NEO-LITHICS 2/04

The Newsletter of Southwest Asian Neolithic Research

Contents

Editorial

In 2004 *Neo-Lithics* entered its 11th year. In its 10th year, the newsletter received a new format, and started more explicitly to follow aims to promote and influence new research agendas; consequently "A Newsletter of Southwest Asian Lithic Research" became "The Newsletter of Southwest Asian Neolithic Research", supported by a re-organization of editorial efforts. We intend to continue on this track, and thank our readers for the encouraging praise we received.

In its 12th year, *Neo-Lithics* will publish a contents list and index of all contributions published so far. Preparations have started to organize Dialogue II of *Neo-Lithics:* "The Early Neolithic Origin of Ritual Centers". Time has come for a candid discussion of the regionally highly diversified evidence, especially in view of the discoveries of the past decade which allow for Near Eastern-wide consideration.

We editors – also in the name of our readers – take the liberty on this occasion to warmly greet Eric Coqueugniot in his new position as chief editor of *Paléorient,* our beloved flagship journal in Near Eastern prehistory. *Paléorient* has survived many difficult times, in no small part because its high standards were mastered and developed by the constant and outstanding engagement of Geneviève Dollfus, a friend and colleague to whom we all owe deep admiration and respect.

May the year 2005 witness successful research in a more peaceful Near East.

Hans Georg K. Gebel and Gary O. Rollefson

A New Early Neolithic Settlement in Southeastern Turkey: Hamzan Tepe

Bahattin Çelik
Harran University <bcelik@hacettepe.edu.tr>

Hamzan Tepe is located approximately 10 km south of the city center of Şanlıurfa in southeastern Turkey. This settlement is named after a hill bearing the same name on 1:25.000 scale topographical maps which contain no habitation. The Hamzan Tepe settlement lies atop virgin rock with an incline of 30° east to west. The region of the settlement, approximately 600-700 m in altitude, has characteristics of a steppe and is called "Fatik Dağları" on maps. It has no water resources and has the appearance of calcareous bedrock that has suffered heavily from erosion. The preserved part of the settlement covers an area of roughly 5000 m^2. It is unfortunate that the garbage dump of the Şanlıurfa metropolitan area for the last 20 years is located 30 m to the east of the settlement, covering a large area of it. The most important plain of the region, Harran Plain, is located approximately 1 km to the east of the settlement. An ineresting aspect of the Hamzan Tepe settlement is its location near a fault line that cuts through the Fatik Dağları, for it appears that because of this fault line masses of flint have surfaced. These flint sources are very close to the actual settlement and provide important resources together with basalt blocks 400 m west of Hamzan Tepe. A similar situation can be observed at Göbekli Tepe (Beile-Bohn *et al.* 1998: 59).

The most striking characteristic of the Hamzan Tepe settlement is the inclusion of two different phases: the first one is Lower Paleolithic, the other is Pre-Pottery Neolithic (Çelik 2003: 48). The close proximity of the settlement to the fertile Harran Plain and the existence of vast flint sources in the vicinity must have played an important role in the selection of the site.

Flint artefacts in the Hamzan Tepe settlement are abundant; the number of artefacts discovered is approximately 250 per m^2, whereas architectural remains are scarce. The thickness of the habitation levels above the bedrock is 20-60 cm, thus partially leaving architectural elements in the open. The existence of several pits, 40-50 cm in diameter and 8-10 cm deep, is proof for the former presence of architectural remains, among which the stelae seem to represent an important group.

On the settlement at Hamzan Tepe where the bedrock was exposed by the local people (Fig. 1) there are cup-hole sized depressions. The diameter of these depressions is roughly 10 cm and their depth 5-8 cm (Fig. 2). Next to these are three round pool-like pits with varying diameters of 1.5-3.0 m and depths of 40-60 cm carved into the bedrock (Fig. 3). Similar pool-like pits are already known from Göbekli Tepe (north and southwest sections: *cf.* Beile-Bohn *et al.* 1998: 47-50, Fig. 20; Hauptmann 1999: Fig. 32) and Karahan Tepe (east and north sections: Çelik 2003: 44-45).

The only architectural remains so far discovered at Hamzan Tepe are a section of a wall constructed of several stone layers and a stele of T-shape (Fig. 4). Stelae of the similar type have been unearthed at Nevalı Çori, Göbekli Tepe, Adiyaman-Kilisik (Hauptmann 2000: Fig. 8-10; Verhoeven 2001: 9, Fig. 1 a-d) and Karahan Tepe. Our stele is smaller in scale and is reminiscent of the stelae on the side walls of the temple at Nevalı Çori

Fig. 1 General view of pool-like pits and area of cup-hole depressions carved into the bedrock.

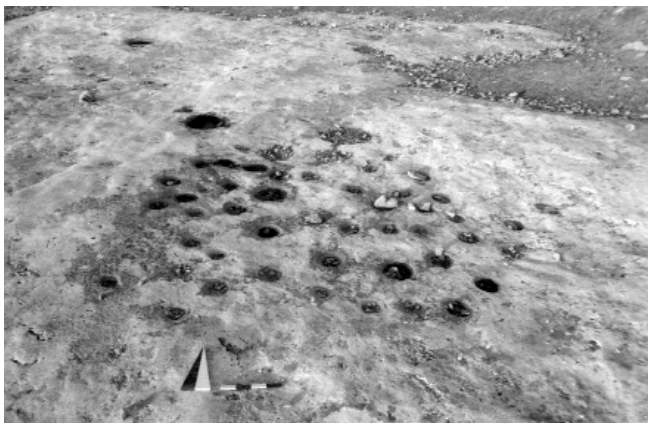

Fig. 2 Cup-hole depressions carved into the bedrock.

Fig. 3 Pool-like pit carved into the bedrock.

Fig. 4 T-shaped stele.

(Hauptmann 1993: Fig. 7) and the stelae of the second phase at Göbekli Tepe (Schmidt 2002: 24-25, Fig. 1). The stele from Hamzan Tepe also shares certain characteristics with those from Karahan Tepe (Çelik 2000a: 7) and indicates that the temple worship tradition as evidenced at Göbekli Tepe, Nevalı Çori, Karahan Tepe, and Adiyaman-Kilisik also existed at Hamzan Tepe.

The section of Hamzan Tepe settlement that is visible today is similar to two areas that have been excavated in the southwestern section of Göbekli Tepe. There the earth above the bedrock is 10-40 cm thick. In the first area were found a stele with a crouching animal and its base *in situ* (Beile-Bohn *et al.* 1998: Fig. 30). The second excavation area contained a temple and pool-like pits carved into the bedrock and smaller round depressions forming a circle (Beile-Bohn *et al.* 1998: Fig. 20). Both areas have also produced numerous flint artefacts (Schmidt 1997: 77). Flint artefacts found on the surface, pool-like pits and depressions carved into the bedrock at Göbekli Tepe are close parallels with those from Hamzan Tepe.

A close study of the small finds unearthed at Hamzan Tepe reveals that the settlement had two habitation phases. The first phase which is believed to date to Lower Paleolithic period is characterized with “triedrique pics” (Taşkıran 2003: Çizim 4) and “bifacials” of the Middle and Upper Acheulian phases. “Triedrique pics” were found in abundance which, according to Taşkıran, were used to dig up the roots of plants (Taşkıran 2003: 248). Parallel finds in great numbers are known from Northern Syria and Southeastern Anatolia (Taşkıran 2003: 247, Çizim 4 ; Hours 1981: Fig. 4.3).

The second phase at Hamzan Tepe is represented by points of Byblos and Nemrik type, datable to the beginning and middle of the Pre-Pottery Neolithic B period. Other finds include obsidian blades in small numbers, flint blades with silica sheen, fragments of stone vessels and hand axes made of river pebbles. Other characteristics of this period in this region are the lack of Çayönü tools and the small scale of the T-shaped stele (Schmidt 2002: 24).

Şanlıurfa-Yeni Mahalle (Çelik 2000b: 6) 10 km to the north and Göbekli Tepe (Schmidt 2002:24) 25 km east of Hamzan Tepe are contemporary Pre-Pottery Neolithic settlements, which is also evident in the typology of small finds (Çelik 2003: Lev. 37, 53 ; Schmidt 1998: Fig. 5.4, 6.4).

Note

A more detailed study of the Hamzan Tepe settlement is in progress within the scope of a doctoral dissertation.

References

Beile-Bohn M., Gerber C., Morsch M., and Schmidt K.
1998 Frühneolithische Forschungen in Obermesopotamien: Gürcütepe und Göbekli Tepe. *Istanbuler Mitteilungen* 48: 5-78.

Çelik B.
2000a A New Early-Neolithic Settlement: Karahan Tepe. *Neo-Lithics*, 2-3/00: 6-8.
2000b An Early Neolithic Settlement in the Center of Şanlıurfa, Turkey. *Neo-Lithics* 2-3/00: 4-6.
2003 Şanlıurfa Kent Merkezinde Çanak Çömleksiz Bir Neolitik Yerleşim: Yeni Mahalle. Unpublished Masters Thesis, Hacettepe Universitesi Sosyal Bilimler Enstitüsü.

Hauptmann H.
1993 Ein Kultgebäude in Nevalı Çori. In M. Frangipane, H. Hauptmann, M. Liverani, P. Matthiae and M. Mellink (eds.), *Between the Rivers and Over the Mountains:* 37-69. Rome: University of Rome “La Sapienza”.
1999 The Urfa Region. In M. Özdoğan and N. Başgelen (eds.), *Neolithic in Turkey: The Cradle of Civilization – New Discoveries:* 65-86. Istanbul: Arkeoloji ve Sanat Yayınları.
2000 Ein frühneolithisches Kultbild aus Kommagene. In J. Wagner (ed.), *Gottkönige am Euphrat: Neue Ausgrabungen und Forschungen in Kommagene:* 5-9. Mainz: Philipp von Zabern.

Hours F.
1981 Le Paléolithique inférieur de la Syrie et du Liban: Le point de la question en 1980. In J. Cauvin and P. Sanlaville (eds.), *Préhistoire du Levant:* 165-191. Paris: CNRS.

Schmidt K.
1997 "News from the Hilly Flanks". Zum Forschungsstand des obermesopotamischen Frühneolithikums. *Archäologisches Nachrichtenblatt* 2/1: 70-79.
1998 Frühneolithische Tempel: Ein Forschungsbericht zum präkeramischen Neolithikum Obermesopotamiens. *Mitteilungen der Deutschen Orient-Gesellschaft* 130: 17-49.
2002 Göbekli Tepe, Southeastern Turkey: The Seventh Campaign, 2001. *Neo-Lithics* 1/02: 23-25.

Taşkıran H.
2003 Paleolitik'te Triedrique Pics (Uçyüzlü Kazmalar) ve Karkamiş Baraj Gölü Alanından Örnekler. In: M. Özbaşaran, O. Tanındı and A. Boratav (eds.), *Archaeological Essays in Honour of Homo amatus:* Güven Ersebük Içın Armağan Yazılar: 245-252. Istanbul, Ege Yayınları.

Verhoeven M.,
2001 Person or Penis? Interpreting a 'New' PPNB Anthropomorphic Statue from the Taurus Foothills. *Neo-Lithics* 1/01: 8-9.

Results from the First Excavation Season at el-Hemmeh: A Pre-Pottery Neolithic Site in the Wadi el-Hasa, Jordan

Cheryl A. Makarewicz[1] and Nathan B. Goodale[2]
[1] Harvard University <makarew@fas.harvard.edu>
[2] Washington State University <neo_lithics@msn.com>

Introduction

The site of el-Hemmeh is a LPPNB-PPNC settlement approximately 1 hectare in size located in the Wadi el-Hasa, Southern Jordan (35° 43' 52" E, 30° 58' 00" N, Fig. 1). El-Hemmeh was originally recorded by G. O. Rollefson, P. Wilke, and L. Quintero in a survey of the area to be inundated by the construction of the Tannur Dam (Rollefson 1999). Cultural deposits attributable to both the LPPNB and PPNC periods were recorded including architecture constructed from flat limestone slabs built to *c.* 2 m in height and plaster floors laid over flat slabs that cover sub-floor channels. Sub-floor channel construction is similar to LPPNB occupations at Basta (Nissen *et al.* 1987), es-Sifiya (Mahasneh 1997), and 'Ain Ghazal (Rollefson *et al.* 1990). Lithic material recovered from surface collection included cores, non-naviform blades/bladelets, Byblos points ("PPNC type") and scrapers. Based on these promising findings, a first excavation season was conducted during August 2004.

Excavation

The 2004 excavation season at Hemmeh began an initial assessment of 1) site chronology, 2) architectural construction techniques, 3) subsistence strategies, and 4) lithic reduction sequences. Three excavation areas were opened for a total of 62 m^2 exposed during the 2004 season including two 5 x 5 m units, one of which was extended an additional 2 x 3 m, and a 2 x 3 m unit (Fig. 2). Excavation units were not randomly placed, but chosen according to exposed architecture and horizontal position across the site.

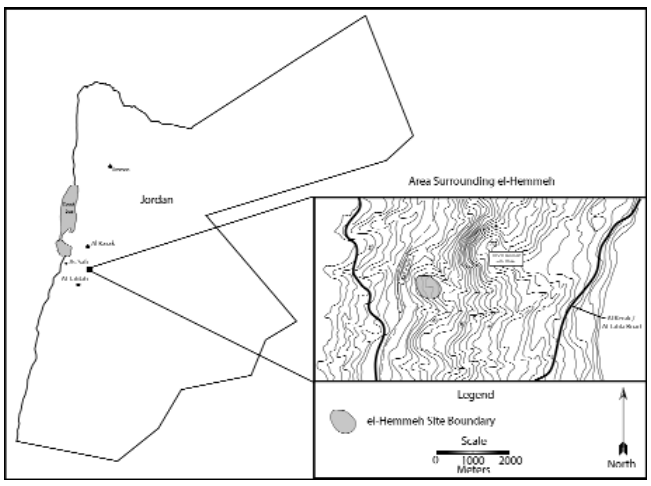

Fig. 1 Location of el-Hemmeh in the Wadi el-Hasa, Jordan.

Unit 464E / 230N

Unit 464E / 230N is characterized by several different construction phases that include the LPPNB and perhaps the PPNC. The tentative PPNC designation is based solely on the presence of poorly consolidated architectural construction techniques that re-uses pre-existing LPPNB walls. Future radiocarbon dating will clarify this chronological issue. The possible PPNC building phase at Hemmeh is represented by a somewhat flimsy NE-SW wall, a two-stone wide and one-course tall wall that intersects with a loosely organized curved N-S wall two stones wide, two courses deep and an earlier LPPNB stone slab wall to form a large, enclosed space (Fig. 2). A hard packed mud floor containing limestone inclusions was uncovered inside this space. Abutting two intersecting walls is a curvilinear arrangement of small stones and

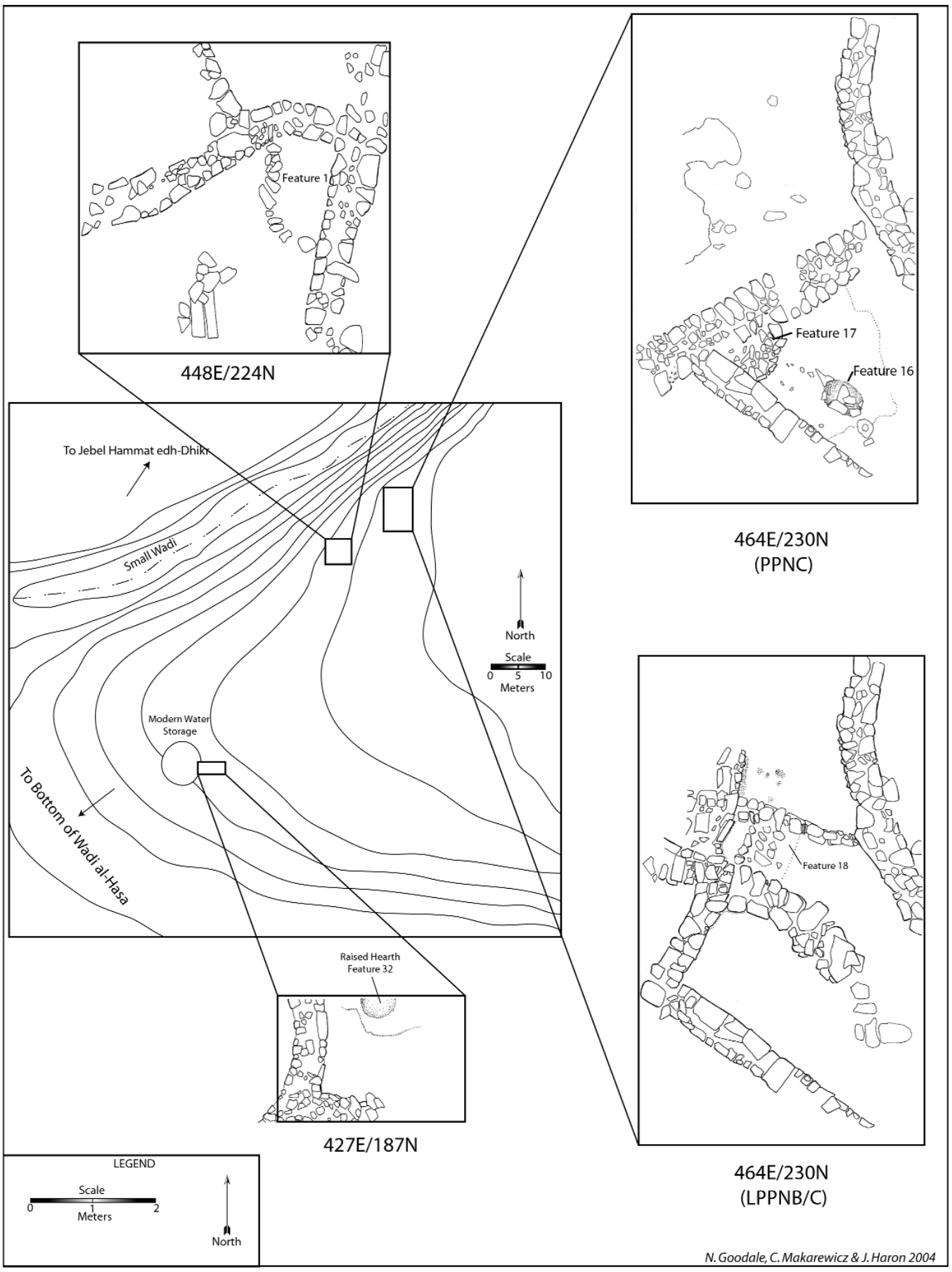

Fig. 2 El-Hemmeh 2004 site layout and excavation plans.

stone pavement that may represent a storage area (Feature 17). The floor surface also contains a large hearth built of large (20 x 30 cm) stones and, immediately next to the hearth, a large (30 x 30 cm) groundstone mortar (Feature 16). Unfortunately, the hard packed floor is degraded around the groundstone mortar and it is unclear if the artifact is *in situ*. North of the NE-SW wall and its associated floor and feature are remnants of a hard packed mud floor. While a direct association between the floor, the east-west PPNC wall, and the curved N-S wall is absent, the presence of degraded floor material in the surrounding sediments suggests the floor once abutted these walls. Earlier constructions, also possibly PPNC, include a poorly built single-stone wide wall and Feature 18, a storage/work area. This feature includes a platform raised *c.* 10 cm above a lower platform built out of flat stones set in a hard packed mud surface. The upper and lower platforms are separated from each other by an alignment of several large stones.

