NEO-LITHICS 1/11

The Newsletter of Southwest Asian Neolithic Research

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Editorial

Foreign Neolithic research, like other archaeological research, benefited for decades from the relatively stable conditions governments created in the countries we love. The projects enjoyed stability while privately we listened to the discontent of our workmen, our Arab friends and colleagues, the man on the street. We felt that we were witnesses to problems but behaved as guests should behave. Project interests ruled our sorrows and sympathies.

"Academic silence" continues, observes what's going on. Some not trusting the restoration of stability in their country of research started to evaluate chances in countries whose governments seem to offer more stable conditions. Shifts in Neolithic research foci may result as a consequence.

Neo-Lithics editorials have always tried not to be opportunistic, and to link our research with the problems in which it takes place. But this time it is most delicate to write the editorial. Thus, we prefer to translate the question of revolution into the Neolithic.

Revolutions, it seems, are sudden, powerful and rapid events. They sweep away old orders and frameworks. Unlike the Neolithic Revolution that took place over thousands of years, Neolithic social and economic implosions must be visible by chronological sharpness: Productive Neolithic frameworks required new types of societal stability and hierarchy, thus creating the conditions for new types of incubator milieus of social and economic overthrow whenever the balance was disturbed. It all started with the Neolithic …

In grief and deep respect we dedicate this issue of Neo-Lithics to our dear friend, colleague, and former director-general of the Jordanian Department of Antiquities, late Fawwas al-Kraysheh who passed away on July 29th.

Hans Georg K. Gebel & Gary Rollefson

A New Early Pre-Pottery Neolithic Site in Cyprus: Ayios Tychonas – *Klimonas* (*ca.* 8700 cal. BC)

Jean-Denis Vigne, François Briois, Antoine Zazzo, Isabelle Carrère, Julie Daujat, and Jean Guilaine

Abtract:
A trial trenching archaeological evaluation at *Klimonas* (Ayios Tychonas, Limassol, Cyprus) evidenced the presence of an open air archaeological site with abundant chipped stone and bone industry, and with well preserved animal bones, beads and pendants. The preserved site appeared to cover more than 700 m². The lithic material was characterized by a unidirectional blade debitage and small arrowheads corresponding to the PPNA tradition. The fauna comprised only two species of large mammals: a small dog (earliest attestation of a dog in Cyprus) and the small Cypriot wild boar which has already been evidenced in Cyprus previously, *ca.* 10,000-9,500 cal. BC. A series of radiocarbon dates from charcoal, burnt bone and tooth enamel indicate that at least one of the occupations dates to *ca.* 8,700 cal. BC. Together with Ayia Varvara – *Asprokremmos*, the radiocarbon dating being strictly contemporaneous, *Klimonas* moves back the earliest Cypriot Pre-Pottery Neolithic to the beginning of the 9th millennium, synchronous with the PPNA on the mainland, and *ca.* 500 years earlier than the earliest PPN occupation at *Shillourokambos*. Subsequently *Klimonas* is due to be further excavated.

Résumé:
Un diagnostique archéologique à *Klimonas* (Ayios Tychonas, Limassol, Chypre) a mis en évidence la présence d'un site archéologique de plein air, comportant une abondante industrie lithique et osseuse, ainsi que des restes fauniques et des parures bien conservés. Il semble que le site soit préservé sur plus de 700 m². L'industrie lithique, caractérisée par un débitage laminaire unipolaire et par des petites pointes de projectile, évoque une tradition PPNA. La grande faune ne comporte que deux espèces, un chien de petite taille (plus ancienne attestation du chien à Chypre) et le petit sanglier insulaire chypriote dont l'existence à Chypre a récemment été mise en évidence, entre 10 000 et 9500 cal. BC. Une série de datations radiométriques sur charbon de bois, os brûlé et émail dentaire indique qu'une des phases d'occupation au moins remonte aux alentours de 8700 cal. BC. Avec Ayia Varvara – *Asprokremmos*, dont les datations radiométriques sont strictement contemporaines, *Klimonas* amène à reculer le début du Néolithique précéramique chypriote jusque dans la première moitié du 9e millénaire, période contemporaine du PPNA continental, c'est-à-dire environ 500 ans avant la plus ancienne occupation précéramique de *Shillourokambos*. *Klimonas* fera l'objet d'une fouille extensive durant les prochaines années.

