples were taken from the surface of the site (sample *Sediment* Ba'ja *1*) and from the paleosol below the

Fig. 4 Sampling the paleosol close to its exposure near the gorge.

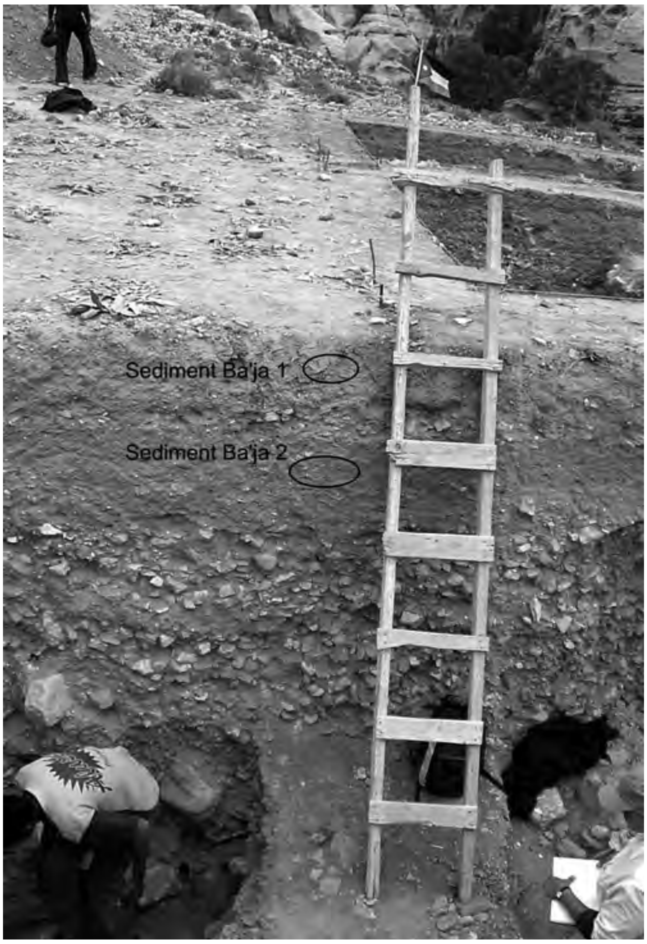

Fig. 5 Sampling the fine-grained sediments covering the ruins of Ba'ja.

architectural occupation of the site (below buttresses in Square C10, sample *Playa* Ba'ja), and formed into rectangular lumps 5x5x8 cm. When sun-dried, both samples became very hard and showed the same density; they only vary in colour (surface source more greyish, paleosol lighter and more reddish), which seems due to $CaCO_3$-additions related to calcareous dust (for a detailed discussion of soil colours and $CaCO_3$ see Lucke 2007). The reason for the hardening seems to be a high clay content, which is probably connected with additions of Saharan dust or weathering products of the limestones further upstream. Both the paleosol and surface material were estimated to contain 20-30% clay, while the calcium carbonate content of both soils is small. It was estimated with the hydrochloric acid test to 7-10% for current soils, while the paleosol was carbonate-free except the nodules. Regarding the stability of these lumps, there was no difference between the paleosol and current soils. Most likely this character of the material made it highly suitable for all plaster/mortar purposes, *e.g.* the fills between the double-faced walls, layers of ceilings and floors, etc.

In order to get a more precise understanding of soil properties at Ba'ja, 13 samples were analysed in the laboratory. These were taken from the above mentioned "playa" in Square C10 at 10 cm depth below the foundation wall, and from the deeper part of that soil after digging down (samples *Playa* Ba'ja, and *Playa deep trench 90-150 cm,* position N 30° 24' 48,4", EO 35° 27' 40,2", 1150 m asl). Unfortunately, the limited time did not allow us to reach bedrock, and the soil was thicker than expected. As well, this paleosol below the deepest foundations was sampled at the rim of Area C, where it was exposed near the steep slope at the gorge of Siq al-Ba'ja (sample *Playa 2,* position N 30° 24' 48,4", EO 35° 27' 40,7", 1144 m asl, Fig. 4). Also, the sediments covering the site were sampled in Area B, where two layers of fine-grained sediments (separated by a band of gravel) had been deposited on the rubble fill (samples *Sediment* Ba'ja *1 & 2*, position N 30° 24' 48,1", EO 35° 27' 39,1", 1144 m, Fig. 5). In order to achieve a comparison with the current soils, the nearby sandstone plateaus were examined with a surface sample *(Boden in-situ)* from a flowering meadow below a *Juniperus sp.* tree (N 30° 24' 52,1", EO 35° 27' 43,1", 1200 m asl), and from a deeper soil profile opened up to bedrock, again near trees *(Juniperus sp.* and *Quercus calliprinus)* (samples *Sandplateau 1-4,* position N 30° 24' 56,3", EO 35° 27' 40,2", 1215 m asl). The results of the lab analyses are presented in Table 1.

Table 1 Results of soil analyses.

Sample No.	RR (dry)	C_{org} %	$CaCO_3$ %	Fe_o [mg/g]	Fe_o [mg/g]	Fe_d / Fe_d	χ (1/kg) *E-3	$(\kappa_{lf}-\kappa_{hf})$ / κ_{lf}*100	pH	conductivity (µS/cm)	Clay %	Silt %	Sand %	Skeleton %
Playa Ba'ja	20	0	0	0.09	4	0.02	25	2.33	8.5	443	17	12	71	0
Ba'ja deep trench 90 cm	30	0	1	0.10	4.9	0.02	29	-	9.6	191	20	14	66	0
Ba'ja deep trench 120 cm	30	0	2	0.10	4	0.02	31	-	9.4	182	17	14	69	1
Ba'ja deep trench 150 cm	30	0	1	0.08	3.8	0.02	24	-	9	272	16	12	72	2
Playa 2	47	0.1	21	0.32	4.7	0.07	49	2.05	7.9	570	34	20	46	1
Sediment Ba'ja 1	30	0.8	7	0.13	4.4	0.03	49	-1.01	8.4	141	17	17	66	3
Sediment Ba'ja 2	20	0.1	9	0.06	3.2	0.02	42	2.08	8.6	113	19	15	66	5
Boden in-situ	20	2.6	6	0.26	3.5	0.02	29	-	8.3	153	15	15	70	0
Sandplateau 1	30	0.3	2	0.05	2.5	0.02	20	-4.3	8.4	66	9	13	78	1
Sandplateau 2	17	0.2	1	0.04	2	0.02	15	-6.06	8.5	60	9	9	82	5
Sandplateau 3	20	0.1	1	0	2	0.00	10	-1.96	8.2	60	9	9	82	9
Sandplateau 4	13	0.1	0	0	1.8	0.00	11	3.64	8.2	40	10	8	82	0
Sandplateau Stein	160	0	0	0	0.1	0.00	-0.3	-	8.5	52	4	7	89	0

Methods of Soil Analysis

The soils were analyzed regarding Redness Rating (RR), pH, electrical conductivity, organic matter, $CaCO_3$ content, magnetic susceptibility, and texture. These belong to the most widely used methods in paleosol research and allow comparison of soil development from a genetic point of view (Lucke 2007). Soil development indices based on iron and manganese oxides could not yet be calculated because the total element contents did not arrive on time.

Colour is a prominent parameter for soil description and sample selection. In order to make it statistically comparable, colours have to be translated into numbers, which is achieved with the Redness Rating. The pH delivers information about the chemical "milieu" of the soil, for example about leaching processes and base accumulation. The electrical conductivity allows an assessment of the degree of base accumulation, *i.e.* soil salinity. Organic matter provides information about the humus content and may indicate buried land surfaces. $CaCO_3$ is a weathering indicator since it is leached from soils with increasing age or moisture, and it may indicate foreign material in sandstone soils on calcium carbonate-free sandstone. The content of pedogenic oxides and hydroxides of iron and manganese usually rises with increasing weathering intensity and age of soils. In combination with other parameters, it is suited for a characterization of development stage and relative age of soils. The specific magnetic susceptibility (referring to the soil mass) quantifies the ease with which a material can be magnetised in a weak field, and reflects the sum of its magnetic properties (dia-, para-, superpara-, ferro, antiferri- and ferrimagnetism). The variation of susceptibility in a high- and low-frequency field (referring to the volume-based susceptibility κ, and calculated as (κlf-κhf)/κlf*100) refers to the percentage of very small (superparamagnetic) grains carrying the magnetic signal. Finally, the texture is a criterion that on the one hand delivers a relative age estimation, since soils should become finer when older, and provides on the other hand information about the soil's behaviour and suitability.

For collection of soil samples, freezer bags were filled from a *ca.* 5 cm thick strip in the middle of the identified layers/horizons. The samples were air-dried for 48 hours at 40° C and then sieved by 2 mm. The fraction > 2 mm (skeleton content) was determined and archived, and all further analyses conducted with the fraction < 2 mm. Colour was determined in the laboratory under standardized light, using the Munsell soil colour chart. The Redness Rating (RR) was computed with the dry samples according to Hurst (1977). It is calculated according to the formula: RR=H*Brightness/Chroma, where H is: 5R = 5, 7.5 R = 7.5, 10 R = 10, 2.5 YR = 12.5, 5 YR = 15, 7.5 YR = 17.5, 10 YR = 20 (the index becomes the smaller the redder the soil). For example, 10 YR 8/1 = 160, and 2.5 YR 4/8 = 6,3.