LPPNB architecture in Unit 464E / 230N is similar to that of LPPNB Ba'ja and Basta. With the exception of one curvilinear wall constructed out of large (30 x 30 cm) round stones, all LPPNB walls were constructed out of flat, stone slabs and all have plaster remnants adhering to wall of which some portions displayed red paint. The curvilinear wall seems to be a later LPPNB construction based on a continuous plastering event that covered this wall and the abutting flat stone slab wall. The plaster at the intersection of these two walls was heavily burned, but only in a very limited area. A passageway or blocked window was uncovered in the plastered SE-NW running wall, immediately west of the burned plaster. Another notable LPPNB features was a degraded plaster floor uncovered in the 2 x 3 m deep sounding immediately adjacent to the original 5 x 5 m unit. This floor was directly associated with the roughly N-S flat slab wall; it is expected that continued excavation will reveal a southward spread of the floor to connect with the other LPPNB walls.

Unit 448E / 224N

In one portion of the small wadi edge lying immediately north of the site, a *c.* 5 m high wall was exposed by erosion. Unit 448E / 224N, a 5 x 5 m^2 unit, was placed here in order to take advantage of this exposed architecture. Excavation revealed three walls bonded together to form four distinct spaces (Fig. 2). All walls are constructed of flat and rounded stones ranging from 5 - 50 cm in diameter. Two walls running roughly N-S and NE-SW are approximately 1 m thick and are double coursed with rubble fill. This construction technique echoes that of other LPPNB sites in southern Jordan such

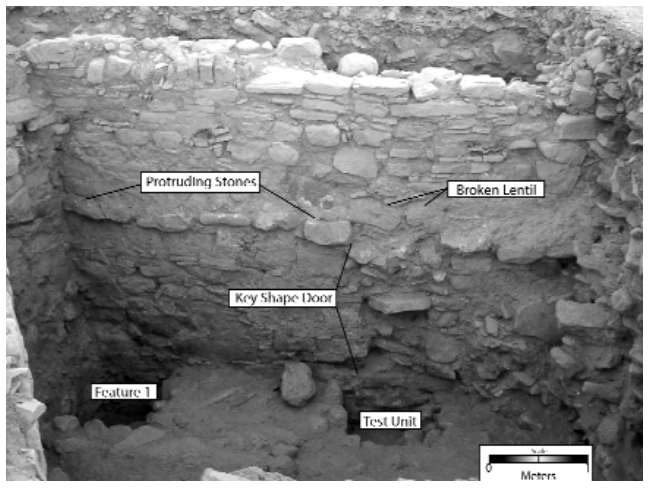

Fig. 3 Unit 448E / 224N – N-S trending wall and the primary architectural features.

Fig. 4 Painted lime plastering in Unit 448E / 224N.

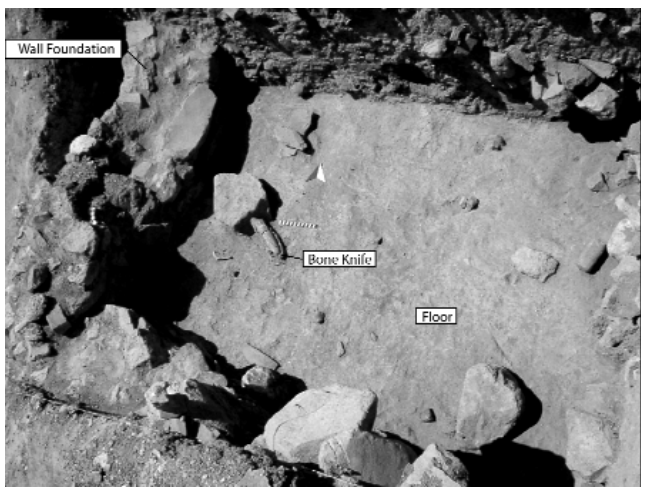

Fig. 5 Unit 427E / 187N - First floor and artifacts recovered on the surface.

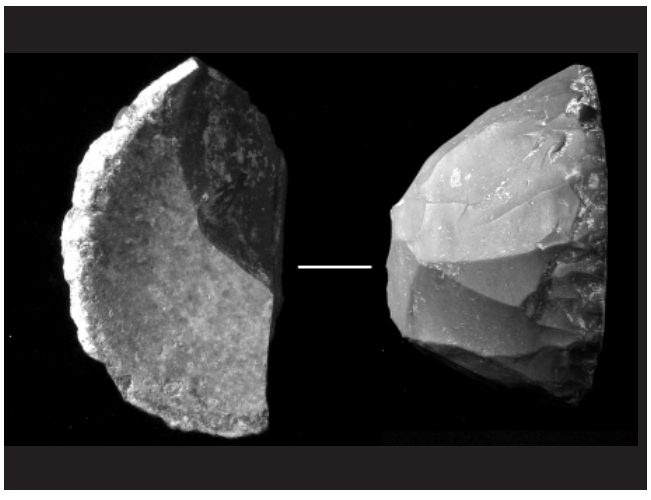

Fig. 6 Flint “bowlet” recovered from el-Hemmeh.

as Ba’ja and Basta. The N-S wall has a number of architectural features worthy of note (Fig. 3). At approximately 1m in depth four separate lime plastering and red lime plastering events were exposed on the western face of the wall (Fig. 4). Just above this is a course of stones that protrudes *c.* 10 cm from the wall (Fig. 3). This could be a support for an upper floor; however, the feature does not continue onto the perpendicular wall. A key shaped, 1m in height passage to the space on the east side of the wall was also found beneath this extended stone course. The uppermost 60 cm of the passageway is 60 cm wide, after which there is a small shelf on each side of the passage frame. At this point, the passage narrows considerably to a width of 30 cm until reaching a single long threshold stone (Fig. 3). The passageway contains a broken lintel at the top and appears to have then been intentionally sealed after the lintel collapsed. Numerous ground stone artifacts were found in the southeast corner of the room and at least 40 stone drills were found in the southeast corner of the room. A possible sub-surface bin (Feature 1) was located in the northeast corner of this room and consists of a single course curvilinear wall abutting the N-S and NE-SW walls. The interior is covered with lime plaster and extends at least 50 cm beneath the floor; the bottom was not reached during the 2004 season.

Unit 427E / 187N

The third excavation unit (2 x 3 m) opened in 2004 is located on the east side of a modern water storage depression *c*. 60 m downslope of the other two units. Excavations here revealed a series of hard-packed mud floors directly associated with two 50 cm high stone walls (Fig. 2). These walls are bonded together in the southwest corner and are constructed of cobbles. The walls are two to three stones thick. The uppermost floor associated with this foundation is a hard packed clay approximately 1 cm thick. Associated with this floor are several artifacts including a large bone knife, a ground basalt cup, a basalt pestle, and nondiagnostic lithic remains (Fig. 5). Contiguously molded out of the floor clay is a raised hearth platform 80 cm in diameter that rises 8 cm above the floor. In the center of this platform is a circular, oxidized patch containing ashy deposits. A small 50 x 50 cm square was further excavated in the northeast corner of the floor, revealing a 5 cm sterile compact mud layer situated on top of two other floors each separated by a sterile fill layer. Unfortunately, the absence of diagnostic artifacts or a distinct architectural style does not permit designation of this structure to a cultural period. Radiocarbon samples collected from floor contexts in this structure are currently being processed.

Faunal Remains

Preservation of faunal remains at Hemmeh is excellent, providing an opportunity to clarify our understanding of both LPPNB and PPNC animal exploitation strategies and evaluate the proposed shift in the relative abundance of taxa associated with the LPPNB/PPNC transition (von den Driesch and Wodtke 1997). Over 600 individual animal bone fragments were recovered from secure contexts during the 2004 season. Preliminary analysis indicates that the assemblage is dominated by caprines *Capra hircus* (n = 29) and *Ovis aries* (n = 28). It was possible to identify the sex of some caprines based on pelvis morphology; one sheep and one goat were identified as female and one sheep and two sheep/goat as male. Five *Bos* sp. remains were recovered, including two fused second phalanges, one unfused second phalanx, a proximal ulna, and a tooth fragment. Only four pig skeletal elements were found: a premolar tooth, a fused and unfused metapodial, and a portion of the mandible. The low percentage of cattle and pig bones is not entirely surprising; pigs and cattle generally require relatively moist environmental conditions. Other taxa identified were *Gazelle* sp., *Vulpes* sp., *Lepus* sp., carnivores and birds. Some species of gazelle inhabit open parkland landscapes and their presence in LPPNB and PPNC contexts may indicate that the inhabitants of Hemmeh utilized ecological zones outside of the Wadi Hasa.

Botanical remains

During the 2004 season, 441.5 L of soil from 10 separate contexts were floated on-site in order to recover plant remains and explore LPPNB/LPPNC subsistence from a botanical perspective. The recovery of seeds and charcoal from the 662.58 grams of light fraction currently under analysis is also crucial for reconstructing the arboreal vegetation surrounding el-Hemmeh. Preliminary analysis by C. White, Boston University, has indicated a high density of carbonized wood remains

in the mud construction melt above the hard-packed mud surface and the presence of *Hordeum* sp., *Lithospermum* sp., and possible *Medicago* sp. seeds in Unit 427E / 187N. Carbonized barley and wheat grains were recovered from the possible PPNC floor and wood remains from the PPNC (?) hearth (Feature 16) in Unit 464E / 230N. If radiocarbon dates indicate that the hearth and associated floor complex are PPNC constructions, the wood remains form an important set of data suitable for evaluating if the PPNB collapse is in part attributable to environmental degradation caused by caprine overgrazing (Köhler-Rollefson and Rollefson 1990).

Ground Stone Artifacts

Nearly 240 ground stone artifacts were recovered from all three excavation units during the 2004 season and analyzed by P. Rassmann (University of Washington). Ground stone items were made from sandstone, limestone, basalt, and orthoquartizte and were in varying states of preservation. Handstones (*manos*) represent the majority of the assemblage at 60-70 % while grinding slabs are the second most common tool type recovered at the site at 15-20 % of the assemblage. The remaining ground tool types include pestles, pestle-handstones, mortars, querns, bowls, worked stones, polishers, pierced stones, several mixed-use tools, and a polished axe. The more remarkable individual finds include a small, narrow basalt cup that is similar to those recovered from PPNA contexts at 'Dhra, a ground sandstone bracelet/ring similar to those recovered from Ba'ja, two pestle-handstones recovered *in situ* lying on the uppermost clay-packed from in Unit 427E / 187N and a group of handstones in varying stages of reduction found near Feature 1 in unit 448E / 224N. Current analysis focuses on handstones and examines handstone reduction sequences by relating the metrical data with the observations made of the types of modification on each of the surfaces.

Lithic Artifacts

The lithic assemblage from el-Hemmeh provides an excellent opportunity to examine the lithic technological transition associated with the cultural shift from the LPPNB to the PPNC. During the 2004 season, a total of 17, 372 lithic artifacts were recovered at el-Hemmeh and are being analyzed by H. Miller (Bristol University), S. Kadowaki (University of Toronto), and N. Goodale. The majority of this assemblage (98 %) is debitage. The remaining portion of the lithic assemblage is comprised of formal and non-formal tools; tools recovered during the 2004 season are primarily awls, retouched flakes, used flakes, and scrapers (Table 1). Byblos points are the most commonly occurring projectile point type. The high proportion of awls is due in part to a "cache" recovered from a degraded floor in the southeast corner of unit 448E / 224N. Preliminary analysis of debitage indicates predominant use of a single platform core reduction strategy, although bipolar and naviform strategies are also present in the assemblage. The 2004 excavation also uncovered two flint "bowlets" from 464E / 230N similar to those Gebel (1999) described from Basta and Ba'ja. The first was pecked and ground to form the concavity, has invasive flake scaring on the ventral face, and contains many battering marks within the concavity. This item also contains reddish pigment on the ground surface (Fig. 6). The second bowlet is less concave, lacks visible pigment and may represent the early stages of flint bowlet manufacture.

Conclusion

The 2004 excavation season at el-Hemmeh yielded exciting architectural, faunal, botanical, and lithic material including architecture similar with LPPNB Basta and Ba'ja such as multi-roomed buildings, wall plaster with red painting, excellent faunal and botanical preservation, an abundant and varied ground stone assemblage, and a large lithic assemblage that includes formal tools, non-formal tools, and debitage. Using these data, el-Hemmeh can be situated within a larger temporal and regional context and address the LPPNB/PPNC transition, LPPNB and PPNC subsistence strategies, and environmental degradation associated with the PPNC.

Acknowledgments: Funding for the 2004 season was provided by the American School of Prehistoric Research and the Department of Anthropology at Washington State University. The authors would like to thank the entire 2004 field crew for their hard work during the summer months including A. Pantos (photography), E. Carlson (illustrations), P. Rassmann (groundstone), S. Kadowaki (lithic technology), C. White (paleobotany), A. Casson (OSL and TL dating), H. Miller (lithic technology), J.T. Williams, M. Kroot, A. Austin, B. Fabre, and M. Parker. Thanks also go to K. Stewart (WSU) who worked to digitize much of the paperwork. We would especially like to thank the Jordanian Department of Antiquities and Department of Antiquities representative Jihad Haroun who facilitated numerous portions of the project including the generation of a topographic map of the area as well as help with flotation. We are indebted to Gary Rollefson who granted us permission to conduct excavations at el-Hemmeh as well as P. Wilke and L. Quintero. Thanks also to Ian Kuijt and Bill Finlayson for their assistance in bringing most of the el-Hemmeh crew, originally part of the 'Dhra team, to Jordan. We would also like to thank all of the personal at the Tannur Dam who made us feel welcome and became our friends. Any errors within this text are solely our responsibility.

Table 1 Lithic tool typologies from the three areas of excavations

	Uni							
Tool Typology	**460E / 230N**		**448E / 224N**		**427E / 187N**		**Count (%)**	
Amuq point	2	(0.4%)	0		0		2	(0.4%)
Byblos point	6	(1.3%)	5	(1.1%)	0		11	(2.4%)
Arrowhead fragment	0		1	(0.2%)	0		1	(0.2%)
Sickle element	2	(0.4%)	1	(0.2%)	2	(0.4%)	5	(1.1%)
Stone bowl	2	(0.4%)	0		0		2	(0.4%)
Burin	1	(0.2%)	2	(0.4%)	2	(0.4%)	5	(1.1%)
Truncation	0		0		3	(0.6%)	3	(0.6%)
Scraper	20	(4.4%)	9	(2.0%)	8	(1.7%)	37	(8.2%)
Notch	4	(0.8%)	4	(0.8%)	0		8	(1.7%)
Denticulate	14	(3.1%)	10	(2.2%)	5	(1.1%)	29	(6.4%)
Awl	6	(1.3%)	118	(26.2%)	4	(0.8%)	128	(28.3%)
Drill	1	(0.2%)	0		1	(0.2%)	2	(0.4%)
Adze	2	(0.4%)	1	(0.2%)	0		3	(0.6%)
Axe	2	(0.4%)	1	(0.2%)	8	(1.7%)	11	(2.4%)
Pick	3	(0.6%)	0		1	(0.2%)	4	(0.8%)
Chisel	1	(0.2%)	0		4	(0.8%)	5	(1.1%)
Chopper	0		1	(0.2%)	2	(0.4%)	3	(0.6%)
Bifacial knife	2	(0.4%)	1	(0.2%)	0		3	(0.6%)
Tanged blade	0		1	(0.2%)	0		1	(0.2%)
Subtotal	*68*	*(15.1%)*	*155*	*(25.4%)*	*40*	*(8.9%)*	*26*	*(58.3%)*
Retouched flake	30	(6.6%)	32	(7.0%)	18	(4.0%)	80	(17.7%)
Retouched blade	17	(3.7%)	8	(1.7%)	8	(1.7%)	33	(7.3%)
Used flake	24	(5.3%)	15	(3.3%)	10	(2.2%)	49	(10.8%)
Used blade	5	(1.1%)	0		2	(0.4%)	7	(1.5%)
Retouched bladelet	7	(1.5%)	5	(1.1%)	3	(0.6%)	15	(3.3%)
Pieces esquille	1	(0.2%)	0		0		1	(0.2%)
Varia	1	(0.2%)	0		2	(0.4%)	3	(0.6%)
Total	*153*	*(34.0%)*	*215*	*(47.6%)*	*83*	*(18.4%)*	*451*	*(100.0%)*

Legend. Total tools equal to 2% of total lithic assemblage recovered.

References

Gebel H.G.K.
1999 Flint "Bowlets" from the LPPNB of Southern Jordan. *Neo-Lithics* 2/99: 12-13.

Köhler-Rollefson I. and Rollefson G.
1990 The Impact of Neolithic Subsistence Strategies on the Environment: The Case of 'Ain Ghazal, Jordan. In S. Bottema *et al.* (eds.), *Man's Role in the Shaping of the Eastern Mediterranean Landscape:* 3-14. Rotterdam: A. Balkema.

Mahasneh H.
1997 A PPNB settlement at as-Sifiyya in Wadi al-Mujib. *Studies in the History and Archaeology of Jordan* 26: 117-131.

Nissen H., Muheisen M., and Gebel H.G.
1987 Report on the first two seasons of excavations at Basta (1986-87). *Annual of the Department of Antiquities of Jordan* 31: 79-119.

Rollefson G.
1999 El-Hemmeh: A Late PPNB- PPNC village in the Wadi el-Hasa, Southern Jordan. *Neo-Lithics* 2/99: 6-8.

Rollefson G., Kafafi Z. and Simmons A.
1990 The Neolithic Village of 'Ain Ghazal, Jordan: Preliminary Report on the 1988 Season. *Bulletin of the American Schools of Oriental Research Supplement* 27: 95-118.

Rollefson G. and Kohler-Rollefson I.
1993 PPNC adaptations in first half of the 6th millennium B.C. *Paléorient* 19(1): 33-42.

Von den Driesch A. and Wodtke U.
1997 The fauna of 'Ain Ghazal, a major PPN and early PN settlement in Central Jordan. In H.G.K. Gebel, Z. Kafafi, and G.O. Rollefson (eds.), *The Prehistory of Jordan II: Perspectives from 1997:* 511-556. Studies in Near Eastern Production, Subsistence, and Environment 4. Berlin, ex oriente.

Wasse A.
(1997) Preliminary results of an analysis of the sheep and goat bones from 'Ain Ghazal, Jordan. In H.G.K. Gebel, Z. Kafafi, and G.O. Rollefson (eds.), *The Prehistory of Jordan II. Perspectives from 1997:* 575-599. Studies in Near Eastern Production, Subsistence, and Environment 4. Berlin, ex oriente.

Renewed Chert Survey in the Wadi al-Hasa

Deborah I. Olszewski[1], Maire P. Crowley[1] and Maysoon al-Nahar[2]
[1] Department of Anthropology, University of Pennsylvania <deboraho@sas.upenn.edu; mcrowley@sas.upenn.edu>
[2] University of Jordan<maysnahar@index.com.jo>

Research by the Wadi al-Hasa Paleolithic Project[1] (or WHPP; Clark *et al.* 1988; Neeley *et al.* 1998; Olszewski *et al.* 1990, 1994) and the Eastern Hasa Late Pleistocene Project (or EHLPP; Coinman *et al.* 1999; Olszewski *et al.* 1998; 2001) shared a common interest in investigating long-term adaptations of Paleolithic and Epipaleolithic groups to the Pleistocene lake/marsh context of the Wadi al-Hasa (Schuldenrein and Clark 2001; 2003). Pleistocene Lake Hasa was contained in the eastern basin of the al-Hasa; its remnants can be seen today as dissected marls in the area west of the small village of Mahattat al-Hasa on the Desert Highway. Similar marl deposits, particularly at the confluences of the tributary wadis with the Wadi al-Hasa, are also present. Fresh-water springs, as well as rainfall runoff, fed these locales and created a series of large ponds (Olszewski *et al.* 2001: 39).