Key-Words: Cyprus, Pre-Pottery Neolithic, Chipped stone industry, Cypriot wild boar
Mots Clés: Chypre, Néolithique précéramique, Industrie lithique, Sanglier chypriote

Introduction

During the 1990's, several new archaeological sites pushed back the earliest Neolithic occupation of Cyprus from the 7th millennium BC[1] (Aceramic Neolithic of the Khirokitia phase) to the second half of the 9th millennium. Radiocarbon dates from *Shillourokambos* (early phase A; Guilaine *et al.* 2000, 2011; Guilaine 2003; Guilaine and Briois 2007) and from well 116 at Mylouthkia (Peltenburg *et al.* 2000, 2001), respectively, indicated that human groups were living in Cyprus from as early as 8500-8300 BC. Their flint industries were characterized by virtually typical PPNB bidirectional blade technology, the cultivation of cereals and the exploitation of large mammals (cattle, goat, pig) which, in most cases, had recently been introduced to Cyprus in the form of early domesticates. These societies of villagers developed in Cyprus throughout the 8th millennium with their material culture shifting towards the Khirokitia culture.

Several authors suspected that Cyprus was frequented before that time (Watkins 2004; Wasse 2007). However, until recently, evidence was missing for the presence of humans in the island between the occupations of the Epipaleolithic site of Akrotiri-*Aetokremnos*, *ca.* 10,500 BC, and these earliest Neolithic settlements, *i.e.* a 2000 year gap. Revision and dating of the limited series of suid bones of *Aetokremnos* recently demonstrated that small island wild boar were living in Cyprus *ca.* 9,700 BC, and could have survived during the 9th millennium as the only, but probably abundant, game for humans (Vigne *et al.* 2009, 2011). In addition, some discoveries of chipped stone assemblages with unidirectional blade knapping, closer to the PPNA or Early PPNB traditions (namely: Ayios Tychonas – *Throumbovounos*, Ayios Tychonas – *Klimonas*) (Briois *et al.* 2005: 42-47, 52-55; Guilaine and Briois 2007); Ayia Varvara – *Asprokremmos* (McCartney 1998; McCartney *et al.* 2006) than to the middle PPNB, suggested that the island might have been frequented at that time. All data, however, came from surveys lacking a well dated archaeological context.

Recent excavations at *Asprokremmos*, however, began to fill the gaps. At this open air site, McCartney and collaborators (McCartney *et al.* 2006, 2007, 2008, in press; McCartney 2010) discovered a semi-sub