The pH was determined with a glass electrode (pH-meter 530 by WTW, with electrode InLab 423 by Mettler-Toledo) in distilled water, with a soil:water solution of 1:2.5. Electrical conductivity was measured with a GMH 3410 conductivity meter in a soil:water solution of 1:5 (according to Schlichting *et al.* 1995). Contents of $CaCO_3$ and C_{org} were determined using a Leco TrueSpec C/N-analyser. Samples were finely ground and examined in doubles in the C/N-analyser, which delivered the total C- and N-contents. Additionally, ignition loss was determined according to Schlichting *et al.* (1995): the samples were heated for two hours to 430 °C, which is supposed to eliminate organic matter, but not to expel CO_2 from calcium carbonate. These samples were then analyzed in the C/N-analyser, too, so that C_{org} could be calculated from the difference after correcting the second C-content by the weight loss caused by ignition. This also allows us to calculate the $CaCO_3$ content under the assumption that the remaining inorganic carbonates are fixed in form of $CaCO_3$.

Pedogenic oxides were extracted with sodium dithionite at room temperature according to Holmgren (Schlichting *et al.* 1995), and the iron and manganese contents measured with an atomic absorption

spectrometer (M-series by Unicam, thermo-flame-spectrometer). Weakly crystallized pedogenic oxides were extracted in the dark using buffered (pH 3.25) oxalate-solution according to Schwertmann (Schlichting *et al.* 1995). Their iron and manganese contents were determined with the atomic absorption spectrometer (AAS), too. Since total element contents were not yet available, only the activity-index Fe_o/Fe_d could be calculated, delivering the ratio of weakly to strongly crystalline iron. The specific susceptibility was determined using an Agico MFK1-A Kappabridge magnetic susceptibility meter (976 Hz, 200 A/m), using the sieved but otherwise untreated fine soil < 2 mm in plastic containers. For a selection of samples, the frequency-dependent susceptibility was determined using a Bartington MS2 magnetic susceptibility meter, operating at 460 Hz (low frequency), and 4600 Hz (high frequency).
Particle sizes were analyzed after removing $CaCO_3$ with 10% hydrochloric acid (until no visible reaction occurred any more). Hydrochloric acid (HCl) was washed out again and those samples with C_{org} > 2% treated with 30% hydrogen peroxide (H_2O_2) in the warm water bath (~50 °C), until no visible reaction occurred any more. Hydrogen peroxide was evaporated and samples dispersed with sodium hexametaphosphate ($Na_4P_2O_4$). Wet sieving determined the sand fraction (according to DIN 19683, 1973), while the smaller particles were analyzed with a Sedigraph 5100 (Micromeritics) (Gerzabek 1991).

Does the Paleosol Point to Soil Degradation since the Neolithic?

It is often assumed that soils in Jordan have been severely degraded since the Neolithic due to deforestation and agriculture (Dregne 1987; Hillel 1991). In this context, the Muslim conquest is seen as the final blow to the fertility of the land in a long history of deterioration, attributed to overgrazing, neglect of terraces, and the lack of soil-conserving land use practices (Lowdermilk 1944). As well, it is often assumed that intact soils and vegetation during the Neolithic period provided enough resources for megasites like Ba'ja under a climate similar to the current one, until the inhabitants of these settlements degraded the landscape to a degree that diminished resources combined with social and climatic factors forced them to abandon the sites (Gebel 2004a; Neef 2004). Following Neef (2004), the barren landscape visible today could be very different from a resource-rich steppe-forest of the past, and cannot be reverted to its former state if the soils were lost.

However, climate variations could also lead to a degradation of soils and vegetation and would interact with land use. In this context, it is very difficult to clarify relationships: even if soil degradation is dated very precisely, that says little about its causes. Overgrazing and growing aridity could have identical impacts and be connected, and only a comparative study as outlined above might succeed in differentiating between natural and anthropogenic causes of landscape change. In this context, recent research in the north found that soil erosion took place mainly at the end of the last Ice Age and during prehistory, and in the form of land slides which are usually triggered by heavy rainstorms (Cordova *et al.* 2005; Maher 2005; Lucke 2007). However, there are regional differences: according to Maher (2005) and Lucke (2007), erosion of *Terrae Rossae* in the northwestern part of Jordan around Wadi Ziqlab and the Jordan Valley came to an end around 6000 BC, and no Neolithic site was found to be covered by red colluvia. The situation is different in the northeast and centre of the country, where Chalcolithic and Early Bronze Age settlements at Khirbet az-Zeraqoun, Madaba, and Khirbet Iskander rest on deep red soils that were seemingly protected by the ruins, while later Iron Age settlements are founded on bedrock (Cordova 2007). A locally different impact of human activity seems likely, and the well-developed paleosol under the foundations of Ba'ja could be an indication of a deteriorating impact of the megasite on the environment.

However, the detailed soil analysis (Table 1) reveals some peculiarities. First, the analysed soils can be grouped: with respect to particle sizes and iron oxides, the paleosol under the foundations of the megasite *(Playa deep trench)* is very similar to the fine-grained sediments (*Sediment* Ba'ja) covering the ruins. The latter contain, however, more $CaCO_3$. In this context, a very high content of calcium carbonate is found in sample *Playa 2,* at the exposure of the paleosol towards the gorge of the *siq,* which is likely connected with the proximity to the gorge and sediments brought from the limestone plateau with floods, or due to deposition of chalk in form of plaster remains. This sample is also characterised by the highest clay content, but this is interpreted to be connected with the high content of $CaCO_3$ due to dissolution of pre-weathered clay in chalk additions during preparations for particle size analysis. The two uppermost paleosol samples *Playa* Ba'ja and *Playa 2* exhibit very high conductivity values: although they are not yet saline (which would be indicated by conductivity levels > 2 mS), they exhibit very elevated levels compared with the other samples. Similar levels in natural soils in the north are only reached in the Jordan Valley (Lucke 2007).

Taking the *Sandplateau* samples as representative for current conditions, and the *Playa* samples representative for conditions before the LPPNB, a reduction of the clay content by approximately 10% can be observed, which seems connected with dropping levels of pedogenic iron oxides. This difference could be responsible for the stronger structural stability of the paleosol. In addition, there is a slight increase in skeleton content, pointing to growing fluvial energies that moved gravel and stones. In fact, the nearly complete absence of skeleton in the paleosol points to very quiet sedimentation conditions without stronger floods.

Another interesting feature is the complete absence of organic material in the paleosol. It is in fact sterile. Organic matter content seems in general very low in the sandstone soils, but it points to very slow sedimentation or in-situ soil genesis of the paleosol. In this context, it seems likely that the Ba'ja paleosol was the result of sedimentation and is not a solely in-situ formed soil, since the varying conductivity values indicate buried surfaces. In-situ soil-forming processes took place as well, characterised by a few strongly weathered stones in the profile, and of course the presence of calcium carbonate nodules.

In the light of these data, the following environmental scenario seems likely for the LPPNB:

• The Ba‘ja paleosol formed in an intramontane basin during the Late Pleistocene and Early Holocene, and caught sediments from the nearby sandstone plateaus. If the *siq* had been present already at this time, it is unlikely that a soil of this depth would have developed at this position in the relief, and it can be assumed that it would have been eroded if not protected by the ruins.

• Sedimentation during the formation of this soil was extremely slow: the complete absence of larger stones points to a precipitation pattern without larger flash floods.

• It seems possible that the soil developed out of former lake sediments. This is a common phenomenon in drying lakes and might explain the uniformity of the profile. The strongest indication comes, however, from the high conductivity values, which suggests that the soil experienced periodic flooding and drying just before the settlement was founded.

• With regard to the lake hypothesis, only the top layers may have experienced periodic flooding and drying, although the strongly elevated pH-values in the deeper parts of the paleosol are an unusual phenomenon in the light of the low $CaCO_3$ contents. Thin sections and an excavation of the paleosol until bedrock might deliver more evidence, but so far it seems that the lake had fallen dry for a time long enough to allow formation of the paleosol until water levels rose again just before construction of the megasite.

• The strongly elevated $CaCO_3$ content in the exposed section of the paleosol *(Playa 2)* points to the influence of plaster or chalk transported down from the nearby chalk plateau over the gorge of the *siq*.

• The sediments covering the site are very similar to the paleosol, although the $CaCO_3$ content is elevated, which indicates that similar soils existed in the vicinity of the site, but which were enriched with $CaCO_3$ when washed over the ruins of the LPPNB settlement. Sedimentation conditions were less quiet than during the paleosol formation, or the involved time period much shorter, or precipitation reduced, because otherwise the $CaCO_3$ should have formed nodules as in the paleosol. In fact, similar soils still exist near the site as indicated by sample *Boden in-situ.*

• The lower contents of $CaCO_3$ and clay on the sandstone plateau (samples *Sandplateau 1-4)* might be taken as indication that enrichment with calcium carbonate was related to fluvial transport of chalk close to the course of the *siq*. The lower clay contents could be related to varying properties of the sandstones, since the source rock of the *Sandplateau* samples consists of nearly pure sand. Unfortunately, possible source rocks of the other soils could not be examined so far. If aeolian deposition of clay as proposed by Yaalon and Ganor (1973) is responsible for the higher clay contents of the soils closer to Ba‘ja, we have to assume that they are older than the *Sandplateau* soil, and that aeolian deposition took place mainly during the late Pleistocene as proposed by Issar and Bruins (1983).