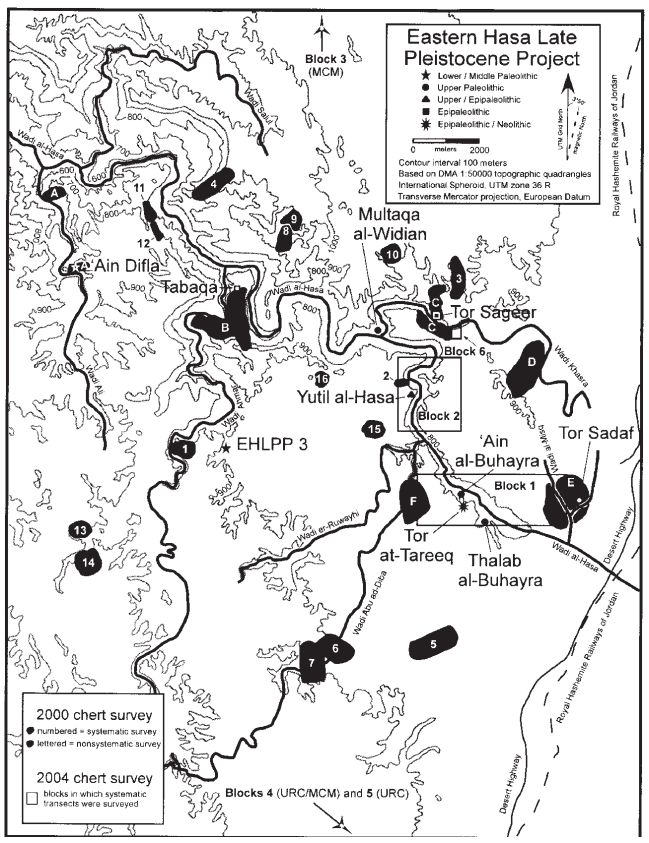

Fig. 1 2000 and 2004 chert survey areas.

While one goal of the WHPP and EHLPP projects was to examine long-term climatic and habitat change, there are many other factors that also underlie the behavioral patterns of hunter-gatherers. These include the need for lithic raw materials such as flint/chert in order to produce stone tools. While typology and technology often receive considerable attention in lithic studies of Paleolithic behavior, it is clear that knowledge about the location of sources of flint/chert with respect to the archaeological sites can also provide fundamental information about prehistoric preferences for certain sources, as well as serving as a proxy for mobility of groups over the landscape. Changes in the use of particular raw material sources over time can also be monitored.

Results of the 2000 Chert Survey

In 2000, the EHLPP examined the al-Hasa region for chert sources using pedestrian survey transects on both the south and north banks of the Wadi al-Hasa drainage system (Olszewski *et al.* 2000; 2001: 53-57). Six non-systematic surveys (A-F) allowed the team to gain experience with the types of cherts and other rocks in the al-Hasa region (Fig. 1). Following this, 16 systematic transects (#1-16) were undertaken. In these, crew mem-

bers were spaced from 50 to 150 m apart, and each person collected chert samples along their line, as well as specimens from marker beds within the geological formations.

Three chert-bearing geological formations with wide exposure characterize the Wadi al-Hasa system. They are pre-Quaternary in age (Cretaceous), and belong to the "Belqa Group" (descriptions are taken from Moumani 1997).

• The Wadi Umm Ghudran Formation (WG) consists of limestone, sandstone, and quartzite occurrences. There are also brecciated cherts, chert lenses, and nodular cherts.

• Above the WG is the Amman Silicified Limestone Formation (ASL), which has numerous, often brecciated, chert beds. The ASL also contains phosphatic cherts, dolomite cherts, coquinas, phosphates, and coquinal limestone. Some nodular chert is present.

• The Al-Hisa Phosphorite Formation (AHP) overlies the ASL. The AHP is characterized by phosphate, phosphatic chert, chert, and several types of limestone.

In 2000, one goal was to find *in situ* nodular sources because preliminary analyses of the lithic artifacts indicated that nodular cherts were preferred. To achieve this aim, the 2000 systematic transects recorded the UTM coordinates for the spot locales of *in situ* chert, including both bedded and nodular cherts. The raw material (RM) designations (recorded as RM 1–17) do not indicate unique sources, but mark locations of *in situ* nodular cherts within the bed sequences of the WG, ASL, and AHP Formations.

The 2000 chert survey demonstrated that cherts are virtually ubiquitous in the Wadi al-Hasa. Many of these, however, were apparently not used by Paleolithic and Epipaleolithic groups, primarily because they are brecciated or otherwise flawed. Some types of knappable raw material (for example, siliceous coquina) were used only after the end of the Epipaleolithic, for instance, in the PPNB occupation at Tor at-Tareeq (radiocarbon dates now place the late occupation at this site in the Neolithic rather than the Middle Epipaleolithic). Additionally, the results of the 2000 chert survey showed that several aspects required further investigation. These included characterization of *in situ* nodular chert sources by sampling them for variability over their visible lateral extents, additional systematic chert survey in the vicinity of those archaeological sites where only nonsystematic surveys had been conducted, and examination of two potential chert-bearing geological formations that are found within 7 to 15 km of the Hasa. These are the Muwaqqar Chalk-Marl Formation (MCM) and the Umm Rijam Chert Formation (URC).

Results of the 2004 Chert Survey

The main goal of the 2004 Wadi al-Hasa Chert Survey was to expand upon the chert survey undertaken in 2000 (Olszewski *et al.*, in press). To this end, an additional 17 systematic transects, ten of which are within the Wadi al-Hasa in the areas designated as Blocks 1, 2 and 6 (see Fig. 1), were carried out. All of these are situated near the archaeological sites, where only nonsystematic surveys had been conducted in 2000. The other seven transects were designed to examine the MCM and URC formations for chert sources; they are in Blocks 3, 4, and 5, outside the Wadi al-Hasa drainage system. The last task of the 2004 season was to explore laterally five RM locales (#s 7, 11, 12, 14, and 16) found during the 2000 survey.

GPS readings (UTM) were taken at the beginning and end of each transect line, using a GPS unit accurate to within several meters. Three to four people, spaced about 20 to 50 meters apart, each collected samples of chert along their transect lines. Lateral exploration of the RM locales began with the designation of an "origin point," which was defined as the UTM coordinates recorded during the 2000 season for each RM. Two people then walked along a lateral recorded as the A-line, while the other two people walked in the opposite direction along the B-line. Both lines thus traced *in situ* cherts and collected samples from *in situ* nodules to gather information on chert quality and color. Chert outcrops were documented using both digital and 35 mm film photography.

Transects within blocks

Three of the blocks (Blocks 1, 2, and 6) are within the Wadi al-Hasa, one (Block 3) is on the Kerak Plateau to the north, and two (Blocks 4 and 5) are near Jurf ad-Darawish to the south.

Block 1 includes the archaeological sites of Tor Sadaf (Early Upper Paleolithic), Tor at-Tareeq (Early Epipaleolithic and Neolithic), 'Ayn al-Buhayra (Late Upper Paleolithic), and Thalab al-Buhayra (Early Upper Paleolithic), spanning a time range from about 45,000 to 8,400 bp. Six systematic transects were walked in Block 1. These sampled primarily the AHP, but also a small portion of the ASL. Generally speaking, rock rubble is typical of the AHP terrain of Block 1, and there are examples of relatively good quality phosphatic chert, as well as siliceous coquina (the latter particularly near Tor at-Tareeq). A few bedded sources were also located, although this source often yields flawed chert. One type of sporadic *in situ* chert is the nodules of good quality silicified oyster shells in the BC member. One of these locales was designated RM 18.

The site of Yutil al-Hasa (Late Upper Paleolithic, Early and Late Epipaleolithic) is contained in Block 2. Three transects were walked in this block, mainly sampling the ASL. Two instances of *in situ* nodule locales were recorded as RM 19, which is in a bed high in the ASL sequence, and RM 20, which is also high in the ASL sequence. The nodules from the two RM locales differ in that those of

RM 19 have a smooth veneer surface, while those of RM 20 have a cortical rind. These point sources may correspond to the same sources as found at the 2000 season's RM 16 and RM 12, respectively.

Through two transects in Block 3, on the Kerak Plateau, the 2004 team examined the MCM, which is described as pale red to yellow marl that contains concretions including cherts (Moumani 1997; Shawabkeh 1990). These transects, however, were not successful in locating chert, principally because these portions of the MCM are overlain by fluviatile and lacustrine gravels.

To the south of the Wadi al-Hasa system, Blocks 4 and 5 investigated the MCM and URC Formations with a total of five systematic transects. As on the Kerak Plateau, the MCM near Jurf ad-Darawish is usually overlain by other materials, in this case, colluvial remnants of the URC Formation. As a consequence, no cherts from the MCM were located by the survey team. On the other hand, results for the URC formation, which is characterized by thick exposures of chalky calcareous marl, chalk beds with *in situ* cherts (both nodular and thinly bedded), limestone, chert concretions, and thickly bedded chert (Moumani 1997), were exceptional. Two transects yielded *in situ* nodular chert of very high quality. These are found in two separate beds and range in color from medium to dark grey and brownish-grey. The designation of RM 21 records a landscape point for the URC nodules (Fig. 2).

Fig. 2 RM 21: *in situ* nodular chert in the URC formation.

Fig. 3 RM 14: *in situ* nodular chert in the WSL/WG formation.

Finally, the one survey transect of Block 6 was walked not far from the archaeological site of Tor Sageer (Early Epipaleolithic). It sampled the ASL formation, and a nodular *in situ* chert (similar to RMs 12 and 20) was observed. This particular source type often yields a relatively glossy chert that is similar in appearance to the artifacts at Tor Sageer.

Lateral explorations of RMs

RM 14 is situated in either the top of the Wadi es-Sir Limestone (WSL) or the basal portion of the WG, and thus represents the oldest geologically occurring *in situ* nodular source available in the al-Hasa system (Fig. 3). The outcrop is very rich and laterally extensive, with light grey or somewhat whitish chert being most common. In some areas of this outcrop, nodules are readily visible, occurring in at least three different levels or lines over about a 30 m thick section. Other portions of the outcrop are hidden by colluvial deposits. The RM 14 chert is similar in appearance to artifacts from some of the occupations at Yutil al-Hasa.

The next oldest geological formation is the ASL sequence; three RMs (#s7, 12, and 16) of *in situ* nodules were recorded high in its sequence of beds. RM 16 is similar in surface appearance to RM 14, with medium grey chert nodules characterized by a smooth veneer. A few examples yielded a whitish chert. The outcrop is quite variable in its visibility, with some portions covered by colluvial deposits. The medium grey color of the nodules is similar to artifacts from Multaqa al-Widian (Early Upper Paleolithic) and possibly also Tabaqa (Late Epipaleolithic). RMs 7 and 12 probably represent the same geological bed, which is situated immediately above the location of the RM 16 geological bed. Both RM 7 and 12 are chert nodules formed in a chert bed. RM 12 chert tends to have a glossy luster, and thus is similar to artifacts from Tor Sageer. RM 7, on the other hand, is represented by at least three "lines" of nodules, two of which yield a medium grey, almost glossy, chert comparable to artifacts at Tabaqa (which is nearby), while the remaining line (which is a smooth veneer nodule) yields white chert.

The geologically highest (youngest) *in situ* source locale that was examined is RM 11, in the BC member of the AHP. It is mainly a bedded chert, although there are some areas with small, irregular nodules. RM 11 raw material tends not to be of high quality compared to the other RM locales.

None of the lateral transects encountered a situation in which the *in situ* nodules could no longer be traced, except for small portions of the transect lines that are covered with colluvial deposits. This meant that the 2004 survey of the lateral extent of the sources was arbitrarily ended simply when the nodular sources became more sparsely visible. This suggests that most raw material *in situ* nodular sources were widely available throughout the al-Hasa region.

Conclusion

The combined results from the 2004 and 2000 chert survey in the Wadi al-Hasa and surrounding region suggest that there are at least four good quality *in situ* nodule sources. One of these is from the WSL/WG, two sources are in the ASL, and one source is in the URC. Differences in type of cortex from the different sources and an overall consistency in color or texture within each source were noted. Other features include the areally limited exposure of the WSL/WG nodules, which may have affected their availability, and issues of transport over medium-range distances (7 to 10 km) if the URC source was used by inhabitants of the Wadi al-Hasa sites. Models for chert raw material procurement and utilization for Late Pleistocene occupations in the Wadi al-Hasa lake/marsh ecological system are currently under development.

Note

[1]The Wadi al-Hasa Chert Survey was funded by grants from the National Science Foundation (#0309247) and the University of Pennsylvania Museum of Archaeology and Anthropology (the Penn Museum). This is EHLPP Contribution No. 25.

References

Clark G.A., Lindly J., Donaldson M., Garrard A., Coinman N., Schuldenrein J., Fish S. and Olszewski D.
1988 Excavations at Middle, Upper and Epipaleolithic Sites in the Wadi Hasa, West-Central Jordan. In A. Garrard and H.G. Gebel (eds.), *The Prehistory of Jordan:* 209-285. British Archaeological Reports, International Series 396(i). Oxford: B.A.R.

Clark G.A., Neeley M., MacDonald B., Schuldenrein J. and 'Amr K.
1992 Wadi al-Hasa Paleolithic Project-1992: Preliminary Report. *Annual of the Department of Antiquities of Jordan* 36: 13-23.

Clark G.A., Olszewski D.I., Schuldenrein J., Rida N. and Eighmey J.
1994 Survey and Excavation in the Wadi al-Hasa: A Preliminary Report of the 1993 Season. *Annual of the Department of Antiquities of Jordan* 38: 41-55.

Coinman N.R., Olszewski D.I., Abdo K., Clausen T.G., Cooper J.B., Fox J.R., al-Nahar M., Richey E. and Saele L.S.
1999 The Eastern al-Hasa Late Pleistocene Project: Preliminary Report on the 1998 Season. *Annual of the Department of Antiquities of Jordan* 43: 9-25.

Moumani K.
1997 *The Geology of Al-Husayniyya al-Janubiyya (Jurf ed-Darawish Area). Map Sheet No. 3151-II.* Amman: Geology Directorate, Geological Mapping Division, Bulletin 38.

Neeley M.P., Peterson J.D., Clark G.A., Fish S.F. and Glass M.
1998 Investigations at Tor al-Tareeq: An Epipaleolithic Site in the Wadi el-Hasa, Jordan. *Journal of Field Archaeology* 25(3): 295-317.

Olszewski D.I., Clark G.A. and Fish S.
1990 WHS 784X (Yutil al-Hasa): A Late Ahmarian Site in the Wadi Hasa, West Central Jordan. *Proceedings of the Prehistoric Society* 56: 33-49.

Olszewski D.I., Stevens M., Glass M., Beck R., Cooper J. and Clark G.A.
1994 The 1993 Excavations at Yutil al-Hasa (WHS 784), an Upper/Epipaleolithic Site in West-Central Jordan. *Paléorient* 20(2): 129-141.

Olszewski D.I., Coinman N.R., Schuldenrein J., Clausen T., Cooper J.B., Fox J., Hill J.B., al-Nahar M. and Williams J.
1998 The Eastern al-Hasa Late Pleistocene Project: Preliminary Report on the 1997 Season. *Annual of the Department of Antiquities of Jordan* 42: 53-74.

Olszewski D.I., Coinman N.R., Clausen T., Cooper J.B., Jansson H., al-Nahar M., Saele L.S., Sampson A.J., Schurmans U. and Thompson J.R.
2001 The Eastern al-Hasa Late Pleistocene Project: Preliminary Report on the 2000 Season. *Annual of the Department of Antiquities of Jordan* 45: 39-60.

Olszewski D.I., Crowley M.P. and al-Nahar M.
in press Preliminary Report of the 2004 Wadi al-Hasa Chert Survey. *Annual of the Department of Antiquities of Jordan.*

Olszewski D.I., Schurmans U. Jansson H., Cooper J.B., and al-Nahar M.
2000. Chert Raw Material Survey in the Wadi al-Hasa, Jordan: Preliminary Findings. *Neo-Lithics* 2-3/00: 16-18.

Schuldenrein J. and Clark G.A.
2001 Prehistoric Landscapes and Settlement Geography Along the Wadi Hasa, West-Central Jordan. Part I: Geoarchaeology, Human Palaeoecology and Ethnographic Modeling. *Environmental Archaeology* 6: 23-38.

Schuldenrein J. and Clark G.A.
2003 Prehistoric Landscapes and Settlement Geography Along the Wadi Hasa, West-Central Jordan. Part II: Towards a Model of Palaeoecological Settlement for the Wadi Hasa. *Environmental Archaeology* 8: 1-16.

al-Shawabkeh K.
1990 *Adir 3152 II Geological Map.* Amman: Geology Directorate, Geological Mapping Division.

Ba'ja 2003: Summary on the 5th Season of Excavation

Hans Georg K. Gebel[1] and Bo Dahl Hermansen[2]
[1] Department of Near Eastern Archaeology, Free University of Berlin <hggebel@zedat.fu-berlin.de>
[2] Carsten Niebuhr Institute, University of Copenhagen <bodahl@hum.ku.dk>

Introduction

From 30th of Aug. – 15th of Sept., 2003 the fifth season of excavation took place at the Early Neolithic site of Ba'ja – al-Mehmad, Wadi Musa district, Governorate of Ma'an. The Ba'ja Neolithic Project is directed by Hans Georg K. Gebel, Free University of Berlin, and Bo Dahl Hermansen, Copenhagen University (deputy director) in cooperation with the Department of Antiquities, Amman. The representative of the Jordanian Government at the dig was Hussein Jerah, Deir Alla (archaeologist). Members of the team in addition to the directors included Mareike Andresen (student, archaeology), Jürgen Baumgarten (assistant archaeologist), Christian Hannß (geomorphologist), Rasmus Kehlet (archaeologist), Moritz Kinzel (architect), Anne Moenster (student, archaeology), Saif Talal al-Quran (archaeologist), Muhammad Barakat Tarawneh (archaeologist), Klaus Traulsen (dig technician). The project is supported by *ex oriente*, a research association at Free University of Berlin, and cooperates with the Carsten Niebuhr Institute at Copenhagen University.

The site of Ba'ja, located in an extreme mountain setting and difficult to reach through a narrow gorge (*Siq al-Ba'ja*) (Gebel & Hermansen 1999, 2000, 2001; Gebel 2001, 2004), lies some 10 km north of Petra/Wadi Musa. This small Late Pre-Pottery Neolithic B village (2nd half of the 8th millennium BC, *c.* 1.2-1.5 ha) is part of a local settlement system in which the mega-sites of al-Baseet (Wadi Musa) and Basta (near Ail) also flourished. Ba'ja is characterized by pueblo-type dense domestic areas, where sandstone rings of bracelet-size were fabricated for export. Recent considerations have emphasized that the extreme location also might be related to topographically favored chances for water harvesting in the gorge passing the site (Gebel in press).

Major Results of the 5th Campaign

The 2003 season aimed to resolve open questions from previous seasons in preparation of an interim monograph and to enable a new period of large-scale excavations by new questions. The 2003 excavations took place in the following squares: C10 and B64-South were newly opened; baulk removals took place at B64/74, B64/65 and B74/84. Excavations were continued in Squares C0, C10, and C20, while in B85 minor excavation and cleaning took place (Fig. 1). The major results of the 2003 season are:

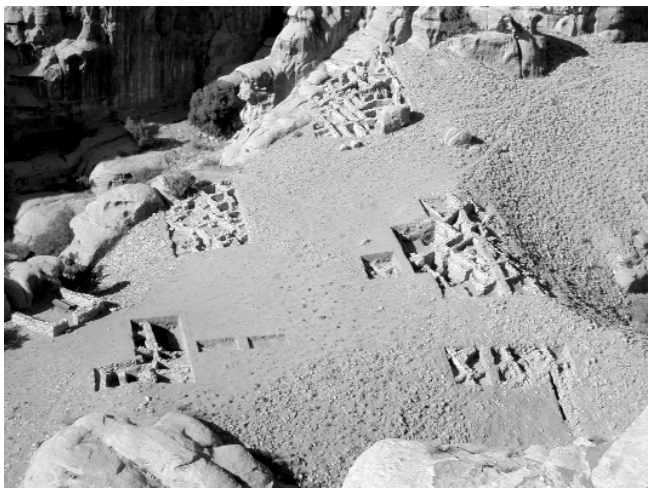

Fig. 1 Ba'ja: bird's-eye view of Early Neolithic Ba'ja from the southwest (photo: K. Traulsen / M. Kinzel).

Collective Burials

The locations of two more intra-mural family burials were found in Area C. They were placed in two tiny (each < 1 m^2) neighboring rooms that had no access by floor-related passages. In the one case, the burial pit was deepened through a plaster floor into the virgin sandy-silty soil on which the walls of the surrounding rooms were also erected. From the burial's cover, only one broken large sandstone stone slab remained, together with a sandstone grinding slab bearing red pigment. The upper burial of an adult was articulated and had a crouched position. Above the sandstone slab, the room fill consisted of collapsed roof / ceiling material and water-laid deposits.

In the other case, the upper layer of the burial consisted of disturbed human and animal bones, among which skull fragments of infants were also attested. Red pigment seems to be attached to the bones.

Thus it would now seem that the collective burial found earlier in Area D is by no means unique. Rather, it has to be expected that each house unit has at least one small,

chamber-like room in the basement containing a collective / the family burial. The 2003 evidence indicates that this house had at least two burial rooms.

Much work was invested in the occupational and postoccupational morphodynamics of the architecture. It became evident that comparisons with similar, even identical, features in sub-recent local architecture are possible and can be a valuable source of explanation.

Occupational Morphodynamics

Occupational morphodynamics appear based on the following principles:

• Intramural floors (of the basement) were raised during habitation and caused a vertical extension of the walls, either room-wise or of entire room-groups (Fig. 2). This could create several (basement) levels in a house, with ceilings moving upwards and ceiling materials deposited on floors. Different levels were connected by inserted stairs / stairwells.

• This also affected existing upper storeys, for which roofs must have been gradually raised, too.

• At some spots, complete rooms or parts of basements were filled with rubble (or, in cases of ground plan alterations, with the material of demolished walls). In such cases, traces were found that a former upper storey was transferred into a basement. This shift was accompanied by an overall re-arrangement of the ground plan, namely the insertion of small rooms often requiring the blockage of former doors and wall openings.

• Intra- and extra-mural spaces in Ba'ja may have served as dumping areas for wall rubble from which dressed wall stones had been removed. Raised levels of open spaces in the settlement seem to have resulted in reduced or blocked doors.

• These processes are co-responsible for the good preservation of the walls' heights in the settlement (up to *c.* 4.50 m) (Fig. 2).

Postoccupational Morphodynamics

Postoccupational morphodynamics were also found responsible for the excellent wall preservation, and can be characterized as follows:

• Several locations in the settlement witnessed sequences of considerable single or multiple event fluvial depositions of sorted material (*e.g.* of fist-sized angular stones, lenses of fine-grained material, coin-sized pebble layers, all potentially mixed with settlement debris) (Fig. 3). These layers indicate the presence of a considerable amount of rubble in the settlement, possibly also of temporarily abandoned ruined areas or areas with accumulations of building debris. Such deposits between the houses could have been transported by water into deserted rooms through wall openings and doors, or tipped over the tops of eroding walls. Final PPNB squatters may have influenced the postoccupational morphodynamics, too.

• The ruins of Ba'ja were rapidly filled by the large volume of material deriving from two-storeyed houses, the raising of thick re-plastered roofs and ceilings. The cellular ground plan provided much material per m^2, and the terraced morphology of the settlement helped to transport the architectural rubble downwards.

• The flat topography of Area B allowed deposition of fine-grained (sandy-silty) layers (Fig. 3) through the millennia that followed the end of occupation. This material experienced low transport energy (sheet floods) and originated from the weathering of the nearby sandstone formations.

• The steeper parts of the settlement show deflation features and a pavement that developed from eroding wall materials, which also facilitated architectural preservation. Spots with architecture preserved up to 3.50 m at slopes of 40º occur.

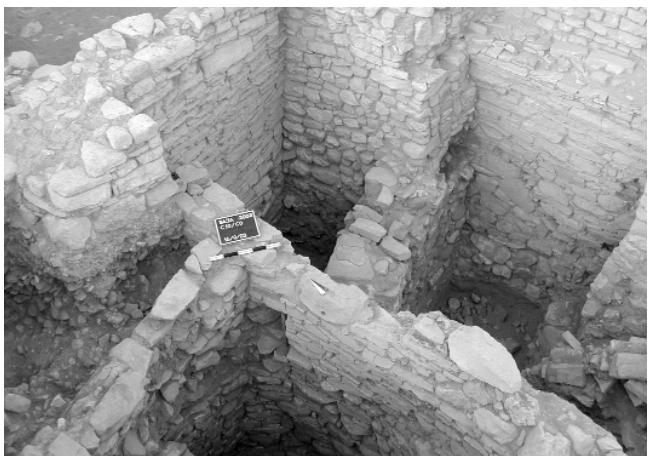

Fig. 2 Ba'ja, Area C, Sqs. 0-10: example of wall heights growing with the rise of floor levels/storeys (photo: H.G.K. Gebel).

Fig. 3 Ba'ja, Area B-South, Sq. 64: example of the huge intra-site multiple deposits resting against a major terrace wall, including sandy deposits going across the top of ruined walls (photo: H.G.K. Gebel).

Area B, Open Space

Investigations of a possible open space below Area B produced more complex evidence: in short, it appears that open spaces in this area existed in some periods, while there was a tendency to occupy this space by domestic architecture. The narrowed and later blocked gate in B74 (Fig. 4) seems to testify to such changing spatial concepts.

Intra-mural Floor Raising at Ba'ja

A striking example of intra-mural floor-raising and related blockings of wall openings / doors is the evidence from Wall 120 in C10. Here, the door Locus 126 and Wall Openings 127A and 127B (east side, respectively 131A and 131B on the west side) had been reached by succeeding floors in the large room of C10. This room obviously had a special function, not only because of its extraordinary size, but also because its floors and walls were red-stained (re-plastered in places up to three times at the level reached in 2001 and 2003). The sills of the wall openings and the threshold of the door were buried by the new floor, and the remaining openings were blocked (Fig. 5) with stones on both the east and west, helping to create smooth wall faces. In addition, the eastern side of the northern opening was closed by using floor material, indicating that closing wall openings and creating a new floor could be part of one single work event. Especially the latter action is a fine example for a building ethology common to any builders of permanent structures: the *ad hoc* use of leftover material from another building project in a context for which it was not prepared (soil bed material used to close a wall opening). A hitherto – to our knowledge – unobserved feature of LPPNB wall openings was preserved by the blocking of the Windows 127 A and B: there was red-stained plaster on their interior faces, too. Thus, the red-stained wall plaster extended into the wall openings. To the west, and situated in its central part, Wall 120 had a (partially) excavated stairwell with 3-4 steps.

Ceiling / Roof Evidence

Among the special findings of the season were imprints of ceiling / roof matting (interlaced, most probably of reed) in a homogenous light brownish mortar (Fig. 6). Above this material a stone layer was found, interpreted as part of the layered ceiling or roof "stratigraphy". A powdery dark brown layer rested between the plastered floor and the aforementioned brownish mortar. Most likely this substance derived from the decayed matting.

Lower Area C Stratigraphy

More evidence was found that the lower stratigraphy of Area C is alike throughout the spur on which the architecture rests: the sandy-silty virgin soil was leveled and

Fig. 6 Ba'ja, Area C: imprints of ceiling or roof matting (photo: H.G.K. Gebel).

Fig. 4 Ba'ja, Area B-South, Sqs. 64-74-84: architecture with blocked "gate" (foreground) and tumbling walls (background) (photo: H.G.K. Gebel).

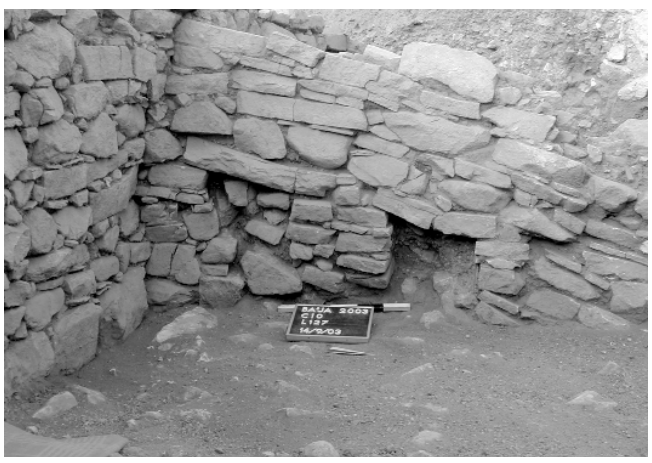

Fig. 5 Ba'ja, Area C, Sqs. 10-20: blocked windows as a result of a raised floor (photo: H.G.K. Gebel).

covered by a layer of fist-sized stones. The walls were founded on this layer. Inside the rooms a lime plaster bed was laid out on the fist-sized stones, which could have received a finishing coat.

Ethnoarchaeological Research in Local Architecture

Part of the campaign was devoted to a study of topographic space management and use as well as decay processes in the traditional villages of Rajif and Basta. Many insights had already been derived (*cf.* also Kinzel, this issue) from these studies, which allowed for more reliable explanations of some features in Early Neolithic Ba'ja.

Future Research

The first five seasons of excavation provided an extraordinary basis for the development of hypotheses to guide a second period of large-scale excavations in Ba'ja. The small size of Ba'ja allows us to excavate an extensive part of an early sedentary community in order to study its social organization in more detail than usual. The past research in Ba'ja has also led to an understanding of our archaeological research as part of environmental and social responsibilities and conservation. Thus, we will continue the excavations in a framework of regional sustainability, much related to and supporting the developing local tribal infrastructure. However, the immediate excavation work will include:

- specialists' exposure of collective burials and a wall painting,
- excavation of Area A, where we expect a *c.* 80 m long ramp or staircase to the site flanked in its upper parts by architecture
- geophysical investigations into the subsurface ground plans, particularly in Area B
- investigations in dumping areas in the lower parts of Area A
- future large scale excavations in Areas B, C, D, and possibly E
- conservation work at walls and constant refilling

References

Gebel H.G.K.
2001 Frühseßhafte verborgen in Felsen. Ba'ja in Süd-Jordanien stellt der Jungsteinzeitforschung neuartige Fragen. *Antike Welt* 32/3: 275-283.
2004 Die Jungsteinzeit Jordaniens. Leben, Arbeiten und Sterben am Beginn seßhaften Lebens. In *Gesichter des Orients. 10000 Jahre Kunst und Kultur aus Jordanien:* 46-56. Mainz: Philipp von Zabern
in press The domestication of water: Evidence from Early Neolithic Ba'ja? In H.D. Bienert and J. Häser (eds.), *Men of Dikes and Canals: The Archaeology of Water in the Middle East.* Orient-Archäologie 10. Rahden: Leidorf.

Gebel H.G.K. and Hermansen B.D.
1999 The Ba'ja Neolithic Project 1999: Short report on architectural findings. *Neo-Lithics* 3/99: 18-21.
2000 The 2000 season at Late PPN Ba'ja. *Neo-Lithics* 2-3/00: 22-24.
2001 LPPNB Ba'ja 2001: A short note. *Neo-Lithics* 2/01:15-20.

Contribution

Some Notes on the Reconstruction of PPNB Architecture

Moritz Kinzel
Technical University Berlin <moritzkinzel@web.de>

Referring to an old proverb –"a picture says more than a thousand words"–, this article should be seen as a comment to the following reconstruction drawings of PPNB architecture from Ba'ja, Basta, and Shkârat Msaied.

The PPNB architecture of southern Jordan, especially in the Greater Petra Area, is said to be "well known" from sites like Basta, 'Ain Jammam, es-Sifiya, al-Basît, Ba'ja and Ghwair. But how well do we really know these well preserved structures? We see only parts of very complex buildings, where no outline of a house is really clear, with the possible exception of the main building in Basta, Area B (Nissen *et al.* 1991; Kinzel 2003). In settlements like Ba'ja, one cannot isolate a single ground plan of a house. What belongs to a house? To reconstruct the full size and volume of a house unit in that context one cannot simply project a ground plan to the vertical dimension. This holds true irrespective of the question of whether or not the PPNB houses were multistoreyed buildings. In detail, the results from Ba'ja and Basta allow different interpretations of the same situation. Fig. 1 gives an example: a commonly used wall between two "rooms" featuring a support for a ceiling or roof and a wall opening.

The following possible interpretations are the first key to understand the character of PPNB architecture:

1) Wall sharing: One-storey buildings, using the roofs

as an activity area, but no second storey. The supposed support of a ceiling is perhaps just a result of different building events, adding a new wall on a higher level on top of the lower parts of the wall. An example is Old Basta village.

2) Split level: A building unit uses different levels. A house can use more than one terrace level. Fig. 4 presents an example from the modern village of Rajif. This seems to be the "normal case" in most of the LPPNB sites of southern Jordan.

3) Two- or multi-storeyed houses: The findings connected with the site topography, the architectural preservation, and the room fills, especially in Baja, can be interpreted as complex multi-storeyed building structures.

Combining these interpretations, we get a tool to characterize the architecture of different sites. In Basta the wall sharing feature is predominant, with a split-level shaping and a few extreme variations of 3) above. The "normal case" in Ba'ja is the multi-storeyed building with varieties of 2) and, to a lesser degree, of 1). This means that all three different types can occur in one settlement, but in every site another feature is the "normal case" (Fig. 1 – All drawings by the author).

A second key to the understanding of these structures is to look at the room sequences. Passageways connect the compartments, sometimes also on different levels (*cf.* 2), split level). By identifying connected rooms as sequences we are able to identify parts of the building structure that were transformed in form and function as a result of rising floor levels (Fig. 2).

In Ba'ja Area C there are different room sequences (RS). RS I: the rooms in C32 and C22 are on different levels connected with doorways following the relief of the slope down the hill. RS II: the rooms of C21 and C20 are more complex. C20 shows an area transformed by floor raising and refilling. A room connected to the others with doorways was filled, and on top of the new plastered floor level a staircase was added connecting different levels independent of the site's topography. If we bring all room sequences and their interrelations together, we will get a better comprehension of the passageway system of the settlements (Fig.3).

The next question in reconstructing PPNB architecture is what did the whole thing look like? For comparisons with PPNB architecture in general, the traditional architecture of the semi-arid regions along the 30° latitude around the world is a treasury of knowledge (Adam 1981). A more specific source of explanation and comparison is the recent traditional village architecture of southern Jordan (*cf. e.g.*, Haberkorn 2000). These villages show a wide range of local varieties that characterize this rural architecture. In modern Rajif, for example, it is possible to find features 1) and 2) as outlined above. Thus, there is a striking example of a split-level house that at the same time represents the wall sharing type. Small passageways connect the different levels of the building complex (Fig. 4). There is reason to believe that the buildings of Rajif have the same wall and roof construction as in Neolithic Ba'ja and Basta (Fig. 5). Also, in Rajif we find a clear example of the complexity of building events. Near the mosque three houses stand next to each other in a line. Originally, each building had a separate entrance and one or two windows. The entrances were oriented to the alley. Later the house in the middle was transformed into a courtyard. The entrances of the other two buildings were then blocked and new doorways oriented to the courtyard were added. These changes resulted in a completely different context of these buildings within the settlement system. Before the middle house was changed into a courtyard, the three buildings were part of different units. Later, two separate areas with their own entrance gates came into being (Fig. 6). With this example in mind, it becomes obvious how complicated it is to reconstruct Neolithic architecture and possible building events. Nevertheless, we may use the study of local traditional architecture as the third key for the understanding of PPNB architecture. But we have to be aware of the danger to transfer recent traditional architecture indiscriminately to LPPNB architecture.

Hitherto it looked as if recent traditional architecture of the Greater Petra Area is based on the rectangular architecture of the Late Pre Pottery Neolithic B, but the results of the 2004 campaigns of the Carsten Niebuhr Institute in Shkârat Msaied add new aspects to this discussion (Jensen *et al.*, in prep.). In Shkârat Msaied there is evidence of solid and substantial, circular stone architecture. The cross-section profile in unit K shows the characteristic roof construction of the region (Hermansen and Bille Petersen, in prep.). Fig. 7 is a reconstruction of this feature. Analysing and interpreting the room fill of unit K, we may assume solid walls were erected using local sandstone and limestone to a height of at least 1.80 m. The beams of the flat roof, about 18 cm in diameter, rested on a scaffold of wooden posts that were placed in wall channels in the interior wall face. Branches and brush were placed across the beams, covered by thick layers of mud and mortar embedded with cobble-sized stones. Finally, on top of the roof construction we may assume some layers of lime plaster. Compared to the roof construction of the LPPNB architecture, this MPPNB construction seems to be the beginning of later traditional building technology. The findings of Shkârat Msaied indicate that as early as in MPPNB people started to experiment with the flat roof construction and its use for daily life. This includes the conversion of rooms, space, and the ground plans from circular structures to more rectangular ones (Fig. 8). Therefore, MPPNB sites like Shkârat Msaied are the fourth key to an understanding of the history of PPNB architecture and its principles.

As seen from the results in Shkârat Msaied, Ba'ja, Basta and other sites, most information about PPNB architecture can be found in the room fills. With respect

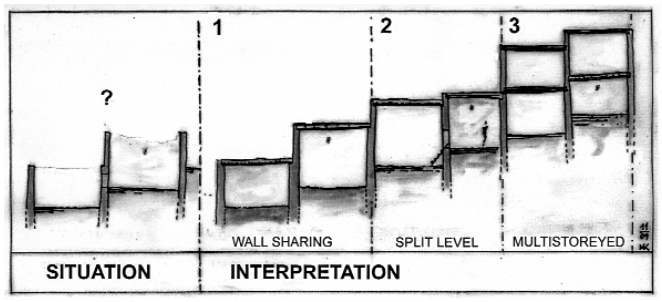

Fig. 1 Possible interpretations of PPNB architecture.