• The magnetic susceptibilities are so low that only a very limited “magnetic enhancement” due to soil development seems indicated, as illustrated by the *Sandplateau* samples. While the topsoil exhibits a slightly higher susceptibility, the source rock even yielded a negative value which points to the virtual absence of magnetic minerals connected with iron and clay. They were probably already removed by weathering, leaving pure quartz with diamagnetic properties. In this context, the low susceptibilities are no surprise but seem connected with the low contents of organic matter, iron, and clay.

• Pedogenic magnetite usually consists of very small grains, and the low variations of the frequency-dependent susceptibilities ($(\kappa lf-\kappa hf)/\kappa lf*100$) provide support that little or no pedogenic magnetic grains are present (the index even turns negative with the *Sandplateau* samples). Therefore we do not attribute the slightly elevated susceptibilities of *Playa 2* and the *Sediment* Ba‘ja samples to soil development, but to ash deposition due to human activities.

• Although soil development indices cannot yet be calculated due to the missing total element contents, the activity index Fe_o/Fe_d leads us to expect that soil development is very limited, or that soils near Ba‘ja may not be soils in the true sense of the word, but sediments released by the weathering of the limestone. A very low Fe_o/Fe_d index could point to very mature soils, but in the light of the very low absolute values (with no oxalate-extractable iron at all in the lower *Sandplateau* samples), it seems possible that the variations of soils observed near Ba‘ja are not the result of soil development, but due to varying properties of the sandstones. This could also be the reason of the colour variations.

The most important environmental change recorded by soils and sediments at Ba‘ja seems therefore a change of stream regimes. Most of the rubble layers covering the ruins seem to have been transported fluvially over a short distance, since they show an orientation parallel to the gorge of the *siq* but lack sorting. The latter point could not yet be completely evaluated, but it seems at least possible that the deposition of some clay-rich layers (which could not be further analysed so far) in the lower part of the settlement were connected with standing water after heavy flooding of the site, so that the fine particles could leave the suspension and settle last in form of clay bands. Again, this would imply that Ba'ja was located at the dead end of an intramontane basin with a temporary lake. The similarity of the fine-grained layers (samples *Sediment* Ba'ja *1 & 2)* finally covering the site with the paleosol might indicate a brief return to earlier quiet sedimentation conditions with few flash floods.

Conclusion

On the basis of the few investigated samples, it cannot yet be said whether Neolithic land use degraded the landscape to a degree that a reduction of available resources contributed to the collapse of the site. In this context, it is interesting to note that deeper soils in the vicinity could only be found in association with trees, which made the sampling difficult due to their dense roots. If the Neolithic inhabitants cut a lot of these trees, they could have caused severe soil degradation since the sandy soils seem very unstable without the presence of roots. However, from a fertility point of view there is no indication that the cutting of trees affected soil properties to a large degree, since the present soils are in fact not much different from the paleosol, and the sediments covering the ruins of Ba'ja are nearly identical to the soil that was buried by the foundations. In this context, the slight variations of soil properties seem more related to variations of the source rock and the position in the relief.

An alternative explanation for the association of trees with soils could be better moisture availability, in the sense that soil-trapping rock pockets provide the moisture which the trees need. In this context, recent research indicated that overgrazing is very unlikely for traditional societies as long as herders focus on maximising returns in form of wool, milk, and meat (Grove and Rackham 2003). Well-managed grazing could in fact be an environmental advantage since it reduces the fire risk and increases biodiversity. With regard to the paleohydrology, the most important feature of the excavations at Ba'ja are the stone layers which can be observed in the ruins. They seem related to flash floods originating from heavy rainfalls during the abandonment of the site. In contrast, the stage I calcium carbonate nodules, and very low skeleton contents in the paleosol are clear indications of a very stable landscape with slow sedimentation before the megasite was founded. In this context, the low magnetic susceptibilities make clear that organic matter levels were always low, pointing to a landscape with similar soils and vegetation as today, but with a different rainfall pattern which likely was characterised by reduced seasonality. The magnetic susceptibilities make clear that the changing stream regime was connected with a different precipitation pattern, and not with deforestation and vegetation reduction.

A key to explaining Ba'ja's subsistence economy might be found in the alluvial plain below the sandstone cliffs, and at the foot of the limestone mountains. Regarding food supply, the close limestone plateau overlooking the sandstone, and the floodplain at their feet (locally called Jabu or Sedd al-Ahmar) seem more promising areas than the rugged sandstone cliffs. Climbing up to the limestone plateau, even the untrained eyes of a soil scientist could observe numerous accumulations of flints with flakes and arrowheads, and remains of another settlement, suggesting an intense use in the past. Between the sandstone cliffs, erosion likely removed such evidence since the LPPNB, and it seems possible that the area was less rugged and dissected in the past. But the most fertile area might have been the floodplain, which exhibits evidence of a long period of aggradation until it was incised.

Fig. 6 Exposure of floodplain sediments below the sandstone cliffs of Ba'ja.

In this context, the change of stream regimes documented by the soils at Ba'ja might be related to changes visible in this floodplain. There, massive sandy sediments accumulated which show several phases of soil development during their aggradation (Fig. 6), pointing to different weathering and sedimentation intensities. This floodplain built up during the Pleistocene according to archaeological material (pers. comm. with Hans-Georg Gebel, April 2007), and might be related to the "older fill" which according to Vita-Finzi (1969) was deposited mainly from 40,000 – 8,000 BC. Thereafter, stream regimes returned to incision: it seems possible that the destruction of a well-watered and stable floodplain close to Ba'ja was connected with a change of stream regimes and precipitation patterns as indicated by the Ba'ja paleosol. In this context, the loss of the floodplain would probably have caused the most severe loss of resources for the inhabitants of Ba'ja. A similar scenario at the end of the Early Bronze Age was documented by paleosols in Israel (Rosen 2007) and Khirbet Iskander in Jordan (Cordova 2007).

The location of Ba'ja in the rugged sandstone cliffs might perhaps be related to a proto-industrial production of stone jewellery, defence needs, and the availability of water in the *siq's* aquifers or even by early Neolithic dams (Gebel 2004b). Our first analysis indicates that soils around Ba'ja may have been distributed as they are today, which would mean that their availability was very limited, so that the location and flourishing of the site cannot be explained by a better soil cover of the surrounding sandstones. Many questions have to be left open, but a more detailed analysis of the floodplain sediments and their relation to soils further upstream could shed more light onto Ba'jas subsistence and the environmental history of southern Jordan.

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Notes

[1] Soils and paleosols in northern Jordan are investigated in a current project on "Interactions of land use, climate and soil development in the context of settlement history in the Decapolis Region", and comparing them with regard to their source rock had proven very important for a better understanding of their genesis and origin (Lucke 2007).
[2] An important example for the potential of paleosol research is given by Gvirtzman and Wieder (2001) for the coastal plain of Israel, who showed that these soils documented the crossing of thresholds leading to landscape change.

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OSL Dating of Neolithic Kissonerga-Mylouthkia, Cyprus

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Abstract

Optically stimulated luminescence ages of quartz extracts in Neolithic pits at Kissonerga-Mylouthkia, south-western Cyprus, correlate with published AMS results (calibrated radiocarbon dates range between 8740 and 6690 BP; OSL dates between 9600 and 7700 BP). The single-aliquot-regenerative-dose protocol proposed by Murray and Wintle (2000) was used to generate equivalent dose (De) distribution histograms for each sample. A consistent set of equivalent doses were obtained from each pit.

Introduction

Recent construction of new tourist facilities in Paphos, southwestern Cyprus, has necessitated the need for rescue excavations at coastal Kissonerga-Mylouthkia. The excavations, carried out by the Lemba Archeological Project (University of Edinburgh) between 1989 and 2000 revealed an extensive array of prehistoric archaeological features including pits, buildings, burials, and a remarkable series of deeply-cut well shafts (Fig. 1a). The wells are believed to be among the earliest in the world, and importantly contain some of the earliest data for domesticates, both animal and plant. Cultural materials, augmented by radiocarbon dates, define two main phases of human activity on the site. Most of the features date to the Early Chalcolithic period, around the mid-4th millennium calibrated B.C. (9 radiocarbon dates; Peltenburg 2003; Fig. 1b; Table 1), but a minority of features, primarily water wells, represent a considerably earlier period, the Cypro-Pre-Pottery Neolithic B (Cypro-PPNB), dating between the early 8th and mid-9th millennium calibrated B.C (5 radiocarbon dates; Peltenburg 2003; Fig. 1b; Table 1).

In this short note we present the results of an integrated optical luminescence dating and archaeological study to date two prehistoric features that potentially extend the range and extent of Cypro-PPNB features at Mylouthkia.