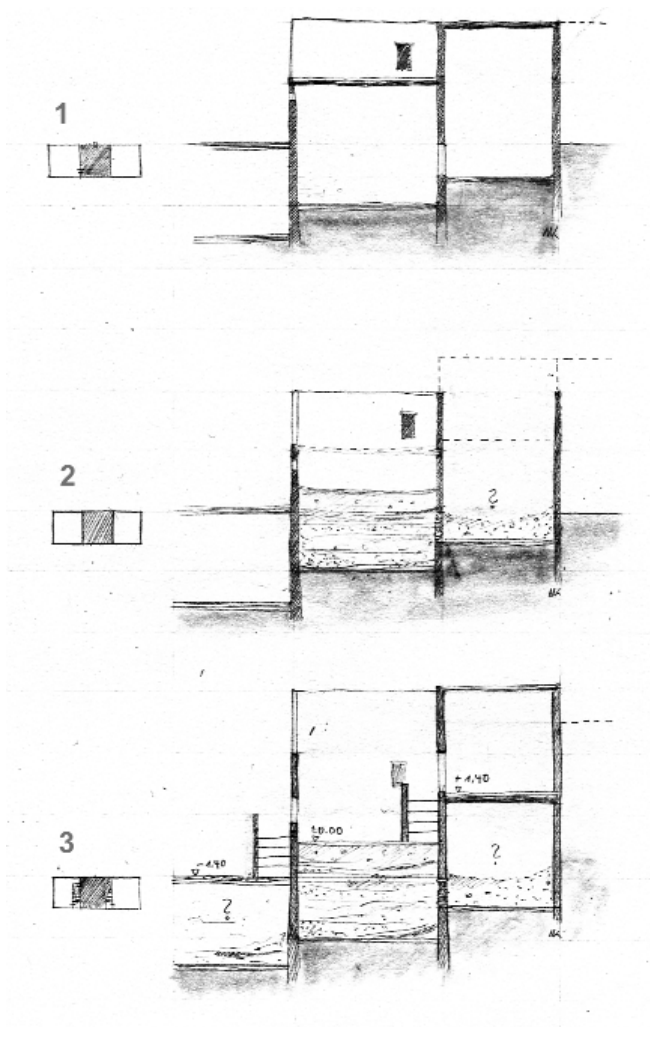

Fig. 2 Ba'ja: C20 / C21, rising floor levels. 1-3 shows the transformation of Area C (*cf.* Fig. 3, RS II).

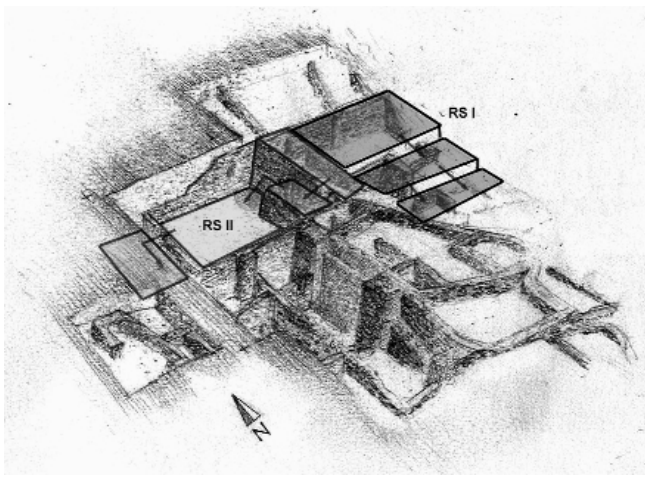

Fig. 3 Ba'ja: Room sequences in Area C: understanding the passageway system of the settlement.

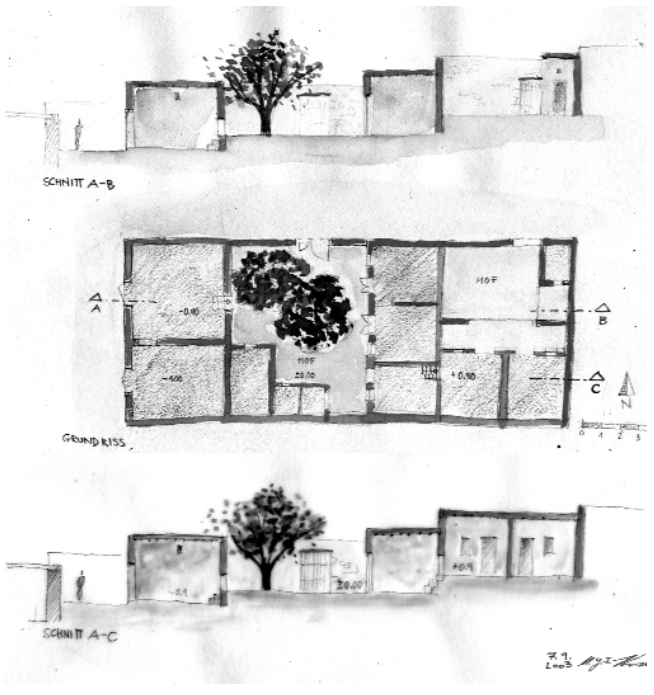

Fig. 4 Rajif, a traditional village in southern Jordan: An example of a split-level house (*cf.* Fig. 1).

to the preservation of PPNB remains two major phases can be distinguished. First, the filling of the small-room architecture during the occupation of the settlement and, second, the processes after the settlements were abandoned (Gebel and Bienert 1997; Gebel 2004). At Ba'ja in particular, the filled room interiors demonstrate that the material stems both from the structure's own debris and its surroundings and rapidly filled the room interiors (Ch. Hannß, pers. comm.). Two interpretations are possible: either parts of the building structure were intentionally filled during the LPPNB occupation in order to create a new building on top of the old walls, or the filling material belonged to a second storey that had existed on top of a basement that was preserved. Although unresolved so far, the results from room fills in Ba'ja give an idea of the roof and ceiling construction. In principle, the construction is the same as in MPPNB Shkârat Msaied and modern Rajif as described above. Thus the stratigraphy or the room fill can be used as the fifth key.

The problem of reconstructing PPNB architecture is

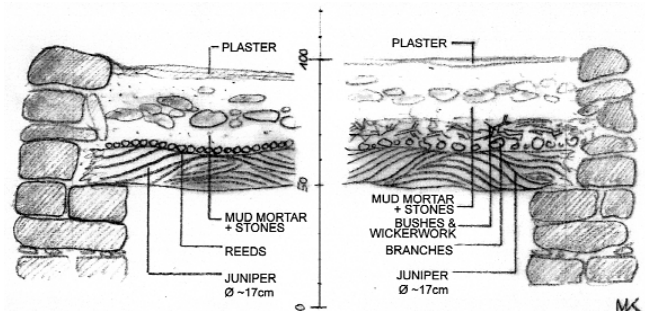

Fig. 5 Rajif: Two roof constructions. Left: similar to the roof construction of Ba'ja. Right: like the roof construction of Shkârat Msaied (*cf.* Fig. 7).

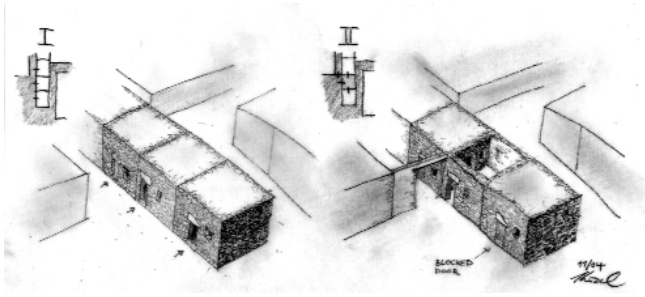

Fig. 6 Rajif: Transformation of ground plans and the settlement system, possibly the result of changes in the social structure of the village.

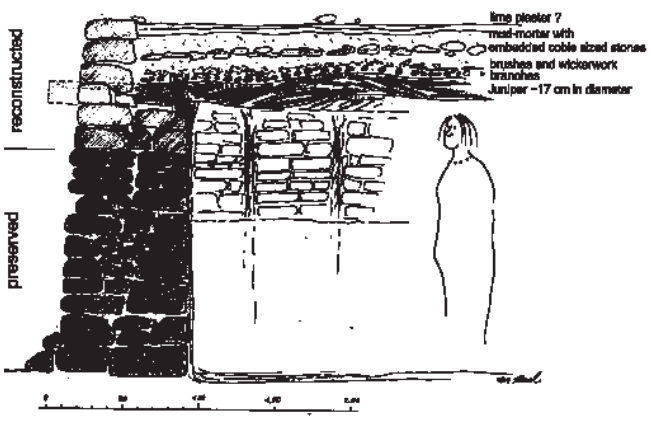

Fig. 7 Shkârat Msaied: Reconstruction of Unit K, cross section.

even more complex. A broader understanding requires an investigation into the functions of different areas and the role of burials in the overall settlement system. Using all five "keys" it still seems possible to give an idea how PPNB architecture could have looked (Figs. 9 and 10). It must be added that the PPNB architecture of the Greater Petra Area is marked by a mountain setting that requires a solid and sustainable way of house building. Each site shows local characteristics and independent developments, sometimes to extreme variations compared to the

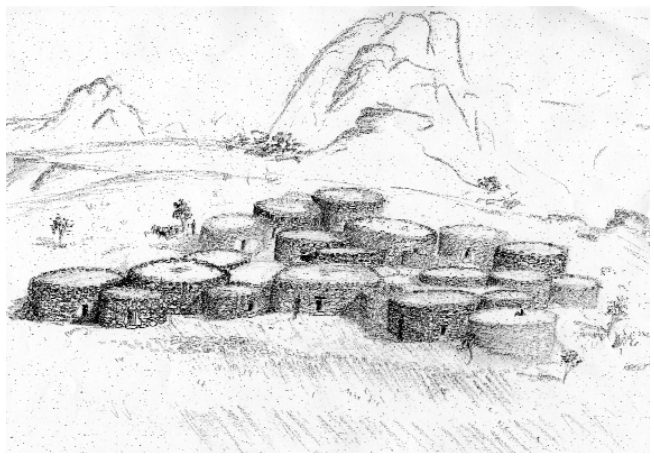

Fig. 8 Shkârat Msaied: Reconstruction of the MPPNB settlement depicting the solid, circular stone architecture with flat roof construction (*cf.* Fig. 7) and walls up to more than 1,80 m.

Fig. 9 Ba'ja: Reconstruction of the LPPNB settlement.

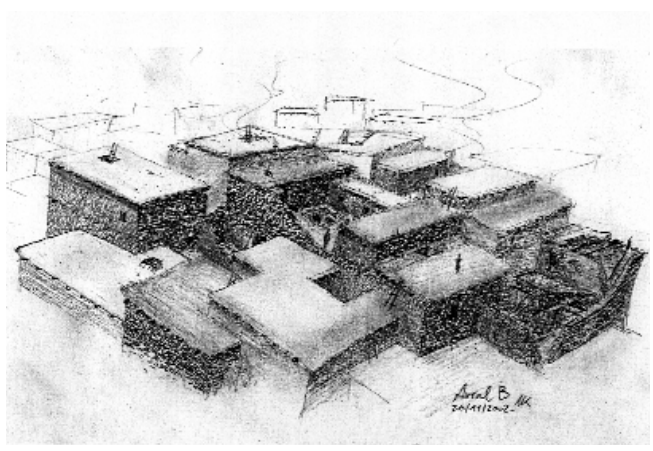

Fig. 10 Basta: Reconstruction of Area B.

"normal case". It should be clear by now that it would be misleading to concentrate on the phenomena of one site only. In order to get a better understanding of PPNB architecture in general, we must compare one site with the knowledge of the phenomena of all others. I hope to present the results of my studies on the reconstruction of PPNB architecture in more detail later.

Acknowledgments: I wish to say "tak" to Charlott Hoffmann Jensen, Bo Dahl Hermansen, and Ingolf Thuesen of the Carsten Niebuhr Institute at Copenhagen University who invited me to join the Danish team excavating the fascinating site of Shkârat Msaied (formerly known as Shaqarat Mazyad). Moreover, I wish to express my gratitude to Hans Georg K. Gebel. My work on PPNB architecture would be impossible without his selfless sharing of knowledge about the PPNB world.

References

Adam J.
1981 *Wohn- und Siedlungsformen im Süden Marokkos.* München.

Gebel H.G.K.
2004 Site Preservation and Site Formation Processes. In: H.J. Nissen, M. Muheisen and H.G.K. Gebel (eds.), *Basta I – The Human Ecology:* 95-116. Berlin: ex oriente.

Gebel H.G.K and Bienert H.D.
1997 Ba'ja hidden in the Petra Mountains: Preliminary results of the 1997 investigations. In: H.G.K. Gebel, Z. Kafafi and G.O. Rollefson (eds.), *The Prehistory of Jordan II: Perspectives from 1997:* 221-262. Studies in Early Near Eastern Production, Subsistence and Environment 4. Berlin: ex oriente.

Haberkorn J.
2000 Ba'ja and Fersh: Bedouin Architecture of the 20th Century. *Annual of the Department of Antiquities of Jordan* 44: 142-144.

Hermansen B.D. and Bille Petersen M.
in prep. Reconstructing Early Neolithic Architecture: The case of Shkârat Msaied (working title). (to be submitted to *Journal of Field Archaeology*).

Jensen C.H., Hermansen B.D., Kinzel M., Hald M.M., Bangsgaard P., Bille Petersen M., Lynnerup N., and Thuesen I.
in prep. The Excavations at Shkârat Msaied, 1999-2004. (to appear in *Annual of the Department of Antiquities of Jordan* 49, 2005).

Kinzel M.
2003 *Basta - Südjordanien. Überlegungen zur Rekonstruktion von Areal B (7000 BC) nach bauarchäologischen Befunden.* Berlin, Technical University, unpublished Master's Thesis.

Nissen H.J., Muheisen M., and Gebel H.G.
1991 Report on the Excavations at Basta 1988. *Annual of the Department of Antiquities of Jordan* 35: 13-40.

Contribution

Production Areas at MPPNB Shkârat Msaied, Southern Jordan

Charlott Hoffmann Jensen
Carsten Niebuhr Institute, University of Copenhagen <charlott@hum.ku.dk>

Introduction

The MPPNB site of Shkârat Msaied, which is situated in the sandstone area between Petra and Wadi Arabah in southern Jordan, has been excavated by a Danish team since 1999 (Kaliszan *et al.* 2002; Jensen in press). So far a number of circular/semi-circular building units situated in clusters have been exposed (Fig. 1). Both building construction and lay-out show close resemblance to the early levels at Beidha. Excavation will continue for another two years in order to extend the excavated area further to the south and east, thereby exposing one of the largest excavated areas with architecture from the PPNB period.

During the 2000 and 2001 seasons of excavation, two areas with concentrations of chipped stone tools and raw material debris from bead production were located (Kaliszan *et al.* 2002). The northernmost area was fully excavated during the 2003 season. The following is a brief report on the chipped stone material from these areas.

The Production Areas

Both concentrations represent secondary deposits deriving from production areas which were primarily used for bead production[1]. The areas have been defined as such because the contents include large numbers of chipped stone, especially drills, debris of the raw material used, as well as unfinished and broken beads. All the waste and beads are of a green material, some of which has been identified as turquoise by the excavators. Since not all of the beads and waste material have been studied, it cannot be excluded that malachite is represented at the site as well. A precise identification of the material awaits analyses by specialists.

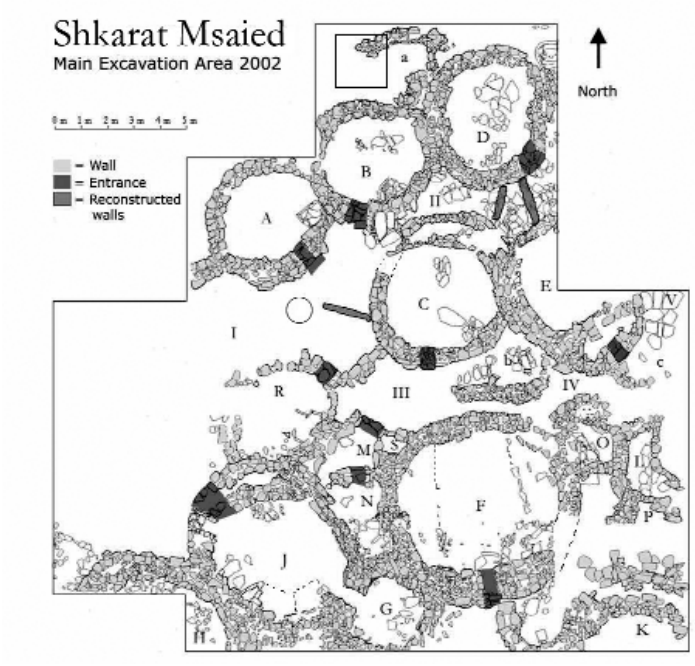

Fig. 1 Plan of the main excavation area with the two areas marked out. Plan prepared by Mikkel Bille Petersen.

The largest concentration of bead-making tools was found in a small circular area more or less in the center of the open Area I (Fig. 1). The deposit has been interpreted as a pit due to differences in the soil and the content. The western part of area I was used as a dump, while the eastern part at some time during the use life of the area was covered by plaster floors and associated walls. The pit is situated near the western limit of the plaster floors. But it is unclear when exactly the pit was dug in relation to when the plaster floors and additional walls were constructed.

The second deposit is situated to the north of Building unit B. In this case the material has been spread over an area covering almost 2 x 2 m. The material was deposited prior to the construction of the wall of enclosure a, during which time the area also seems to have been used as a dump.

The Chipped Stone Material

The content of the area I pit includes 2,364 pieces of chipped stone (including debris), representing the complete process from chunks to finished tools (Table 1), which indicates that the tools used in the production were also produced in the workshop. As shown in Table 2, 454 tools were found, of which 418 are registered as drills/borers. The majority of these (80 %) are made on bladelets (Table 3). The rest are made on blades, burin spalls, or core trimming elements, which also mostly are of bladelet size. Almost 10 % of the drills could not be precisely determined according to blank type (registered as indeterminate blades/bladelets, indeterminate flakes/blades or indeterminable).

Table 1 Chipped stone content of the two areas.

	Pit Area I		Northern Area	
Class	**N**	**%**	**N**	**%**
Cores	30	1.3	9	2.6
Core preparation/ rejuvenation	70	3.0	38	10.9
Blades unipolar	34	1.4	18	5.2
Blades bipolar	25	1.1	9	2.6
Blades indeterminate	7	0.3	4	1.1
Bladelets unipolar	358	15.1	16	4.6
Bladelets bipolar	64	2.7	10	2.9
Bladelets indeterminate	4	0.2	4	1.1
Indeterminate blade/ bladelet	1	0.05	3	0.9
Indeterminate blade/ flake	78	3.3	12	3.4
Flakes	401	17.0	124	35.6
Burin spalls	39	1.6	2	0.6
Debris	426	18.0	16	4.6
Thermal debris	372	15.7	28	8.0
Chunks	1	0.05	1	0.3
Tools	454	19.2	54	15.5
Total	2364	100.0	348	99.9

Table 2 Tool classes from the two areas.

	Pit Area I		Northern Area	
Type	**N**	**%**	**N**	**%**
Arrowheads	4	0.9	4	7.4
Drills/borers	418	92.1	27	50.0
Burins	1	0.2	5	9.3
Scrapers			2	3.7
Knives	1	0.2	3	5.6
Glossed elements			1	1.9
“Pieces esquillées”			2	3.7
Notched pieces			3	5.6
Retouched bladelets (lateral ret.)	13	2.9		
Retouched bladelets (distal ret.)	17	3.7		
Blades/ flakes with use retouch			2	3.7
Retouched flakes			3	5.6
Indetermin. Fragments			2	3.7
Total	454	100.0	54	100.2

Table 3 Blanks of drills/borers.

	Pit Area I		Northern Area	
Class	**N**	**%**	**N**	**%**
Bladelet unipolar	250	59.8	8	29.6
Bladelet bipolar	66	15.8	3	11.1
Bladelet indeterminate	23	5.5	5	18.5
Indeterminate blade/ bladelet	18	4.3	2	7.4
Blade unipolar	1	0.2	1	3.7
Blade bipolar	1	0.2	2	7.4
Blade indeterminate	1	0.2		
Indeterminate flake/ blade(let)	13	3.1	4	14.8
Flake			1	3.7
Burin spall	21	5.0		
CTE + blades with crest scars	17	4.1	1	3.7
Indeterminable	7	1.7		
Total	418	99.9	27	99.9

The high content of tools made on bladelets fits well with the fact that all the cores found in the pit are bladelet cores made on flakes or small chunks. The size of the working face ranges from 3.3 to 5.5 cm, with an average of 4.2 cm. None of the cores were heavily used; most cores produced a minimum of two to six removals, while only a few have produced more than ten. Half of the cores have two striking platforms. Only one core is of the naviform type, while the others show a variation of opposed, 90° or other types of cores. A single core has three striking platforms while the rest are single platform cores.

No burins were found in the pit to account for the 5 % made on burin spalls, but among the debitage 39 burin spalls could be identified.

The material found in the second deposit is more diverse, both concerning the chipped stone as well as other find groups. Where no other objects than those relating to bead production were found in the pit, these loci contained a number of objects in bone and stone not related to the bead production process. The overall chipped stone content is also much smaller: 348 pieces. As with the pit, the complete working process in chipped stone is represented. Also, the tools are much more diverse than in the pit, with drills only accounting for 50 % of the tool group (Table 2). Almost 60 % of these are made on bladelets and none on burin spalls, although five burins were identified in the tool group and two burin spalls among the debitage. The burins show multiple removals of spalls, indicating a use as a "core". The few cores found (nine in all), of which two are flake cores, show the same variation concerning orientation and number of platforms as in the former deposit.

Drills / Borers

The group of drilling/boring tools has been classified according to the typology of the Beidha material by Peder Mortensen (1970: 26-29). As can be seen from Table 4, a number of different types are represented, of which the most numerous is B2, borers with retouched converging edges forming a pointed end, and especially B6, blades or other types of blanks with short drill bits. Two types of double borers/drills are represented: B2-B6 and B6-B6. Both are types with one end of the B6 type while the other is either a B2 or a B6 type. The latter is also represented at the site of al-Basît (Rollefson and Parker 2002: 22). Drills with longer drill bits, type B7, are also found in the material. The large number of indeterminate pieces is mostly due to the problem of identifying a broken drill as either B6 or B7.

Most of the drills/borers are asymmetrical as can be seen on Figure 2. The boring tip is often placed close to one of the lateral edges of the blank instead of in the center, and the tip is seldom straight. As mentioned above, most tools are made on bladelet blanks. This gives an average length of the drills/borers as 2.62 cm, with a maximum/minimum length of 5.84/1.69 cm. The average width of the tools is 1.01 cm, with measurements spanning from 0.5 to 1.68 cm. The small size of the tools suggests they were hafted during use.

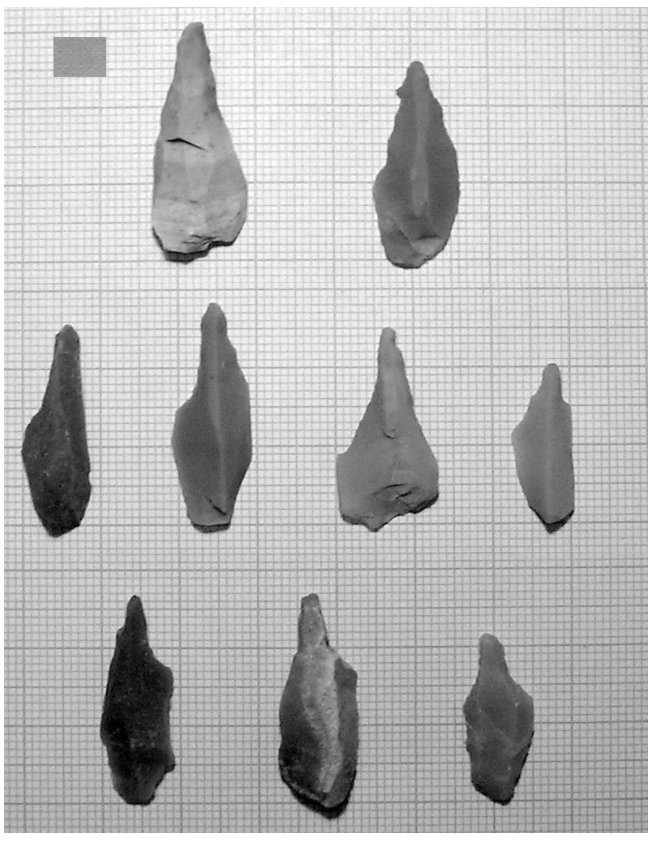

Fig. 2 Drills/borers made on bladelets shown against millimeter graph paper. Top row type B2. Central and bottom row mostly B6.

Table 4 Drill/borer types according to Mortensen's typology (1970).

	Pit Area I		Northern Area	
Type	**N**	**%**	**N**	**%**
B2	51	12.2	9	33.3
B3			1	3.7
B6	250	59.8	3	11.1
B7	14	3.3	8	29.6
B2-B6	9	2.2		
B6-B6	34	8.1	2	7.4
Indeterminable	60	14.4	4	14.8
Total	418	100.0	27	99.9

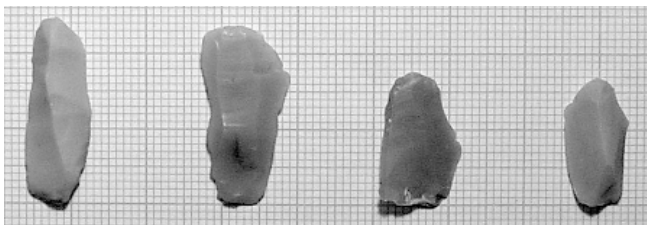

Fig. 3 Bladelets with distal retouch shown against millimeter graph paper.

A number of bladelets from the pit show lateral or distal retouch (*cf.* Table 2 and Fig. 3). Some showing distal retouch may originally have been drills broken during use, but the retouch identified on the bladelets cover the complete distal end, therefore the retouch must have been at least partly made after the drill was broken. The function of these tools is unclear, but they may have had a specific use in the production process.

There are slight variations between the two deposits. The drill type B6 is by far the most numerous type, almost 60 %, in the pit material with B2 being the second most popular with 12 %, excluding the indeterminate material. In the northern area the types B2 and B7 are almost equal in percentage, together accounting for just above 60 %.

Concluding Remarks

High contents of drills/borers among the chipped stone group have been identified at other PPNB sites in the southern Levant. These sites have also been interpreted as having bead making workshops since raw material waste as well as beads are numerous in the find lists (Finlayson and Betts 1990; Rollefson 2002; Rollefson and Parker 2002; Rollefson *et al.* 1999). The similarities are also seen in the type of blanks used for the drills. Bladelets account for a large portion of the blanks at several sites, including al-Basît in the Wadi Musa area (Rollefson and Parker 2002), while others show a high amount of burin spalls, *e.g.*, Jebel Na'ja in the Black Desert (Finlayson and Betts 1990). As has been pointed out by Rollefson (2002: 5), the explanation for the differences in blanks used for drills is chronological. Bladelets are mostly used in the PPNB period while burin spalls are more numerous among the material from Pottery Neolithic sites. The MPPNB date of Shkârat Msaied supports this conclusion.

The two deposits presented here are both secondary. The question remains as to where the production activities originally took place. Do the deposits represent two workshops, or do they originally derive from the same activity area? The differences seen between the two samples are probably due to the fact that the workshop material found in the northern area is mixed with material dumped from other activities. Several areas have been suggested already in a paper given at the 4ICAANE in Berlin (Jensen n.d.), but no final conclusion can be reached. It is also a question whether the production of beads was primarily for local consumption or if it should be considered industrial. Beads are not very numerous among the finds at the site, but the number of drills and the amount of waste found, especially in the pit, speaks for a quite intensive production.

Note

[1] The production areas were presented by the author at the 4ICAANE in Berlin in April 2004 as part of a paper entitled "Workshops and Activity Areas in the PPNB Period: The Excavations at Shkârat Msaied". I wish to thank Gary Rollefson for inviting me to present the bead production areas in the pages of *Neo-Lithics*. The English of this article was kindly edited by Stephen Lumsden, Carsten Niebuhr Institute.

References

Finlayson B. and Betts A.
1990 Functional Analysis of Chipped Stone Artefacts from the Late Neolithic Site of Ğabal Na´ja, Eastern Jordan. *Paléorient* 16, 2: 13-20.

Jensen C.H.
in press Three Years of Excavation at the PPNB Shkârat Msaied, Southern Jordan. In J. Margueron, P. Miroschedji, and J.-P. Thalmann (eds.), *Proceedings of the Third International Congress on the Archaeology of the Ancient Near East.* Winona Lake: Eisenbrauns.
n.d. Workshop and Activity Areas in the PPNB Period: The Excavations at Shkârat Msaied. Paper presented at the 4ICAANE in Berlin, April 2004.

Kaliszan L.R., Hermansen B.D., Jensen C.H., Skuldbøl T.B.B., Bille M., Bangsgaard P., Ihr A., Sørensen M.L., and Markussen B.
2001 Shaqarat Mazyad – The Village on the Edge. *Neo-Lithics* 1/02: 16-19.

Mortensen P.
1970 A Preliminary Study of the Chipped Stone Industry from Beidha, an Early Neolithic Village in Southern Jordan. *Acta Archaeologica* 41: 1-55.

Rollefson G.O.
2002 Bead-making Tools from LPPNB al-Basît, Jordan. *Neo-Lithics* 2/02: 5-7.

Rollefson G.O. and Parker M.C.
2002 Craft Specialization at al-Basît, Wadi Musa, Southern Jordan. *Neo-Lithics* 1/02: 21-23.

Rollefson G.O., Quintero L.A., and Wilke P.J.
1999 Bawwab al-Ghazal: Preliminary Report on the Testing Season 1998. *Neo-Lithics* 1/99: 2-4.

Contribution

Flint Axes and Neolithic Debitage in the Prehistory Collection of Aleppo Museum, Syria

Yayoi Yamazaki[1], Osamu Maeda[2] and Makoto Arimura[3]
[1] JICA senior volunteer assigned to Aleppo Museum <yamhad@mail.sy>
[2] University of Manchester <osamu.maeda@stud.man.ac.uk>
[3] Université Lumière, Lyon 2 <arimura@club-internet.fr>

It is well-known that a large number of archaeological finds from both old and recent excavations and surveys are housed in Aleppo Museum. Especially during the first half of the last century, many archaeological finds were preferentially brought to Aleppo Museum. This short paper deals with some flint axes, naviform cores and blades stored in Aleppo Museum that may show interesting regional affiliation.

The museum moved to the present building at the beginning of the 1970s. In 1974 the finds from the series of excavations in the Tabqa Dam area were displayed in the first hall of the second floor in addition to the permanent exhibitions. Then in the 1980s an exhibition hall for the prehistory collection was also set up on the first floor. These changes, however, seem to have caused confusion in the registry, and some of the labels and markings on the artefacts were lost[1].

A small project for reorganisation of Aleppo Museum began on October 2002 under the agreement between the Syrian Ministry of Culture and JICA (Japanese International Cooperation Agency), initially concentrating on the artefacts stored in the prehistory collection. The aim of the work is to establish a visual database for all the artefacts in this collection in order to facilitate further studies and activities at the museum. The actual work began with the cleaning of the artefacts and then progressed to primary sorting and labelling of accession numbers, which are recorded in a computer database. Up to the present (August 2004), around 5000 data-sheets have been recorded with digital photographs, and there are still several items to be completed.

The flint artefacts discussed in this paper were "found" in the collections the find place of which is problematic. They were kept in boxes with a large number of Paleolithic flint tools (Acheulean bifaces and Mousterian blades and flakes), bearing the Inventory Numbers[2] from 8703 to 9002[3]. Oddly, these artefacts, including Paleolithic materials, are registered as the finds from Ras Shamra under the Aleppo Museum Number M1658[4]. However, the other finds from Ras Shamra are usually prefixed with "RS", and their Aleppo Museum Numbers are much younger. In addition to this, two other points cause us to reconsider the site where these artefacts were collected: first, their heavily weathered surfaces indicate that they are possibly from a surface collection, and second, they seem to have collected with Paleolithic material that was not found during the Ras Shamra excavations. Thus, it seems that the Museum Number on these artefacts is not reliable, and it seems more likely that they were collected from another place.

Although there are unfortunately no other documents to allow us to speculate on their original find place, similarities in raw materials and condition of weathered surfaces on all of these artefacts suggest that they were probably collected from the same location. Thus, although their original find place is not known, we believe that these flint artefacts are worth studying on this occasion of "rediscovery" of archaeological finds long stored in Aleppo Museum.

Chipped and Polished Flint Axes

Thirty-nine flint tools are categorised as chipped and polished axes[5] and a roughout. Generally, chipped flint axes with polished edges are well known in the southern and central-inland Levant, where they are usually referred to as bifacial tools. On the other hand, in the northern and central-coastal Levant, where fully polished axes made of other kind of rocks (often reported as celts) are more distinctive, not much attention has recently been

paid to chipped and polished axes[6]. However, it should be noted that several flint axes found in this region certainly show regional traditions of prehistoric flint axe production with which the axes in this collection have some similarities.

Most of the axes in this collection are made of relatively high quality greyish-brown flint, sometimes with cortex. The surfaces of all the axes are heavily weathered and worn. They are all shaped by rough flaking and often polished on the cutting edges and parts of bodies. The raw materials used and the general process of manufacture are almost the same among all of them. However, based on the differences in their size and the shapes of the transverse sections, which may represent different functions of the tools and production methods, they are categorised into several types: large axes with rectangular section, small axes with rectangular section, axes with plano-convex section, axes with lenticular section, and axes with rhomboid section.

It seems that the different shapes and sizes were affected by the original shapes of the flint nodules chosen for manufacture. It is, however, not certain whether different nodules were chosen on purpose to make different types of axes. When considering the use of these axes, no distinctive difference is observed in the condition of the cutting edges between the different types. The cutting edges are bifacially shaped into slightly convex or straight edges and have almost symmetrical longitudinal sections. The use of tranchet blow to form a cutting edge is virtually absent. Polishing of the cutting edge is seen in all the types except for the one with rhomboid transverse sections. Edge damage or re-sharpening of the cutting edge is seen in many axes on both faces of the cutting edge, although no patterns are recognised in the edge damage. On the other hand, battering marks on the circumference of the butt end are only seen in the large axes with rectangular transverse sections, the dominant group in this collection. This feature, as well as their relatively large sizes and weights, may indicate a different function for this type of axe.

When comparing all these axes with those from other sites, similar flint axes are seen in several Neolithic and Chalcolithic sites in the Levant. In the southern and central-inland Levant, the axes are all bifacial tools with various shapes (*e.g.*, Barkai 1999; 2003; Haidar-Boustani 2004). Round or triangular bifacial axes seem to be more common than rectangular ones. On the other hand, in the northern and central-coastal Levant, elongated rectangular bifacial axes, sometimes larger than 10cm in length, are more common than the other shapes, and axes with rectangular transverse sections are sometimes found. Such examples are well represented in the lithic assemblage from Byblos and other Lebanese coastal sites such as Tell Arslane (Cauvin 1968). A large number of bifacial axes were found from the *Néolithique Ancien* to *Enéolithique* levels, and axes with a rectangular transverse section, similar to those in this collection, have also been reported from the *Néolithique Ancien* level (*Haches à pans verticaux*) and also from the *Néolithique Moyen*, *Récent* and *Enéolithique* levels (*Haches à pans coupés:* the sides of these axes are naturally flat face without intensive flaking). Also, in the Rouj Basin in the northern region of the Ghab, flint axes with a rectangular section have been found along with those with plano-convex and lenticular sections in the Late PPNB and the PN levels of Tell Ain el-Kerkh (*e.g.*, Tsuneki *et al.* 1999). Their production technique is similar to the axes in this collection, but the axes from Tell Ain el-Kerkh are smaller and well polished from the cutting edge to the upper part of the body. Flint axes with elongated rectangular shapes are seen in other Neolithic/Chalcolithic sites, such as Ras Shamra (Contenson 1992), Tabbat al-Hammam (Hole 1959), Tell el-Kerkh 2 (Iwasaki and Tsuneki 2003) and Arjoune (Copeland 2003), although these assemblages do not seem to include axes with a rectangular section.

This suggests that the axes in this collection, especially the axes of elongated rectangular shape with rectangular sections, should be placed in the regional tradition of axe production of the northern and central-coastal Levant, to which more attention should be paid. The evidence from the sites mentioned above shows that this kind of axe continued to be used in this region for a long period from the PPNB to the Chalcolithic.

Additionally, to help form more detailed images of the axes in this collection, some typological features that are characteristic to each type are described below.

Rectangular section (26 objects, Fig. 1: 2, 4): This type has a characteristic rectangular transverse section and rectangular plan. The sides of the axe are formed by flat flaking or by naturally flat faces. The body is sometimes shaped by long blade-like flaking from the cutting edge and/or the butt end. The butt ends are often flat and rectangular. They are divided into two different size categories: *Large Rectangular* (16 objects, Fig. 1: 4) and *Small Rectangular* (10 objects, Fig. 1: 2). The production technique of these two types is identical, but their functions may have been different because of their sizes and, especially, weights (Table 1). Interestingly, battering marks are only observed on the circumference of the butt ends of the Large Rectangular axes.

Plano-convex section (5 objects, Fig. 1: 3): The upper part of this type has a plano-convex transverse section formed by a flaked or a natural flat face on one side and a flaked convex face on other, similar to those termed "adzes" elsewhere. However, the cutting edges are made by bifacial flaking, which is sometimes polished after flaking, and often they have almost symmetrical longitudinal sections. Edge damage is often seen on both faces of the working edges. Thus, it is not clear whether this type was actually used as an adze or an axe, although the butt shape, often tapered, might indicate the different use of this type.

Lenticular section (4 objects, Fig. 1: 6): This type has a lenticular transverse section and the longitudinally symmetrical cutting edges resulting from bifacial shaping. The tapered butt ends of the two axes are shaped by bifacial flaking into symmetrical shape. Their body thickness is thinner than the rectangular or plano-convex sectioned type. Cortex left on the both faces of one axe shows that the original nodule was not very thick. All four pieces are similar in their sizes.

Rhomboid section (3 objects, Fig. 1: 5): This type has a rhomboid transverse section formed by bifacial flaking. All are relatively roughly made and do not have polishing on the working edges. Cortex is often left on the both faces of the body demonstrating the original size of nodules. Their butt shapes may be tapered, rounded or flat.

Roughout: In addition to these axes, one roughout is present (Fig. 1: 1). It has rectangular transverse section with cortex on each face, so it is almost the original size of the nodule. The working edge is not yet set. It seems to be a roughout for a Large Rectangular axe since its shape and size roughly fit those of the finished products (Fig. 1: 4).

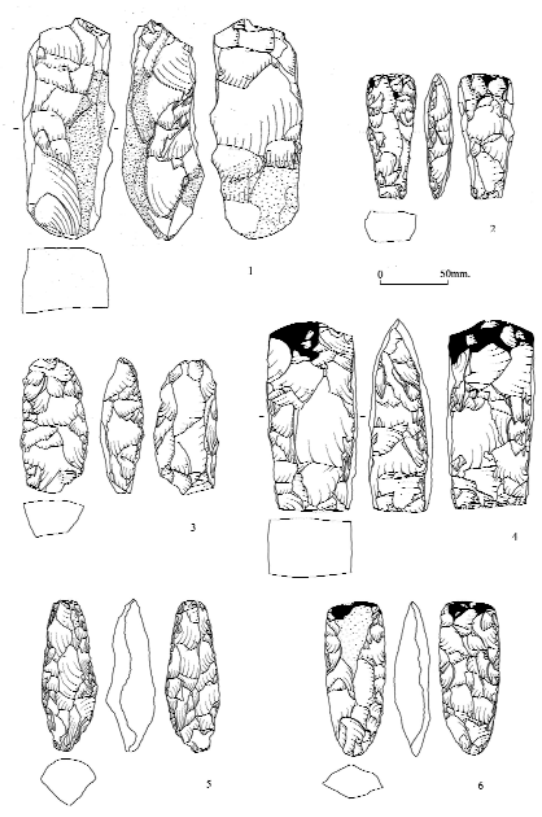

Fig.1 Various types of flint axes.