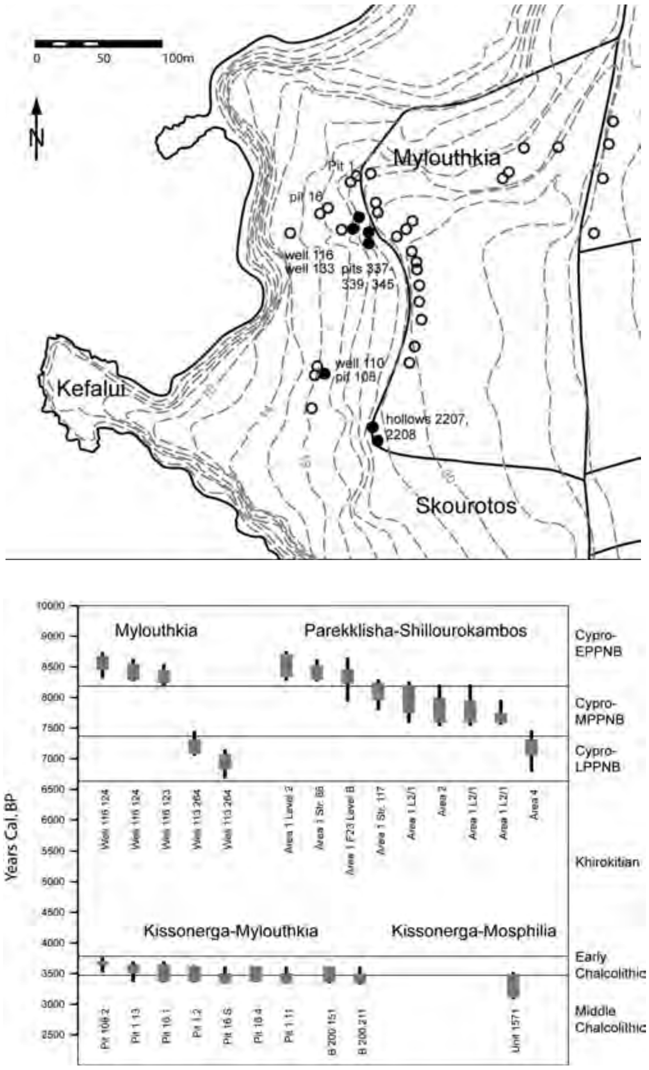

Fig. 1 (a) Site plan with location of surveyed and excavated features; closed circles denote Cypro-PPNB structures; open circles denote Chalcolithic structures. Features described in text are labelled.
(b) Radiocarbon dates (single s.d.) from sites of the Cypro-PPNB period (c. 8700-6500 Cal BC); Mylouthkia and Parekklisha-Shillourokambos (modified from Peltenburg *et al.* 2000; Guilaine and Briois 2000; 2001).

Optical dating provides a means to determine the burial age of sediments that have been exposed to sunlight (bleached) before deposition. The calculated age is the time elapsed since the last bleaching event. Many common minerals, including quartz and most feldspars, are able to store energy (and thus latent dating information) at defects within the crystal structure. Electrons may be evicted from their stable ground state by the addition of

Table 1 AMS results from charred seeds, cereal grains and charcoal from sites at Kissonerga-Mylouthkia and Parekklisha-Shillourokambos (Peltenburg *et al.* 2000).

Context	Sample no.	Material	Years BP	Calibrated BC. from Oxcal (2 Ø)
Period 1A – Mylouthkia				
Well 116.124	Ox A-7460	Barley	9316 ± 60	8740 – 8320
Well 116.123	AA-33128	Grain	9235 ± 70	8630 – 8280
Well 116.124	AA-331129	Grain	9110 ± 70	8540 – 8490 (?) 8490 – 8200
Period 1B – Mylouthkia				
Well 133.264	Ox A-7461	Pistacea sp.	8185 ± 55	7450 – 7430 (?) 7350 – 7060
Well 133.264	AA-33130	Lolium sp.	8025 ± 65	7140 – 6690
Period 2 – Mylouthkia				
Pit 108.2	OxA-7464	R415 charcoal	4885 ± 45	3780 – 3530
Pit 1.13	BM-1475	Charcoal	4815 ± 60	3710 – 3370
Pit 16.1	BM-1539	Charcoal	4790 ± 80	3710 – 3360
Pit 1.2	BM-1473	Charcoal	4765 ± 55	3650 – 3370
Pit 16.4	BM-1540	Charcoal	4740 ± 50	3640 – 3370
Pit 1.11	BM-1474	Charcoal	4665 ± 50	3630 – 3360
Pit 16 face	BM-1476	Charcoal	4650 ± 50	3520 – 3360
Period 3 – Mylouthkia				
B200.151	OxA-7463	C525 Pistacia	4710 ± 50	3640 – 3360
B200.211	OxA-7462	C529 Pistacia	4650 ± 50	3630 – 3340

energy to the system, *e.g.* from exposure to ionizing radiation emitted during radioactive decay. A portion of the electron population may be trapped at a defect site, until a further amount of energy is introduced via thermal (TL) or optical (OSL) excitation. This additional energy overcomes an activation potential and allows electrons to recombine at other sites. If the recombination centre is of the luminescence-type, energy is omitted in the form of a photon. Luminescence emission following thermal stimulation is termed thermo-luminescence (TL). Luminescence emission following optical stimulation is termed optically stimulated luminescence (OSL).

The 'natural' signal – that resulting from the natural radiation during burial – is compared with signals, from the sample, resulting from known doses of radiation, administered by a calibrated radiation source. The 'equivalent dose' is the laboratory dose of nuclear radiation needed to induce luminescence equal to the natural signal. Additionally, an assessment of the radioactivity of the sample and its surroundings using chemical and/or radiometric methods, and the contribution from cosmic radiation is required. This is termed the 'dose rate'. A luminescence age is calculated by dividing the one quantity by the other, *i.e.*

$$\text{Age (ka)} = \frac{\text{Equivalent dose (Gy)}}{\text{Dose rate (Gy/ka)}}$$

OSL and TL measurements are made on small (typically 4-6mg) aliquots of refined quartz or feldspar (of a limited grain size) from the sample to be dated. As each aliquot is apt to contain a mix of grains, some of which are well bleached and others that are poorly bleached and/or not bleached at all, it is necessary to measure several aliquots to estimate a pooled equivalent dose and assess levels of scatter.

Background

Mylouthkia is a severely eroded coastal settlement located at the northern end of the Ktima Lowlands, overlooking a natural harbour, Kefalui (Fig. 1a), in the Paphos District. The site may have overlooked this hospitable anchorage in the Chalcolithic and Neolithic, though it is not known to what degree marine transgression or tectonic instability has altered this configuration. It is comprised of two distinct occupations separated by several millennia, assigned to the Cypro-PPNB and Early Chalcolithic. We have restricted ourselves to the study of the Cypro-PPNB in this report. An authorative account of the excavations at Mylouthkia is provided by Peltenburg (2003).

As of 2000, the Lemba Archaeological Project had identified five wells, a semi-subterranean structure and three pits belonging to the Aceramic Neolithic. Rescue excavations, necessitated by the recent construction of new tourist facilities in Paphos, subsequently identified two hollows that were thought to be Neolithic in age.

The features we refer to are visible in the road cutting serving Queens Bay Hotel, below the village of Kissonerga, *c.* 140 m south of the major Neolithic wells. They are located some 15 m apart and are buried beneath the modern land surface to a depth of about a metre. Sample 'SUTL1581' was taken from the fill of one of these features, a large hollow (designated 'Feature 2208') which measures *c.* 11 m from north to south, and is generally < 1 m deep. In the centre of this hollow, a basal depression exists which is *c.* 60 cm deeper than the adjacent base level. It is filled with a sequence of pale to dark grey ashy layers, silts and gravels. It is from this lower portion of the fill that the OSL sample was taken. The absence of pottery and the presence of a single worked flint suggest that this feature probably dates to the early (Cypro-PPNB) phase at Mylouthkia. Sample 'SUTL1582' was taken from the fill of a second feature of unknown extent (designated 'Feature 2207'). Cursory cleaning and examination of the exposed section yielded two stone vessel fragments and two pieces of worked flint which, combined with the absence of pottery, suggests that the feature should also belong to the earlier (Cypro-PPNB) phase of use of the site. Future excavation may yield material that can be radiocarbon dated, which would provide a powerful cross-check to the results gained from our OSL samples.

Methodology

Samples were collected from cleaned vertical faces by inserting opaque plastic and/or stainless steel tubes into the soil profiles, a depth of *c.* 15 cm. The samples were collected in natural daylight, but were wrapped immediately in opaque black plastic bags. Each bag was sealed individually to retain soil moisture.

All sample handling and preparation was conducted under safelight conditions in the SUERC luminescence dating laboratories. Approximately 300 g of material was collected from the central, light protected core of the tubes, and wet sieved to obtain two fractions: 90-150 microns 'polymineral' for initial tests, and 150-250 microns 'quartz' for dating measurements. Both fractions were treated with 1M HCl for 30 minutes to dissolve carbonates. The coarser fraction was then treated with 15% HF (followed by washing in HCl) and density separated at 2.52, 2.58, 2.62, and 2.74 gcm^{-1}. Quartz was isolated from the 2.62-2.74 gcm^{-1} fraction by etching in 40% HF for 40 minutes (and washed in HCl). The 90-150 micron polymineral and 150-250 micron quartz grains were presented for measurement as mono-layers on 10 mm diameter, 0.25 mm thick stainless steel disks, fixed with silicone oil.

OSL measurements were carried out using a RISO TL/OSL automated machine. Luminescence from the quartz fraction was stimulated using blue diodes (470 Δ 20nm) with detection in the ultraviolet defined by two Hoya U340 filters (Botter-Jensen *et al.* 2000; Spencer and Sanderson 2002). The SAR protocol (Murray and Wintle 2000; Sanderson *et al.* 2001) was used to determine the De on each disc measured. In the SAR method, each natural or regenerated OSL signal is corrected for changes in sensitivity using the luminescence response to a subsequent test dose. Regenerative dose response curves were constructed using doses of 4, 8, 12, 16 and 20 Gy, with a test dose of 1 Gy. A second dose of 4 Gy was applied at the end of the run as a further sensitivity check. To ensure the prepared quartz contained no significant feldspar grains or micro-inclusions, a feldspar contamination test (the IRSL was read out after the sample was subjected to 20 Gy) was carried out at the end

Table 2 Activity and Equivalent concentrations of K, U and Th for samples SUTL 1581-1582 as determined by HRGS. Dose rates determined by TSBC and HRGS.