Neolithic Cores and Blades

The collection also includes two blade cores and some blades of the Neolithic type. All of them are of brownish flint with white-patinated surfaces, as are Paleolithic artefacts and flint axes.

One naviform core (Fig. 2: 1) is characterised by acute platform angles and trimming-flake scars on the core sides. Its technological features can be seen in the blade scarring patterns on the working face, which show the particular rhythm of blade removals characteristic to the PPNB blade industry. It, as well as some blades (Fig. 2: 2), indicates that the predetermined blades, in this case pointed central blades, were intentionally removed following the removals of a pair of blades from one striking platform and another pair of blades from the other platform. When compared with lithic industries in northwest Syria, such as at Tell el-Kerkh (Arimura 2003), this blade technology seems to belong to the Late PPNB to the early Pottery Neolithic. Although no formal tools are present in this collection, it is likely that this blade technology aimed to produce blanks for blade tools commonly seen in these periods, such as points, endscrapers or burins.

The other core, the most diagnostic piece in this collection in spite of a missing fragment, is a naviform core of the type originally defined by J. Cauvin (1968) as a core with a boat-like shape and a crested ridge running along its back (Fig. 2: 3). It has a narrow working face and well-prepared core sides forming a symmetrical

Table 1 Average dimensions of flint axes in the collection.

	length (mm)	edge width (mm)	body width (mm)	butt width (mm)	body thickness (mm)	butt thickness* (mm)	weight (g)
Large Rectangular	111,5	53,9	58,0	48,6	36,9	26,3	382,6
Small Rectangular	89,6	26,7	33,9	27,6	24,1	15,4	108,7
Plano-convex	98,0	29,3	42,3	22,3	27,8	14,9	118,8
Lenticular	95,1	36,7	37,7	18,1	23,3	10,2	96,0
Rhomboid	101,0	30,2	37,4	16,7	36,1	11,5	145,0
Roughout	161,3	-	62,8	-	53,0	-	778,0

*excluding tapered butts

shape. The blades that have been removed are quite narrow, around 15 mm wide. This type of "classic" naviform core is known from several sites from the central Levantine coast to the middle Euphrates valley, and most notably it has been reported from the recently excavated Early PPNB sites in Syria (Abbès 2003; Arimura 2002 n.d.). The blade scarring patterns of these cores show that this type of core was used to produce a particular type of predetermined blade, which is removed from one striking platform following the removals of a pair of long lateral blades from the other platform (Abbès 2003: Pl. 13).

It is worth noting that such a rhythm of blade removal and the narrower width of blade can be a chronological marker of the north Levantine Early PPNB, because they are clearly different from the naviform cores of later periods such as the one mentioned above (Fig. 2: 1-2). From the Middle to the Late PPNB onward, opposed-platform blade cores, including naviform cores, and blades produced from these cores become larger, possibly because of the exploitation of new outcrops of large flint nodules and the use of a new flaking method to produce predetermined blades. The cores and blades in this collection are additional evidence of such a change in the regional tradition of blade production.

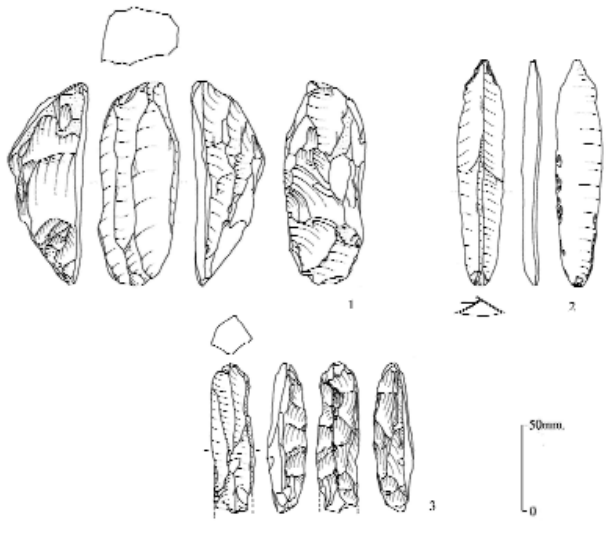

Fig.2 Naviform cores and blade.

Summary

The typological and technological features of all these artefacts makes it reasonable to think that they were possibly collected from a site in the northern or central-coastal Levant. Chronologically, the cores and blades in this collection seem to come from different periods between the Early PPNB and the early Pottery Neolithic. On the other hand, the flint axes in this collection could be from any period from the PPNB to the Chalcolithic. It is probable that the site was occupied for a long period as a lithic-production site[7] on or near rich flint resources.

As "rediscovered" from the storage of the museum, this collection of the flint artefacts should enrich our vision of the flint industry in the Levant, implying the presence of long-lasting lithic production site and the regional tradition of flint industry there.

Acknowledgements: We wish to express our gratitude to Mr. Bashir Shaabani and other staff of the Aleppo Museum for their support concerning this study. We also thank Dr. Elizabeth Healey for the correction of our English.

Notes

[1] High humidity in the storage in the basement also caused problems for the conservation of the collection.
[2] Although the numbers are missing for some pieces, similarities in raw materials and surface conditions indicate that all the pieces apparently belong to the same group of the collection.
[3] The Inventory Numbers were applied before the Museum Numbers were registered. Since the artefacts from the survey by Pervès in the 1940's bear the numbers between 2000 and 3000, the artefacts here seem to have been brought to the museum in much later ages (*cf.* Pervès 1946-48).
[4] The museum number is supposed to have been registered in the 1970s.
[5] Although such chipped flint tools are often divided into axes, adzes or chisels (*e.g.* Cauvin 1968; Barkai 2002) depending on the cutting edge width and its symmetry, there is no distinct typological boundary in the cutting edge of the tools in this collection. Thus, the term "axe" is used for all chipped and polished tools in this collection.
[6] Frank Hole (1959) has pointed out that "chipped and polished axes" occur in the region from northwest Syria to central Levant.
[7] It is comparable to Slenfe, a similar lithic-production site on the mountains west of the Ghab. The surface collection from Slenfe includes Paleolithic hand axes, Neolithic blade industries and Cananean blade cores (Cauvin 1968: 227; Arimura n.d.).

References

Abbès F.
2003 *Les outillages néolithiques en Syrie du Nord. Méthode de débitage et gestion laminaire durant le PPNB.* British Archaeological Reports, International Series 1150. Oxford: B.A.R.

Arimura M.
2002 Tell Ain el-Kerkh, site PPNB ancien dans le nord-ouest de la Syrie? Etude préliminaire du matériel lithique des couches les plus anciennes. *Orient-Express* 2002/4: 103-108.
2003 Chipped stone artefacts. In T. Iwasaki and A. Tsuneki (eds.), *Archaeology of the Rouj Basin: A Regional Study of the Transition from Village to City in Northwest Syria Vol. 1*: 57-97. Al-Shark 2. Tsukuba, University of Tsukuba.
n.d. The Lithic industry of the Early PPNB layers at Tell Ain el-Kerkh, Northwest Syria. In the publication for *the 5th International Workshop on PPN Chipped Stone Industries in the Near East*, Fréjus, March 2004.

Barkai R.
1999 Resharpening and Recycling of Flint Bifacial Tools from the Southern Levant Neolithic and Chalcolithic. *Proceedings of the Prehistoric Society* 65: 303-318.
2002 Towards a Methodology of Neolithic and Chalcolithic Bifacial Tool Analysis. *Neo-Lithics* 1/02: 3-8.
2003 The PPNC Bifacial Tool Industry from the Submerged Site of Atlit-Yam, Israel. *Eurasian Prehistory* 1(2): 139-162.

Cauvin J.
1968 *Les outillages néolithiques de Byblos et du littoral libanais (Fouilles de Byblos, IV)*. Paris: Libraire d'Amérique et d'Orient, Adrien Maisonneuve.

Contenson H. de
1992 *Préhistorie de Ras Shamra: Les sondages stratigraphiques de 1955 à 1976.* Ras Shamra-Ougarit VIII. Paris: Editions Recherche sur les Civilisations.

Copeland L.
2003 The Lithic Industries. In P. J. Parr (ed.), *Excavations at Arjoune, Syria.* British Archaeological Reports, International Series 1134: 71-151. Oxford: B.A.R.

Haidar-Boustani M.
2004 Flint Workshops of the Southern Beqa` Valley (Lebanon): Preliminary results from Qar`oun. In E. Peltenburg and A. Wasse (eds.), *Neolithic Revolution: New Perspectives on Southwest Asia in Light of Recent Discoveries on Cyprus:* 133-144. Levant Supplemetary Series 1. Oxford: Oxbow.

Hole F.
1959 A Reanalysis of Basal Tabbat al-Hammam, Syria. *Syria* 34: 149-183.

Iwasaki T. and Tsuneki A. (eds.)
2003 *Archaeology of the Rouj Basin: A Regional Study of the Transition from Village to City in Northwest Syria* Vol. 1. Al-Shark 2. Tsukuba: University of Tsukuba.

Pervès M.
1946-48 La Préhistoire de la Syrie et du Liban. *Syria* 25: 109-129.

Tsuneki A. et al.
1999 Third Preliminary Report of the Excavations at Tell el-Kerkh (1999), Northwestern Syria. *Bulletin of the Ancient Orient Museum* XX: 1-32.

Contribution

The Lithic Assemblage of Qidron: A Wadi Raba Site in Central Israel

Danny Rosenberg, Ron Shimelmitz and Edwin C. M. van den Brink
Tel Aviv University <Rosenberg@post.tau.ac.il; shimelmo@post.tau.ac.il>

Introduction

The site of Qidron (Khirbet el-Asfura) is located in the fields of Kibbutz Hafetz Haim, *c.* one kilometer southeast of Moshav Kidron, central Israel. The site is situated some 17 km east of the present Mediterranean Sea shore at an elevation of about 55 m above sea level. It is adjacent to the confluence of two small streams, the Timna and the Altake, and the larger Soreq stream. The site is attributed to the Wadi Raba culture (van den Brink and Rosenberg, in prep.), and it is situated *c.* 9 km northwest of the Late Neolithic site of Teluliot Batashi (Kaplan 1958b).

During 2003, an area of 170 x 250 m was probed and investigated, partly by mechanical means and in part by manual excavations. Apart from one location (Area 2, Loc.1) that was densely packed with archaeological material, only in one other area (Area 1, situated 70 m south of Loc.1) were remains of a possible stone-laid surface found. Even in this limited area, characterized by at least one pit, only dispersed flint and pottery scatters were exposed. The lithics of Area 2, Loc. 1 are the focus of this paper.

The Excavations

Anticipating the digging of a water purification reservoir, three test and salvage excavations were conducted at the site during 2003[1]. Preceding these excavations a preliminary test by mechanically dug trenches was performed revealing only scarce finds at most of the inspected area. In the first season, two areas 70 m apart were tested. In the southern area (1), a small expanse of horizontally laid, medium-sized pebbles was revealed as well as a small pit. These features yielded only sporadic finds attributable to the Wadi Raba culture[2]. The northern area (2) was only cursorily probed during this season.

During the following two seasons, eight probes (A-H) were made at various locations, aimed at mapping the site's perimeters. These too yielded only sporadic finds, mostly attributable to the Wadi Raba culture[3] (van den Brink and Rosenberg, in prep.). In addition, excavations at Areas 1 and 2 were resumed. At Area 1, only few pottery and flint items were found in association with the concentrations of pebble stones mentioned above. At Area 2, a large pit (Loc.1) was uncovered with an abundance of finds including pottery, flint, groundstone items

and animal bones (van den Brink and Rosenberg, in prep.).

The pit's outline first appeared 20-30 cm below the present surface. It is oval in shape (*c.* 5 x 4.5 m at ground level) and its estimated depth is 1.5-2 m (excavations were halted before reaching virgin soil). Excavation of a relatively small part of the pit (less then fifty percent of its total estimated volume) revealed that it had possibly two or three accumulation events, though this was noticed only in the southwestern part of the pit, marked by occasional alignments of small stones. The pit is characterized by dense deposits of animal bones, pottery and groundstone artifacts, as well as lithic waste and tools. All sediments were sifted through a 2 mm mesh, and in view of the homogenous nature of the sediment and the assemblages of the pit, the lithic finds will be presented below as one unit (Loc.1).

The Assemblage of Loc. 1

The lithic assemblage includes 812 items (Table 1). These were made from a variety of raw materials, mostly of low quality. The most common raw material is a non-homogeneous flint, characterized by whitish chalk lenses within a gray siliceous material. This raw material can be found in abundance in the vicinity of the site, appearing as large boulders (some reaching the size of ca. 0.5 x 0.5 m), usually with no cortex.

Primary element blades are rarer (n = 4, 0.8 % of the debitage and tools). This corresponds well with the scarce blade production at the site. In contrast to the 191 flakes (36.3 % of the debitage and tools), only 11 blades were found (2.1 % of the debitage and tools). There are only two complete blades, and they are very different from each other s (27 and 49 mm long). The bladelets (n = 12, 2.3 % of the debitage and tools) form two groups according to raw material and typology. The first (n = 7) includes items made of a semi-translucent, highly siliceous flint, brown to gray in color. These are characterized by scars of previous bladelet reduction, and most of them are curved. They represent a particular reduction sequence. The second group (n = 5) includes cruder bladelets, made of a variety of raw materials. These are assumed by-products of blade or flake reduction. In addition, two burin spalls were found.

Table 1 Loc. 1 Lithic assemblage.

Type	N	%
Primary Elements – Flakes	49	9.3
Primary Elements – Blades	4	0.8
Flakes	191	36.3
Blade	11	2.1
Bladelets	12	2.3
Core Trimming Elements	41	7.8
Cores	108	20.5
Tested Pebbles	8	1.5
Burin Spalls	2	0.4
Tools	100	19.0
Subtotal	526	100.0
Chunks	243	
Chips	43	
Total	812	

Core trimming elements (CTE) include 41 items (7.8 % of the debitage and tools). Amongst these are four core tablets as well as nine overshots. The latter lack any uniformity except for two overshots, which seem to relate to bladelet production. The crested blades (n = 6) present a similar picture. Three of them are roughly shaped by few blows only, while three others, of bladelet size, are better shaped and seem to belong to bladelet production. The CTE varia (n = 22) is the largest CTE group, and it seems to correlate with the opportunistic reduction of flakes that characterize this assemblage.

Flake reduction is the most prominent feature of the core technology at Qidron. Of the 108 cores found (20.5 % of the debitage and tools), 90 are flake cores (Fig. 1: a-b), one is a blade core, two are blade and flake cores (Fig. 1: c-d), 12 are bladelet cores (Fig. 1: e-f) and three are core fragments. Eight 'tested' pebbles (relatively large items having only one or two scars and with no clear striking platform) were also found in the pit (1.5 % of the debitage and tools).

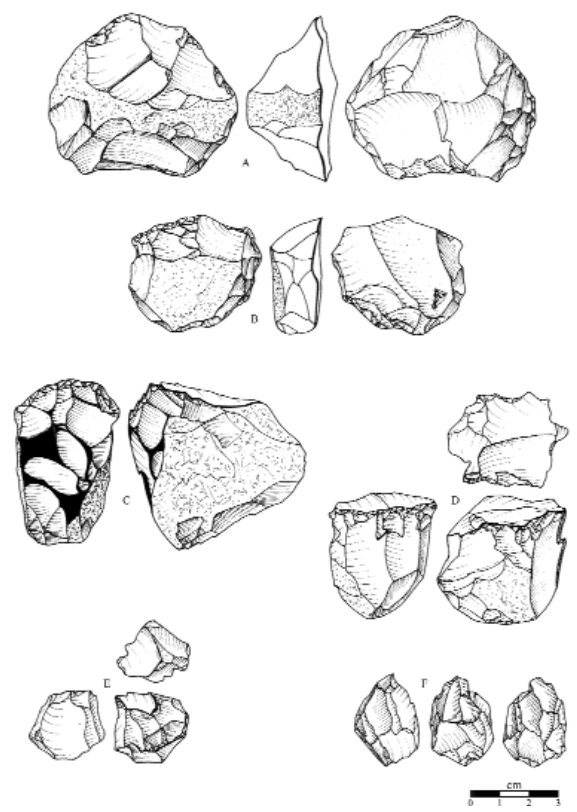

Fig. 1 Cores from Khirbet el-Asfura. Flake cores (a-b), flake and blade cores (c-d), bladelet cores (e-f).

Table 2 Loc. 1 tools.

Tool Type	N	%
Arrowheads	2	2
Sickle Blades	14	14
Bifacials	1	1
Burins	5	5
Retouched Flakes	26	26
Retouched Blades	2	2
Retouched Bladelets	5	5
Denticulates and Notches	20	20
Scrapers	9	9
Borers	1	1
Varia	9	9
Tool Fragments	6	6
Total	100	100

Flake cores were divided into three groups according to the number of striking platforms. Those with one striking platform (n = 48) form the largest group (their max. size varies between 30-80 mm). Of these, 14 have a semi-peripheral reduction pattern, seven are characterized by a narrow shape in which the reduction was concentrated at the narrow facet, and 28 are amorphous. Flake cores with two striking platforms (n = 27) are mostly amorphous, and only one is quasi-pyramidal. Their maximum size varies between 32-120 mm. Flake cores with three or more striking platforms (n = 15) are mostly amorphous; two are discoidals (their max. size varies between 37-80 mm). Two cores of the latter group were secondarily used as hammerstones.

Blade production is attested on three cores. One is a blade core with a single striking platform and two are blade and flake cores (with scars of both blades and flakes on their production surfaces). One of these has one striking platform and the second has two. One of the production surfaces of the latter core has been slightly polished (Fig. 1: c), probably the result of secondary use. It should be noted that this core has cortex at both lateral sides and it is not a recycled bifacial as known from some Neolithic and Chalcolithic sites (Barkai 1999). Both the blade core and the polished blade and flake core exploited the naturally narrow outline of the raw material, with no further preparations. Of the 12 bladelet cores, seven have one striking platform and five have two. All of these are exhausted and their maximum size varies between 22-36 mm. Of these, all but two are made from semi-translucent flint.

Tools (n = 100) constitute 12 % of the debitage and tools (Table 2), in which retouched flakes (n = 26) and denticulates (n = 20) predominate. In contrast to most of the tools in the assemblage, the denticulates are almost entirely shaped on the chalky, non-homogenous material.