Sample (SUTL)	Activity Concentrations / Bq kg^{-1}			Equivalent Concentrations[1,2]		
	K	U	$D\alpha$ (dry)	$D\beta$ (dry)	$D\gamma$ (dry)	$D\beta$ (dry)
1581	316.4 ± 21.4	37.8 ± 4.20	1.33 ± 0.24	1.02 ± 0.07	3.06 ± 0.34	0.33 ± 0.06
1582	268.8 ± 20.8	37.38 ± 4.09	2.98 ± 0.27	0.87 ± 0.07	3.03 ± 0.33	0.73 ± 0.07

Sample (SUTL)	Dry Infinite Matrix dose rates[3] by HRGS / $mGya^{-1}$			TSBC / $mGya^{-1}$
	Th	K (%)	U (ppm)	
1581	8.75 ± 0.95	1.31 ± 0.08	0.62 ± 0.04	1.72 ± 0.07
1582	8.95 ± 0.92	1.18 ± 0.07	0.59 ± 0.04	1.71 ± 0.07

1 Conversion factors (based on OECD, 1994): 40K: 309.26 Bq kg^{-1} $\%K^{-1}$; 238U: 12.34787 Bq kg^{-1} $ppmU^{-1}$; 232Th: 4.057174 Bq kg^{-1} $ppmTh^{-1}$.

2 Working values for Shap granite.

3 Based on dose rate conservation factors from Aitken, 1983.

Table 3 Annual dose rates for SUTL 1581 and 1582.

Sample (SUTL)	Water Content			Effective β dose rate[1] / mGya^{-1}	Dγ (wet) by HRGS[3] / mGya^{-1}	Effective γ dose rate[3] / mGya^{-1}	Total dose rate[2] / mGya^{-1}
	FW / %	SW / %	Assumed / %				
1581	10.79	24.81	15 ± 5	1.15 ± 0.07	0.53 ± 0.04	0.53 ± 0.04	1.86 ± 0.09
1582	-	-	15 ± 5	1.09 ± 0.07	0.51 ± 0.04	0.51 ± 0.04	1.79 ± 0.08

[1] Effective beta dose rates combine water content corrections with inverse grain size attenuation factors obtained by weighting the 200 micron mean grain size attenuation factors of Mejdahl (1979) for K, U and Th sources by the relative contributions to beta dose rate from each source determined by HRGS.

[2] Obtained from the combination of effective beta and gamma dose rates and an additional 0.185 mGya^{-1} allowance for the dose rate due to cosmic radiation (Prescott and Hutton 1994).

[3] These rates are based on a γ water correction on the Dγ (dry) by HRGS.

of each run. To assess the dependence of De on preheat temperature, four different preheat temperatures were investigated (220, 240, 260 and 280 °C).

Dose rate measurements from the dating samples were undertaken by Thick Source Beta Counting (TSBC; Sanderson 1988) and High Resolution Gamma Spectrometry (HRGS); the results of which are shown in Tables 2 and 3.

Results and Discussions

The effective dose rate, water content (calculated and assumed), mean De and OSL age for each sample are shown in Tables 2, 3 and 4. Polymineral separates were subjected to both infra-red stimulated luminescence (IRSL) and thermoluminescence (TL), no response was received under either stimulation, implying little/or no feldspar contamination.

Dating measurements were carried out on the quartz separates. Due to the limited amount of quartz in the sediment only 14 aliquots could be measured for each sample. Poorly bleached aliquots were rejected from further analysis based on the 4 Gy sensitivity check, the robust mean, feldspar contamination and radial plots. The data derived from the SAR dose determinations were analysed at two scales; individual dose response curves were analysed using the Risø 'Analyst' program; composite data sets were explored using Excel spreadsheets and Jandel Sigmaplot software. There was no evidence of significant differences in normalised OSL ratios (both in natural and regenerated dose points) between subsets of discs pre-heated at temperatures from 220°C to 280°C (Fig. 2).

Accordingly composite dose response curves from selected discs for each sample were constructed and used to estimate equivalent dose values for each individual discs and their combined sets (Fig. 3). The growth curve data were fitted with a single saturating exponential function and the equivalent dose was estimated by interpolation with the net-natural sensitivity-corrected lumi-

Table 4 Summary of SAR results for Mylouthkia pits 1 and 2.

Sample (SUTL)	Mylouthkia – Pit 1 (1581)	Mylouthkia – Pit 2 (1582)
Recycling ratio	1.00 ± 0.01	0.99 ± 0.01
De at 220°C / Gy	16.43 ± 2.24	12.94 ± 1.57
De at 240°C / Gy	16.94 ± 0.52	15.38 ± 1.64
De at 260°C / Gy	17.01 ± 1.56	16.32 ± 3.47
De at 280°C / Gy	17.51 ± 1.81	15.24 ± 0.20
Combined De / Gy	16.97 ± 0.44	14.95 ± 2.30
Robust Mean - De / Gy	17.13 ± 1.21	14.44 ± 1.64
Effective dose rate / mGya^{-1}	1.86 ± 0.09	1.79 ± 0.08
Age / ka	9.12 ± 0.49	8.37 ± 0.61
Age / years BP	9118 ± 493.42	8367.8 ± 612.7

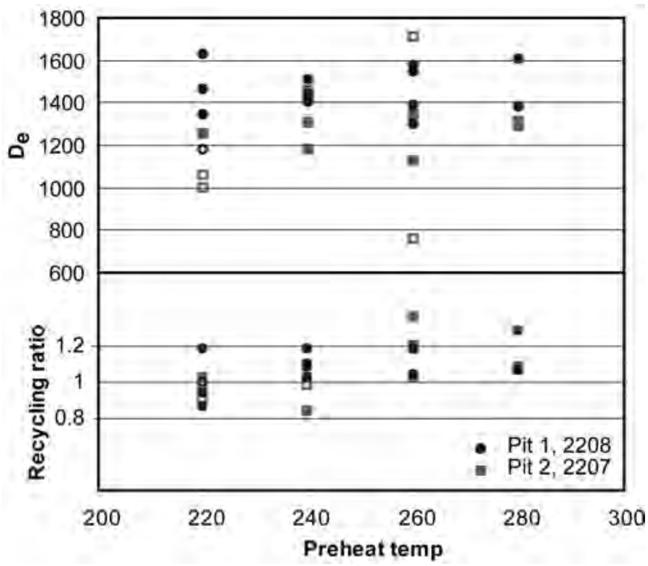

Fig. 2 Preheat Plateaus for quartz extracted from two pits at Mylouthkia. Closed squares/circles indicate concordant data. Open squares/circles indicate disconcordant data (outwith 2 standard deviations).

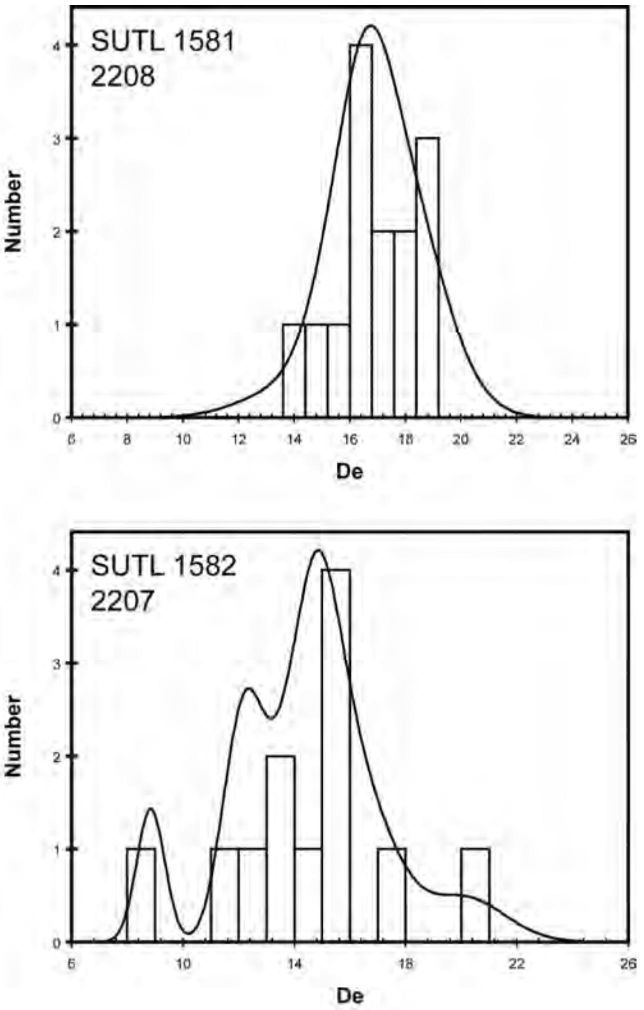

Fig. 3 Weighted histograms of SAR equivalent doses for samples 1581 and 1582.

nescence level. The distribution in equivalent dose values was examined using weighted mean histogram plots (after Spencer and Sanderson 2002). It is clear from these plots (Fig. 4) that both samples have a narrow distribution in equivalent dose values, and this is reflected in the relatively small uncertainity in weighted mean results.

To check for the presence of non-uniformity (sample heterogeneity) in sample radiation dose histories we have compared aliquot intensity and equivalent doses. The distribution in equivalent doses is shown visually in Figures 3 and 4; however we were concerned with how averaging the equivalent doses would affect our calculated age. In Figure 3 the mean, median, robust mean and the logged and non-logged central age modelled mean of Galbraith (1999) are shown. The robust mean was calculated by two methods; by the use of an in-house excel program, which removed any data outwith 2 standard deviations in a continuous loop, so that data excluded from the last calculation was not included in the next; and by an excel add-in 'robust statistics' available from the Chemistry Society of London, which calculates a robust mean using Huber's estimate 2. Figure 3 indicates that similar values of equivalent dose are calculated in all six methods, implying that we can be confident in determining a calculated luminescence age.

The two hollow- or pit-like features 2207 and 2208, at Mylouthkia yielded OSL ages of 8.37 ± 0.61 and 9.12 ± 0.49 ka. AMS results from charred seeds and cereal grains at the same site date to the late 10th and 9th millennium; *i.e.* period 1A well 116 (Fig. 1a) has a coherent set of three later 10th millennium BP AMS dates from barley and over short-lived cereal grains (Fig. 1b); period 1B well 133 (Fig. 1a) has two later 9th millenni-

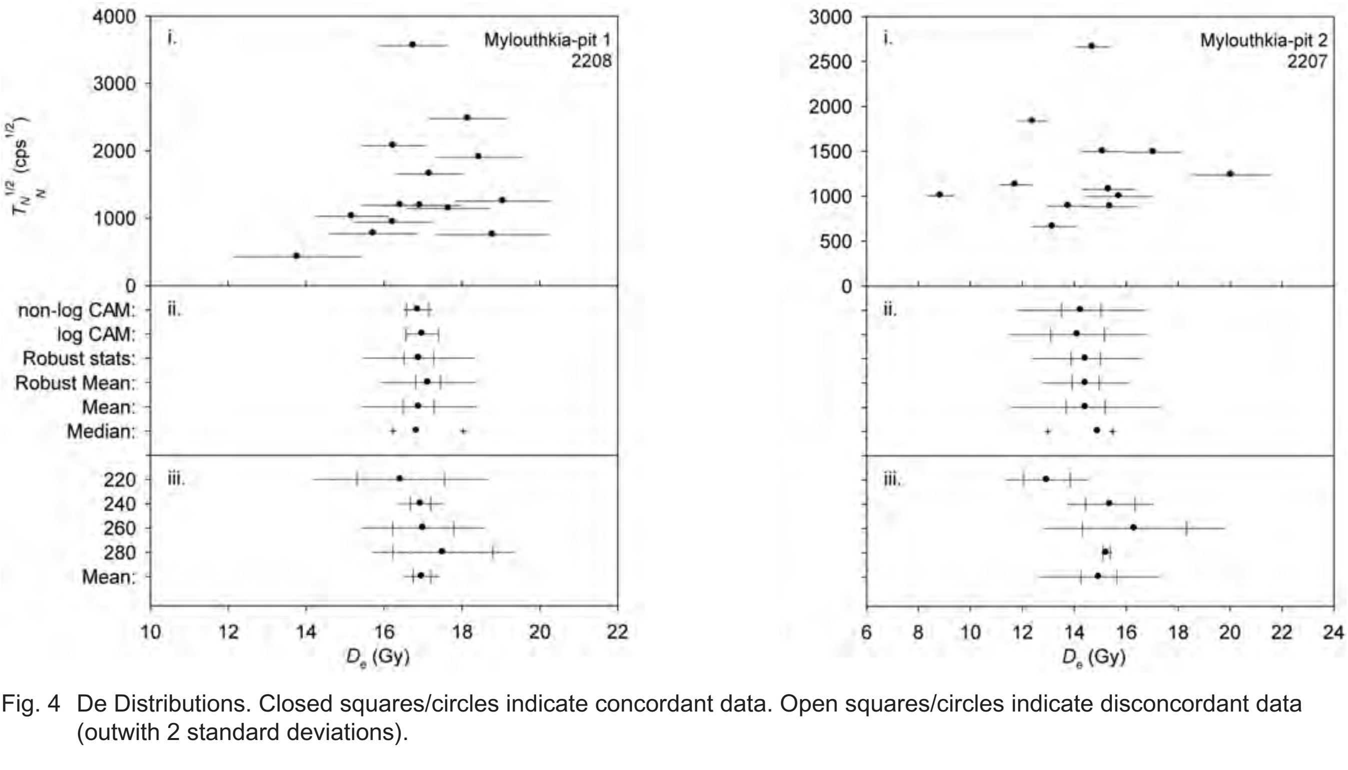

Fig. 4 De Distributions. Closed squares/circles indicate concordant data. Open squares/circles indicate disconcordant data (outwith 2 standard deviations).

um AMS dates from charred seeds (Fig. 1b). In this established chronological framework, hollow/pit 2208 may be designated a Period 1A Cypro-PPNB feature and, hollow/pit 2207 a Period 1B Cypro-PPNB feature.

A comment must be made on the luminescence properties of the quartz extracted from the Mythoukia pits. The bedrock in the area is a carbonate-siliclastic sequence, so the quartz within the pit-fill must therefore be derived from a more distal source. Likely provenances are the Troodos Massif, which forms much of the high ground in the centre of the Island and the Mamonia Complex, in western Cyprus. The quartz must have been transported to the Mylouthkia region by fluvial or aerial processes. A small contribution from loess-type deposits of the Sahara must also be considered. Petrographic examination of the sediment does not provide any clues, as there are several quartz variants and morphologies. A recognised problem in the accurate dating of sediments using a multi-grained approach is an overestimation in equivalent dose due to stimulation of a mixed dose population consisting of bleached, partially bleached or unbleached grains. It was envisaged therefore, that the Mylouthkia sediments would yield a broad distribution in equivalent doses. However, the laboratory work has shown that the quartz was sufficiently zeroed at deposition to allow valid luminescence dates to be calculated. The sediment infilling the pit must have accumulated slowly allowing sufficient bleaching to occur. Therefore the technique of OSL may be used as a valid means of dating sediment of mixed provenance in carbonate-siliclastic sequences, if detailed geomorphological and sedimentological studies are used to identify potential samples/sites.

Conclusions

Traces of some of the earliest successful human colonists of Cyprus can be dated to the late 10th millennium BP at Mylouthkia, in the southwest corner of the island. Our OSL results contribute to an expanding catalogue of data on the Early Aceramic Neolithic occupation of Cyprus, which has allowed scholars to glean a better understanding of the processes of island colonisation, and has led to a fresh appraisal of the role of Cyprus in the narratives of the Eastern Neolithic (begging questions on the early spread of agriculture and trade). They confirm the validity of OSL dating of archaeological features without recourse to costly excavations.

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Short Note

Neolithic Foot-shaped Objects Found in Shir, Middle Orontes Region

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The Late Neolithic site of Shir, located *c.* 12 km northwest of Hama in western Syria, has been the subject of a cooperative project between the German Archaeological Institute in Damascus (DAI) and the Direction Générale des Antiquités et des Musées de la Syrie (DGAMS) since 2006. The long-term aim of the excavations is to expose on a large scale the central habitation area in order to clarify the settlement's layout, functional areas and social structures that were present during the thus far relatively little known time span between 7000 and 6200 calBC.

During the three previous excavation campaigns a stratigraphic sequence of six building layers could be determined in the southern part of the settlement. The oldest layer was founded on a burnt layer above the natural rock. Aside from the main find categories, lithics and pottery, all of the layers contained a huge amount of highly varied bones and stone objects, which as a rule served for daily purposes, such as the preparation of tools and food, as well as storage and ornamentation. In addition, however, a few objects were discovered whose purpose must have been in other spheres. Among these are two objects shaped like a foot and made of limestone; they were found in the spring of 2007. Both objects are casual finds. Neither their position at discovery nor fabric or form allow them to be regarded as one pair that belong together.

No. 1 (FN 0531/L7/07) was found in Area L7 in one of the upper layers. Its length of *c.* 13 cm corresponds to the size of a small child's foot (Figs. 1a-c). It is broken at the height of the ankle where the leg joins, and the frontal part of the foot is likewise broken off. The preserved part of the leg's join to the heel slants backwards at an angle and, thus, resembles the position of a stretched foot and leg. The material is light grey limestone, most likely of local origin. Traces of work are clearly visible on the striated smoothed surface, but there is no fine polish typical of stone bowls and celts in Shir.

No. 2 (FN 0585/L8/07) was found in Area L8 adjoining in the north and is *c.* 12 cm long and 7 cm high (Figs. 2a-c). This object is almost completely preserved in the area of the foot, while the leg is also broken off at ankle height. The heel and leg-join are more steeply worked, so that an impression is gained of a straight position of foot and leg. The material is light grey limestone interspersed with dark grey spots. Here as well traces of striations from the carving are visible, especially in the area of the sole.

Neither object derives from an *in situ* context, but each was found in the area of pits and debris. Therefore, no clues as to their original function can be drawn from direct associations. Both stone feet are very stylised and neither displays any details such as toes, ankle or heel. Nevertheless, in their fabrication they do attest a superior conception of form and excellent workmanship in stone. The breaks in the area of the ankles could indicate their having once been part of large stone sculpture, although it is noteworthy that thus far no other fragments of large statues have been found in Shir. Therefore both pieces probably belong to a small group of foot-like or foot-shaped objects, which appear occasionally in different times and different regions in Syria and whose significance cannot be defined clearly yet.