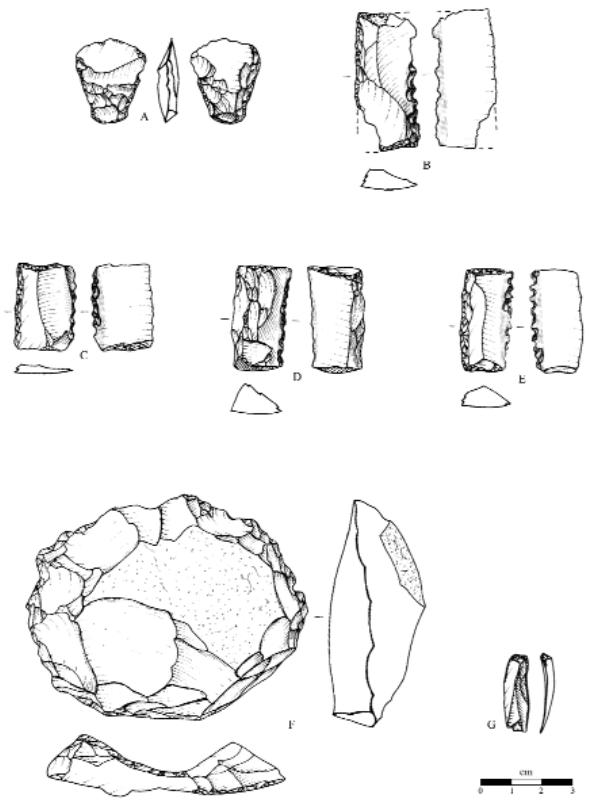

Fig. 2 Lithic artifacts from Khirbet el-Asfura. Transverse arrowhead (a), sickle blade (b-e), scraper (f), micro endscraper (g).

Two transverse arrowheads of two typological subgroups were retrieved from Loc.1. One is a wide axe-like transverse arrowhead shaped on a flake. It has a convex, sharp end and its lateral edges were bifacially retouched (Fig. 2: a). This arrowhead has close parallels in Kvish Harif (Rosen 1984: Fig. 6: 2-3, 9). The second is a narrow, elongated, broken arrowhead shaped on a blade. It bears similarities to the transverse arrowhead found at Nahal Zehora I (Barkai and Gopher 1999: 60, Fig. 10.1) and to two of the transverse arrowheads found at Kvish Harif (Rosen 1984: Fig. 6: 18-19).

Fourteen sickle blades were found (Fig. 2: b-e), most of which are whole (n = 12). Type terminology follows Gopher (1989). The sickle blades include type A (n = 2), C (n = 8), D (n = 3) and E (n = 1). The whole sickle blades range in length between 18-51 mm, with widths that range between 12-19 mm, and they are 4-11 mm thick.

As a group, the sickle blades are characterized by a retouched back, truncations, and a denticulated cutting edge. They are mostly rectangular, or in few examples, quasi-trapezoidal. Cross-sections are usually triangular or trapezoidal. The back is mostly abruptly (n = 8) or semi-abruptly (n = 4) retouched. In one example, the back was irregularly retouched and in another it is a natural back. In most cases, both ends were truncated. The cutting edge denticulation was characterized as fine (n = 1), medium (n = 10) or deep (n = 3). Only one sickle blade was shaped on a flake; the rest were made on blades

(all wider than 15 mm). Gloss was found on both ventral and dorsal sides but for a single exception, where it appeared on the ventral side only.

Only one bifacial rough-out was found made on cherty flint (maximum dimensions 68 x 41 x 23 mm). Five burins were found, and of the nine recovered scrapers, seven are endscrapers and two are sidescrapers (Fig. 2: f). Four of the end scrapers were also abruptly retouched along their lateral edges.

There are two retouched blades: one is a thick, inversely retouched blade, and the second is a thin blade, semi-abruptly retouched on one edge and bears some minor pressure-retouch on the other edge. Five retouched bladelets (microliths) were found as well. All are made of semi-translucent flint and have a fine retouch. Three of these are whole with a curved profile, and one is a micro-endscraper (Fig. 2: g).

In addition, one borer, six unidentified tool fragments, and nine tools catalogued as varia were found as well. One of the varia tools is a large flake bearing some rough knapping; it might be a massive chopper or a bifacial roughout. Another varia tool is an elongated flake with abrupt retouch all around its circumference, in which one end is pointed; this might have been used as a borer.

Discussion and Concluding Remarks

In general, the lithic technology of Qidron can be characterized as flake-oriented, as indicated by both blanks and cores. The reduction sequence seems to be opportunistic with no standardization – a phenomenon characterizing other Wadi Raba assemblages *(e.g.*, Barkai and Gopher 1999; Gopher 1989: 84). Nevertheless, a small-scale blade production was noticed, demonstrating a more organized reduction sequence as can be seen in the two blade cores and the sickle blades. It is interesting that the percentage of blade items among the tools[4] (including primary element blades, blades and bladelets) is higher than in the waste (22 % and 3.4 %, respectively). A minor blade production was also noted at some other Wadi Raba sites such as Munhata and Nahal Zehora I (Barkai and Gopher 1999: 45, Table 2; Gopher 1989: 86).

The fact that most of the sickle blades are of type C and only two are type A (Gopher 1989) corroborates the chrono-cultural attribution of the site to the Wadi Raba culture (van den Brink and Rosenberg n.d.). Type C sickle blades are known from other Wadi Raba sites such as Qiryat Ata; Nahal Zehora I; Tel Yosef; Jericho PNB; Munhata 2a, Tel Teo', Beisamun and possibly Kabri (Bankirer 2003: 172, 176; Barkai and Gopher 1999; Covello-Paran 1996: 68; Crowfoot-Payne 1983: 716, Fig. 343; Gopher 1989; Gopher and Rosen 2001: 53; Fig. 4.12.6; D. Rosenberg pers. obs.; Marder *et al.* 2002: 301; Fig. 7.3:5).

The systematic production of bladelets from semi-translucent flint is noteworthy since it is usually ascribed to Chalcolithic industries (Gilead 1984; Hermon 2003). Bladelet production was found at some other Wadi Raba sites (*e.g.*, Gopher 1989: 84); however, no connection to the Chalcolithic bladelet reduction was noted. Chalcolithic bladelet production can be characterized by the deliberate selection of raw material, and also by the typology of the secondary modification of these bladelets; the *fossile directeur* of this trajectory is the micro-endscraper (Gilead 1984). A single micro-endscraper was amongst the microliths found at Qidron, and notably it is made on the semi-translucent raw material. This would suggest that the use of semi-translucent flint for specific microlith production might have its roots in the Wadi Raba culture. Evidence for this was found in other Wadi Raba sites as well. In Nahal Zehora I, Barkai and Gopher (1999) remark that many of the cores in the 'small core' category are bladelet cores and that some were made from a semi-translucent flint. Gilead (1990) also notes that this phenomenon appears in sites from the early Chalcolithic, which he called the 'Besor Phase'.

The lithic assemblage of Loc. 1 (Area 2) at Qidron, a rather unusual feature of this unit, joins the meager number of lithic assemblages published to date of the Wadi Raba cultural entity. First defined in the 1950s (Kaplan 1958a), this entity is spread from the central Béqaa Valley in Lebanon in the north, to the Soreq Valley in Israel in the south (Gopher 1995; Gopher and Gophna 1993) where Qidron is one of the most southern manifestations of this entity.

Notes

[1] The first excavation season was directed by E.C.M. van den Brink on behalf of the Israel Antiquities Authority. The second and third seasons were directed by D. Rosenberg on behalf of the Israeli Center of Archaeology of Tel Aviv University and on behalf of the Israel Antiquities Authority respectively. Recently a fourth season was conducted, directed by E.C.M. van den Brink on behalf of the IAA. Excavation of Loc. 1 (Area 2) was completed during the fourth season and an additional seven pits were located and manually excavated in Areas 1 and 2 as well as in a newly probed Area 3, located *c.* 25 m north of the latter area. The very nature of pit Loc. 1 and five similar features dug in 2004, as well as the relationship between Areas 1 and 2 are now clarified. The final results of seasons 2003 and 2004 will, in due time, be published elsewhere (van den Brink and Rosenberg, in prep.). May it suffice here to state that based on *in situ* finds at the bottom of the larger pits, these pits appear to have been intentionally dug into the sterile alluvial soil to create semi-subterranean dwelling/living spaces. The pits originally were probably roofed over by a wickerwork of branches and twigs covered with mud (several pieces of hut loam were recovered during the excavations). These pits, used initially for domestic purposes must therefore be understood as being part of a settlement. After final abandonment of the site, the pits were left exposed to the elements of wind, rain and seasonal flooding, gradually being filled in with settlement debris (pottery, flints, ground stone items, spindle whorls, animal bones, shells, etc.), washed in from surface settlement debris accumulated over time in between the now-abandoned dwelling pits or huts.

[2] The material found also includes many non-diagnostic ceramic sherds (mostly plain body sherds) and flints.

[3] Also here many non-diagnostic ceramic sherds and flints were found.
[4] Tools shaped on blades include retouched blades, retouched bladelets, 13 sickle blades, one arrowhead and one burin – a total of 22 tools.

Acknowledgments: Excavations at Qidron were carried out at the request of Kibbutz Hafatz Haiem and with collaboration between the Israel Antiquities Authority and the Sonia and Marco Nadler Institute of Archaeology at the University of Tel Aviv through the Israeli Archaeological Association. We would like to thank the editors for their kind permission to add here, at the last minute, some additional details concerning the 2004 season. We would also like to thank A. Gopher and E. Orrelle for reviewing the manuscript and for their helpful suggestions. We thank I. Groman-Yeroslavski who worked with us at the field, R. Pinhas for making the drawings, and the people of the "500 project" of the Israel Antiquities Authority for working with us at Qidron.

References

Bankirer R.Y.
2003 The Flint Assemblage. In A. Golani (ed.), *Salvage Excavations at the Early Bronze Age Site of Qiryat Ata:* 171-182. Jerusalem: Israel Antiquities Authority Report 18.

Barkai R.
1999 Resharpening and Recycling of Flint Bifacial Tools from the Southern Levantine Neolithic and Chalcolithic. *Proceedings of the Prehistoric Society* 65: 303-318.

Barkai R. and Gopher A.
1999 The Last Neolithic Flint Industry: A Study of the Technology, Typology and Social Implications of the Lithic Assemblage from Nahal Zehora I, a Wadi Raba (Pottery Neolithic) Site in the Menashe Hills, Israel. *Journal of the Israel Prehistoric Society* 29: 41-122.

Covello-Paran K.
1996 Tel Yosef. *Hadashot Arkheologiyot* 106: 68 (in Hebrew).

Crowfoot-Payne J.
1983 The Flint Industry of Jericho. In K.M. Kenyon and T.M. Holland (eds.), *Excavations at Jericho V:* 622-759. Oxford: Oxford University Press.

Gilead, I.
1984 The Micro-Endscraper: A New Tool Type of the Chalcolithic Period. *Tel Aviv* 11: 3-10.

1990 The Neolithic-Chalcolithic Transition and the Qatifian of the Northern Negev and Sinai. *Levant* 22: 47-63.

Gopher A.
1989 *The Flint Assemblage of Munhata: Final Report.* Les Cahiers du Centre de Recherché Français de Jerusalem – 4. Paris: Association Paléorient.
1995 Early Pottery-Bearing Groups in Israel: The Pottery Neolithic Period. In T. E. Levy (ed.), *The Archaeology of Society in the Holy Land:* 205-225. London: Leicester University Press.

Gopher A. and Gophna R.
1993 Cultures of the Eight and Seventh Millennia BP in the Southern Levant: A Review for the 1990s. *Journal of World Prehistory* 7/3: 297-353.

Gopher A. and Rosen S.A.
2001 Lithics of Strata XIII-III, the Pre-Pottery Neolithic-Early Bronze Age. In: E. Eisenberg, A. Gopher and R. Greenberg (eds.), *Tel Teo – A Neolithic, Chalcolithic and Early Bronze Age Site in the Hula Valley:* 49-82. Jerusalem: Israel Antiquities Authority Reports 13.

Hermon S.
2003 *Socio-Economic Aspects of Chalcolithic (4500-3500 BC) Societies in the Levant: A Lithic Perspective.* Unpubl. Ph.D. Diss., Be'er Sheva: Ben-Gurion University.

Kaplan J.
1958a Excavations at Wadi Rabah. *Israel Exploration Journal* 8/3: 149-160.
1958b Excavation at Nahal Soreq. *Eretz Israel* 5: 9-24.

Marder O., Prausnitz M. W., Khalaily M. M. and Bankirer R. Y.
2002 Kabri 1975: The Flint Assemblage from Area A. In N. Scheftelowitz and R. Oren (eds.), *Tel Kabri – The 1986-1993 Excavation Seasons – Aharon Kampinski:* 299-306. Tel Aviv: Emery and Claire Yass Publication in Archaeology.

Rosen S.
1984 Kvish Harif: Preliminary Investigations at a Late Neolithic Site in the Central Negev. *Paléorient* 10/2: 111-121.

van den Brink E.C.M. and Rosenberg D.
in prep. *Qidron – Excavation of a Late Pottery Neolithic/Early Chalcolithic, Wadi Raba Site near Qidron, Israel.* Israel Antiquities Authority Reports.

New Website

Carsten Niebuhr Institute, University of Copenhagen: Shkârat Msaied Neolithic Excavation and Survey Project:
www.neolithic-shkaratmsaied.hum.ku.dk

PhD Dissertation Project: Environmental Impact Assessment: Modelling Subsistence Practices of PPNB – PN Transition

Dana Campbell
University of Liverpool <danac@liverpool.ac.uk>

Several years have passed since an argument proposed that localized ecological degradation may have been one result of potentially non-sustainable agricultural practices by members of the largest Levantine Late Pre-Pottery Neolithic B (LPPNB) communities (Rollefson and Köhler-Rollefson 1989). This proposal has been central to ongoing healthy debate regarding the causes and significance of comprehensive change that occurred with the LPPNB – Pottery Neolithic (PN) transition. Though extensively discussed, the theory has yet to be tested.

The primary aim of my Ph.D. research project is to evaluate the potential impact that particular subsistence strategies may or may not have had upon the ecology surrounding certain key communities; in effect, a more sophisticated and updated consideration of site catchment analyses. Collectively, the sites under evaluation represent a broad range of environmental circumstances, geomorphological setting, relative population levels, and varied subsistence economies. The analysis is informed by a combination of ethnographic research, the published results of specialized agricultural experimentation, and general ecological study; involving both relevant farming practice and technique, and those floral and faunal resources that excavation has demonstrated were likely exploited.

An innovative suite of ecological models, simulating natural and crop production, and livestock management, has been married to a GIS in order to both reconstruct the environmental circumstances in which these communities were established, and to model the impact that a series of potential economic scenarios may have had through time.

This project will not only serve to evaluate and systematically test one of the more ubiquitous theories relating to the end of the PPNB, but will allow a better understanding of both the potential impacts of the earliest mixed-agricultural communities on their environments, and of the significance of the transformation represented by the PPNB – PN transition.

If you have any comments, questions, or suggestions, please contact me at: danac@liverpool.ac.uk

Rollefson G.O. and Kohler-Rollefson I.
1989 The Collapse of Early Neolithic Settlements in the Southern Levant. In I. Hershkovitz (ed.), *People and Culture in Change: Proceedings of the Second Symposium on the Upper Palaeolithic, Mesolithic, and Neolithic Populations of Europe and the Mediterranean Basin:* 73-89. British Archaeological Reports, International Series 508(i). Oxford: B.A.R.

Byrd, Brian F.
Early Village Life at Beidha, Jordan: Neolithic spatial organisation and vernacular architecture. The Excavations of Mrs. Diana Kirkbride-Helbæk. Beidha Excavations no. 2. British Academy Monographs in Archaeology no. 14. Published for the Council for British Research in the Levant by Oxford University Press. 454 line drawings and photographs. (Due to appear early in 2005)

Abstract
This book explores the spatial organization and vernacular architecture of the Early Neolithic village of Beidha in southern Jordan. This is the second book on Beidha (the first volume focused on the earlier Natufian settlement) and it is a case study rigorously investigating changes in community organization associated with early sedentism and food production in Southwest Asia.

Diana Kirkbride-Helbæk's extensive fieldwork at Beidha yielded a considerable occupation span, extensive horizontal exposure, numerous excavated buildings with well preserved architecture and features, and a relative abundance of *in situ* artifacts. These broad horizontal excavations revealed a moderately sized early farming community dating to the middle of the Pre-Pottery Neolithic B period, primarily after 7000 BC.

The first three chapters of the book place the early village of Beidha within the context of the origins of sedentism and food production; provide an overview of the site and the excavations; and present the analytical approach and the methods used in this study, as well as the final phasing model for the history of the settlement.

The subsequent two chapters detail the stratigraphy and chronology of the early Neolithic village, and examine the built environment and architecture focusing on the construction, remodeling, and use life of individual buildings. The next two chapters explore by phase architectural patterning, continuity and change, and then community organization and the utilization of space. The book concludes with a broader consideration of emerging organizational trends expressed in the remarkable built environment of early Neolithic settlements in Southwest Asia.

The results reveal that the successful establishment of sedentary food-producing villages was marked by novel social and economic developments and the autonomization of households, and formalization of corporate bodies represented important trends during this transition. These two organizational trends then formed the foundation upon which later, more complex social constructions were built.

Barkai, Ran
Flint and Stone Axes as Cultural Markers: Socio-Economic Changes as Reflected in Holocene Flint Tool Industries of the Southern Levant. Studies in Early Near Eastern Production, Subsistence, and Environment 11. Berlin: ex oriente (in press).

Masthead

Addresses of Neo-Lithics

Submissions NEO-LITHICS, Prof. Dr. Gary O. Rollefson, Department of Anthropology, Whitman College, Walla Walla, WA 99362, USA. Email: rollefgo@whitman.edu
NEO-LITHICS, Dr. Hans Georg K. Gebel, Dr. Jürgen Baumgarten, ex oriente e.V., c/o Free University of Berlin, Hüttenweg 7, 14195 Berlin, Germany. Emails: baumgarten@mpib-berlin.mpg.de, hggebel@zedat.fu-berlin.de. Fax 0049 30 98 311 246 or 0049 30 83852106

Orders ex oriente e.V., c/o Free University of Berlin, Hüttenweg 7, 14195 Berlin, Germany
Email: ex-oriente@gmx.net. Fax 0049 30 98 311 246 or 0049 30 83852106

Deadlines twice a year: 15th of May and 15th of November

Submission Guidelines
Text formats: in WORD; text, bibliography and caption styles: cf. current issue of *Neo-Lithics*; illustration formats: high resolution eps, jpg, or tif.files – no illustrations embedded in the WORD text –, originals prefered (illustrations are required to the Berlin addresses, as well as hard copies of texts); please, keep bibliographic references to the utmost minimum necessary.

Subscription Information
In the upper right part of the address field (envelope) you will find the issue mentioned until which (included) you paid your subscription. If you find an invoice with this issue, a renewal of subscription is necessary for the next three years / 6 issues. If the invoice is not paid after two months it is understood that a prolongation of the subscription is not desired, and no further issues will be sent.

Neo-Lithics is published and distributed by ex oriente, Berlin,Germany

Printing House: Sievert Druck und Service, Bielefeld

Now available:

Basta I: The Human Ecology

edited by

Hans J. Nissen, Mujahed Muheisen & Hans Georg K. Gebel

with contributions by
Maria Thaís Crepaldi Affonso, Cornelia Becker, H.G.K. Gebel, Andreas Hauptmann, Bo Dahl Hermansen, Ulrich Kamp, M. Muheisen, Reinder Neef, H.J. Nissen, Ernst Pernicka & Nabil Qadi

bibliotheca neolithica Asiae meridionalis et occidentalis (2004) & Yarmouk University, Monograph of the Faculty of Arcaeology and Anthropology 4 (2004)
(with 10 specialist contributions, XV + 310 pages, 69 figures, 34 plates, 63 tables/ diagrams/ appendices, hardcover - 98 Euro)
[ISBN 3-9807578-0-3]

Contents:

Please order directly at:
ex oriente, Hüttenweg 7, 14195 Berlin, Germany
Fax 0049 30 8385-2106; Email ex-oriente@gmx.net
(25% discount on all books for ex oriente members)