In a recent compilation of the so-called "stone feet" that are known at present, seven similar objects from six sites were presented. Their occurrence ranges from MPPNB into the Early Bronze Age and extends across Labweh, Halula, el-Kowm, Tell ʻAbr, Mashnaqa and Horum Höyük (Haidar-Boustani 2006: 139ff.).[1] All of these pieces display a similar stylised form and appear, as examples from Halula and Tell ‘Abr suggest, to have been limited solely to the area of the foot, at least partly; that is, they should be viewed as being without any association with large statues in the round. However, since the entire area of the possible leg is missing from the examples in Shir, the same cannot be maintained with certainty in their case. Further, it cannot be discerned with certainty whether the objects represent the right or the left foot.

Suggestions pertaining to the function of these “stone feet” are difficult to make. Nevertheless, it is unlikely that they served for secular purposes. Their rare occurrence is indicative rather of a special use. On the basis of their size (between *c.* 12 and 25 cm) and weight, it can be assumed that they were likely stationary. Whether they were placed on view in certain places cannot be determined. Yet, there is clearly no standing surface recognisable on both foot-shaped objects from Shir. In view of the slightly rounded sole or surface, they could not have stood alone and would have had to be secured.

With regard to their meaning, they could be viewed as a personal protective symbol (*cf.* Haidar-Boustani 2006: 143), which a person occasionally carried or set up in specific places. The nature of the protective aspect of the foot is unclear.[2] Moreover, it is questionable whether the assumed symbolic content of the stone feet always remained the same throughout the several thousand years of their appearance in the Near East.

For clarification of the significance of these remarkable objects, more distinct and clearly identifiable find contexts are necessary than those that have been brought forth for the previously found objects.

Figs. 1a-c Foot-shaped object no. 1 from Shir, different views.

Figs. 2a-c Foot-shaped object no. 2 from Shir, different views.

Notes

[1] A further group of similar foot-shaped objects was found in Copper Age sites in the eastern Balkans (Hansen 2007: 247, fig. 154).

[2] It should be noted in general that in later periods the foot is seldom attested as a symbol in the Near East. The most well-known examples are three over-sized impressions of naked feet in the gateway to the cella of the Late Bronze Age/Early Iron Age temple of ʻAin Dara. In view of their emplacement in the area of the cella, it is presumed that they should symbolise "divine footsteps" (Abu-Assaf 1990: 44).

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Conferences, Workshops, Call for Papers

BANEA 2008 Conference
University of Liverpool, February 29-March 2, 2008

BANEA08 Theme 1:
Theoretically speaking: New approaches to old problems

"Approaches to and interpretations of archaeology in SW Asia have traditionally been characterised as explanatory, evolutionary, and processual" (Flannery 1998). Recent research, primarily drawing on European post-processual and interpretative perspectives, has begun to engage with concepts such as 'ritual', 'symbolism' and 'the landscape'.

Theoretically speaking aims to drive the situation forward, exploring theory, its elevance, and applicability to the archaeology of the region. The relevance of theory and the need to apply theory in practice to concrete archaeological material will be discussed, bringing stronger relevance and tangibility to theoretical debate.

The conference is intended to encourage collaboration, discussion and debate, encouraging and driving research into the approaches, interpretations and practices that archaeologists and those studying the past face.

Papers and workshop proposals are invited on the following themes (although we also welcome suggestions in other relevant areas):

1. Gendered agency (including the archaeology of the body and embodiment, and queer approaches).
2. Landscape and architecture; reaching beyond nature/culture dualisms.
3. Humans and their interactions: animals, plants, food and drink, material culture, the environment.
4. Memories, histories and identities.
5. The human body: Life, death and representation.
6. The Socio-politics of archaeology in the region.

Organisers:
Karina Croucher, University of Liverpool (karina.croucher@liverpool.ac.uk) and Brian Boyd, University of Wales, Lampeter/Columbia University (bb2305@columbia.edu)

BANEA08 Theme 2:
Bioarchaeology in SW Asia: Recent advances

Papers are invited on current research in the area of Bioarchaeology in SW Asia. For the purposes of this conference bioarchaeology relates to the study of the biological characteristics of plant, animal and humans and any combination thereof that enhances our understanding of the archaeology of SW Asia. Papers will be considered on, but not limited to, the following topics:

1. Physical anthropology; Demography; Pathology.
2. Mobility and dispersal; Domestication; Agricultural and pastoral management practices.
3. Human/animal impact on the environment; Diet; Genetics.

Organiser:
Jessica Pearson, University of Liverpool (jessica.pearson@liverpool.ac.uk)

Workshop:
Ritual and social change: The Late Bronze and Iron Ages in Jordan

This workshop looks at the archaeological reflections of differences in ritual, conspicuous consumption and feasting between the Late Bronze and Iron Ages, and how they reflect changes in society.

Organisers: Bruce Routledge (bruce.routledge@liv.ac.uk) and Eveline Van der Steen (Eveline.Van-Der-Steen@liverpool.ac.uk)
Further information can be found on the conference website:
http://www.liv.ac.uk/sace/events/confer/banea/index.htm

6th Conference on PPN Chipped and Ground Stone Industries of the Fertile Crescent: STEPS (Studies in Technology, Environment, Production and Society)

University of Manchester, March 3-5, 2008

cf. Neo-Lithics 1/07, pp. 48-49. Registration/circulars: elizabethhealey2004@yahoo.co.uk, or by mail to Dr. Elizabeth Healey, School of Arts, Histories and Cultures, (Archaeology, Mansfield Cooper Building), The University of Manchester, Oxford Road, Manchester. UK. M13 9PL.

The conference will run from mid-morning on Monday 3rd March until the late afternoon of Wednesday 5th March 2008 (can be extended if more papers are offered). Accommodation and the conference will be held at Chancellors Hotel and Conference Centre, University of Manchester, Fallowfield, Manchester (http://www.conference.manchester.ac.uk/chancellorshotelconference-centre). The total cost of the conference over two and a half days will be 220-250 pounds sterling (includes a registration fee and accommodation for two nights and all meals; payable on arrival). Full text papers and posters should be submitted at or before the conference in order to guarantee a prompt publication, with a six week period of grace after the conference for any amendments in the light of discussion (publication in the ex oriente SENESPE series).

Basta Final Symposium

Free University of Berlin, April 24-27, 2008

Participants in the Basta final publication are gathering with commentators, facilitators and distinguished specialists to link the excavation results of the various research fields by a systemic approach, in order to reconstruct the Basta Socio-Economic and Cognitive System preparing Basta V (summary volume of the Basta final publication). Sessions of the meeting are:

- I: Disciplines' Summaries for the Basta Sub-Systems,
- II: Consultants' Comments,
- III: The Rubble Layers (Discussion),
- IV: Sub-Systems' Discussion,
- V: Sub-Systems' Entries,
- VI: Post-Excavation Fates (Discussion),
- VII: Evaluation of the Socio-Economic and Cognitive Systems of Basta, and the Mega-Site Issue.

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Domestication of Water

Special Issue of *Neo-Lithics:* Call for Papers

Dear Colleagues,
Water management has been among the central issues of Neolithic archaeology of the Near East, but the scarcity of direct evidence has long kept us frustrated. However, things have undergone a complete change. As you are aware, recent investigations, especially in Cyprus and southern Levant, have shed new light on the issue. In view of this situation, the editorial board of *Neo-Lithics* and me as guest editor are planning a special feature on Domestication of Water in the forthcoming issue 2/08.

As was the case in *Neo-Lithics* 1/04 (forum on Cyprus Neolithic) and *Neo-Lithics* 2/05 (forum on The Early Neolithic Origin of Ritual Centers), the special issue on Neolithic Water Domestication opens with three keynotes (from Hans Georg Gebel, Tony Wilkinson (requested), and myself), followed by comments from scholars whose (field)work has addressed these topics as a response to the keynote articles and as a chance to provide additional information on their evidence. Replies to the commentators by the keynote writers then may round off the discussion. It is our aim to make an in-depth discussion based on specific evidence and, in so doing, to stimulate further investigation.

We would like to ask if you would be willing to be one of the commentators, and to receive later the keynotes for your contribution. We will be expecting contact from those who were involved in relevant investigations, or those who are planning to embark on an investigation in the near future. Those who are not directly concerned with such an investigation yet have a strong interest in this issue are also welcome. We offer selected topical areas below for the comments, but other points are also welcome.

We will (within some four months) distribute the keynote articles to those who offer a positive involvement. The deadline for the commentators' contributions most likely will be three months after the keynotes were sent out to commentators. In order to plan the issue, we kindly ask you to express preliminarily your interest to particpate until end of February 2008.

Sumio Fujii
Guest editor of *Neo-Lithics* 2/08
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Framework of evidence:

Water harvesting, storage, and as resource (by dams, by wells, by using topography, containers, crafts using water).

Internal and external site-related water management (*e.g.* channels like in Ba'ja, es-Sifiya, and most likely others; moisture management, flood management: this could be also pre-discussed in the mailing list *Neo-Lithics*).

Evidence of first hydraulic horti-/agriculture in Northern Mesopotamia in the Late PPN/Early PN through to Hassuna/Samarra.

Framework of questions:

Embedding water domestication into the Neolithic domestication/storage ideas in general.
Domestic water use vs. foraging water use.
Parameters of Neolithic water storage and management.
Formation of early irrigation landscapes.
Shifting water-related site locations in early settlement history.

Ongoing PhD Research

Janine Major

A Contextual and Technological Analysis of Natufian Art from the Perspective of Wadi Hammeh 27

Doctoral dissertation, Archaeology Program,
La Trobe University, Melbourne
Supervisors: Dr. Phillip Edwards and
Dr. David Frankel

Abstract
My doctoral research is a contextual and technological analysis of Natufian art with a case study focus on the Jordanian site of Wadi Hammeh 27. The growing interest within the archaeological literature of the role that symbols and images may have had in forming the social and economic relationships within and amongst communities of the Epipalaeolithic and early Neolithic of the Levant underpins the motivation for my research. During the Epipalaeolithic, and particularly within the culture of the Natufian, the Levant experienced a florescence of art that is impressive in relation to its relative sudden appearance, its high degree of technical mastery as well as its application to otherwise functional artefacts. Wadi Hammeh 27 has yielded one of the most extensive and well provenanced corpuses of decorated items, particularly from an open-air Early Natufian settlement, providing an opportunity to study these from both a technological and contextual point of view. The only other site, which has yielded a comparable amount of art items, is Hayonim Cave. An intensive investigation of the iconic, schematic and geometric images from Wadi Hammeh 27 will provide a means to discuss Natufian art at the local site level but also to situate such a discussion within the broader regional and social aspects of the context of Natufian art.

The art assemblage from Wadi Hammeh 27 is not only significant in relation to its secure provenance but also in the variety of number and type of examples it has yielded. These include anthropomorphic, zoomorphic and/or geometric motifs which appear on bone and stone items including figurines, pendants, sickle hafts, plaques, pebbles, grooved stones, waisted stones, pestles, vessels and architectural elements.

Francesco d'Errico's use of microscopic analyses to investigate prehistoric symbols provides the methodological framework for the technological analysis of the Wadi Hammeh 27 assemblage. Through the application of a microscopic analysis, I will endeavour to investigate the fine detail of these artefacts, their motifs, and evidence of the methods and sequence of their production in order to add another dimension to the continuing discourse on Natufian culture. The technological analysis of the Wadi Hammeh 27 assemblage will involve optical microscopic observation that will be recorded with a digital camera at a number of resolutions, in order to develop a story of production from the 'macro' to the 'micro' detail, i.e. from the selection and preparation of the raw 'canvas' to the sequence of production of the motif and any subsequent reuse.

Some items from Wadi Hammeh 27 have the potential to offer beneficial information from very high resolution analysis such as provided through SEM analysis. In order to ensure the integrity of preservation of the original, resin casts will be required for the actual analysis. From a methodological point of view, I have so far encountered a number of issues during preliminary experimentation in replicating artefacts. During moulding procedures, the porosity of the bone and stone items under consideration leaves the originals susceptible to chemical alteration. For example, experiments undertaken to date on bone and stone items have resulted in residue transfer and staining from both silicone-based and latex molding agents. Staining of an original piece may not be immediately evident, thus 'testing' an area on an original is not necessarily satisfactory unless subsequently monitored for a considerable period. These issues will continue to be investigated before any replication of the original items.

The focus on the Wadi Hammeh 27 assemblage will be complemented by firsthand observation of Natufian art items from other sites that will assist in developing an overall understanding of the technologies of the production of Natufian art. Combined with a contextual analysis of all Natufian art items, I hope to be able to identify patterns regarding relationships between media, motif, technology, context and regional similarities/differences and spheres of interaction.

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Obituary

Nabil Qadi (Abu Salim)

rahmatu allahi aleik

A Personal Obituary

Nabil lived quietly and patiently, modestly and with humility, guided by his deep devotion and respect to the Almighty's will. He rarely complained, and did all his best to facilitate the personal and professional life of those around him. He was not hunting for reputation or wealth, but he cared about the essential internal and external needs of his beloved ones, friends and colleagues. He was not hierarchy-minded. He observed us in a caring way, and tried to help discretely those in danger doing wrong. He was just in his opinions and honest in all doing, and was always forgiving and respectful to those who neglected him. He had a silent wit, and it was difficult to find him angry. Praying was the foundation of his life and actions.

Nabil Qadi at Free University of Berlin in May 2005, discussing the LPPNB ground stone industry he prepared for publication.

I spent much time with Nabil: during the seasons at Basta, in the storerooms at Yarmouk University, in his home. We were close in the shared professional work, but we were even closer when over years he guided me the right way. He had simple and human advice resting in his beliefs. I never met anyone more convincingly living and teaching the interior *jihad*, or struggle for being good. He did not tolerate extremes, or things demanding more than one can bear or manage. When others were noisy, he became quiet.

Nabil was the backbone of most excavation projects the Institute of Archaeology and Anthropology at Yarmouk University carried out in the eighties and nineties, including 'Ain Ghazal, Basta, Abu Thawwab and other Neolithic enterprises. Without him the success and fame of these projects would not have been achieved, and their directors owe Nabil more than they probably ever realize. He was indispensable in the projects, caring comprehensively for everything: technically, logistically, and socially. He was adept in improvisation and pragmatic solutions, doing the things and not discussing them. But, didn't these talents ironically lead us not promote him beyond the BA level he reached?

Nabil became a field person, although quite engaged –in his way– in materials' analysis and academic work until his last years, which he spent without a real challenge and support in a basement of Yarmouk University. There are a lot of stories, funny and sad ones, about his professional life. *E.g.,* he was the only one who could excavate with two trowels, one in each hand. Many don't know that already as a young BA he fought to respect the Antiquities Law of Jordan, as, for example, when he was working as a Department employee in Petra, he was instrumental in the arrest of a German antiquities dealer in the old Amman airport in the sixties.

My brother Nabil Qadi passed away at the age of 61 on Friday, 7th of December 2007, after a surgical treatment of a stomach-related problem developing since longer. We are mourning and will not forget him, joining in this his wife, his four daughters, his son, and all his family.

Hans Georg K. Gebel

Masthead

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just as deadlines approached when we as co-editors were feverishly striving to get people to submit copy. Remember the desperate efforts at the beginning to rely on lithic topics only (*e.g.* reprinting "How the Rabbit Killed Flint" from AAA 3, 1910, in NL 1/96). But by 1996, we were pleased that more and more manuscripts were submitted. We found that we cannot maintain the newsletter with just lithic topics, and that a forum of quickly published excavation news was much appreciated. The content of *Neo-Lithics* grew accordingly. So did the number of subscriptions, and consequently more money was available for the production of *Neo-Lithics*. In 2003 we were pleased to present the newsletter in a new and much more professional format, one that included illustration with a much higher degree of reproductive quality. This professionalism is owed to Jurgen Baumgarten, joining in as managing editor of *Neo-Lithics*. In addition, the newsletter by then became a membership bonus to ex oriente members, helping to secure its financial basis. Still, its production is a true non-profit enterprise. With the current issue, we now have 64 pages (116 pages for both issues from 2007), the largest issue ever.

The year 2004 included a new concept for *Neo-Lithics:* theme-based issues that would appear occasionally, such as *Neo-Lithics* 1/04, when the Cyprus Neolithization was a major theme, as well as another section devoted to supra-regional approaches to Neolithization in the Near East. Another "dialogue" appeared in 2005 (early Neolithic ritual centers), and two more are planned in the near future.

In the last issue of 2004 (*Neo-Lithics* 2/04), after 11 years of publication, an index was published by J. Baumgarten with A. Collo that included the tabulation of articles according to several topics (site, author, and subject). Within the subject index, articles were counted according to geographic location, and there was a clear bias in terms of representation, with the southern Levant more frequently the focus of reports than any other part of the eastern Mediterranean. Including all of the issues except this one (2/07), the table shows that of the 113 field reports that have appeared in *Neo-Lithics,* 63 (56%) are from the southern Levant (and of these, 50 [44%] from Jordan alone).

In part, these data reflect the relative intensity of Late Epipaleolithic/Neolithic research in the various regions, but on the other hand there are probably other elements in play. For example, although *Neo-Lithics* publishes English and French articles, not everyone in areas outside of the southern Levant is fluent in these two languages. There is also a high likelihood that *Neo-Lithics* is not reaching audiences outside the southern Levant, and we hope this can be changed. We appeal to everyone working in the greater eastern Mediterranean region, including the Caucasus, the Arabian peninsula, Egypt and North Africa in general, and southeastern Europe to consider providing the Neolithic archaeological community with more information about what has been learned/is to be learned about the Late Epipaleolithic and Neolithic in these areas outside the Levant by submitting manuscripts to *Neo-Lithics.* With a turn-around time of only several weeks, *Neo-Lithics* is one of the quickest ways to let colleagues in the greater Neolithic community know what is developing.

Since 1994, *Neo-Lithics* promotes the idea of the "Neolithic family" active in the Near and Middle East, meaning that Neolithic research should bring colleagues together and should integrate research agendas by crossing borders in minds and research territories. It is a long way, however, but weren't these policies since Berlin 1994 helping the spirit? In this sense, good luck to the 6th Conference on PPN Chipped and Ground Stone Industries of the Fertile Crescent, to take place in Manchester, March 3-5, 2008.

Gary O. Rollefson and Hans Georg K. Gebel

Table. Contributions to *Neo-Lithics* according to regions.

	A	C	E	G	Ir	Is/P	J	L	S	T	U	Y	Total
n	1	3	1	1	3	13	50	2	13	24	1	1	113
%	1	3	1	1	3	11	44	2	11	21	1	1	100%

Abbreviations: A=Aegean; C=Cyprus; E=Egypt; G=Georgia; Ir=Iran; Is/P=Israel/Palestine; J=Jordan; L=Lebanon; S=Syria; T=Turkey; U=Uzbekistan; Y=Yemen