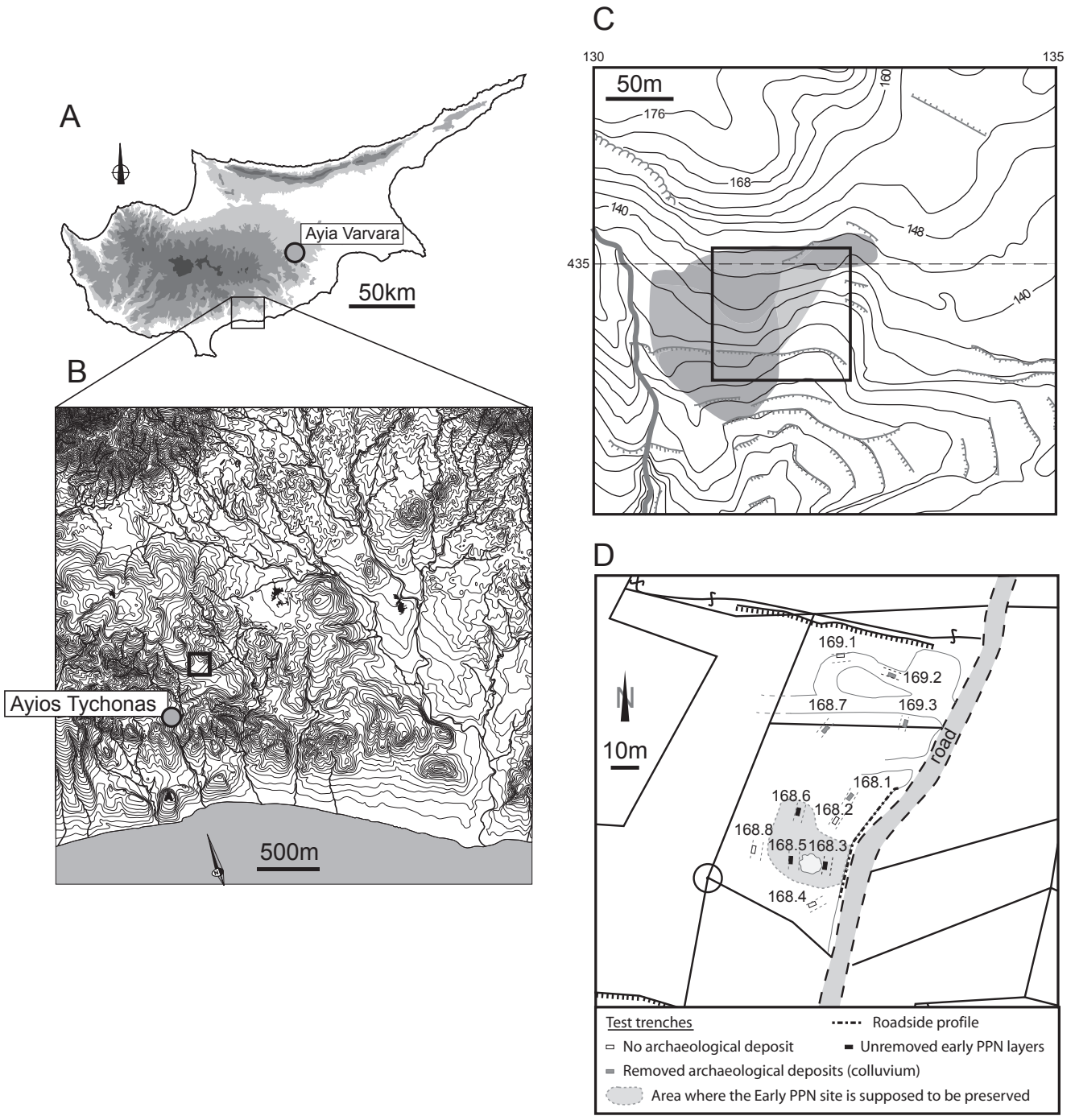

Fig. 1 Location of Ayios Tychonas-*Klimonas* and of Ayia Varvara-*Asprokremmos*: A in Cyprus, B in the Ayios Tychonas – Pyrgos area (drawing P. Devèze; contour lines equidistance 25 feet); C north-east to the old village of Ayios Tychonas with the location of the Pre-Pottery flints (grey) zone located by Briois *et al.* (2005)(contour lines equidistance 4 meters); D Location of the 11 trenches with reference to the plots (computer graphics P. Gerard (A), P. Devèze (B,C) & JDV (D)).

structure, postholes, channels and hearths associated with unidirectional knapped lithics, numerous lozenge points, calcareous bowls, picrolite and shell beads, a PPNA like shaft-straightener, a clay human head and rare and poorly preserved suid and bird bones. They interpreted this site as a hunter settlement. The overall range of dates of six charcoals were between 9,141 and 8,569 cal. BC, the consistency and similarity of the dates, however, allowed Manning *et al.* to model a shorter time interval of between 8,800 and 8,630 cal. BC (Manning *et al.* 2010).

Presented in this paper are the main results from a recent trial evaluation at *Klimonas*, a site which produced dating evidence from the first half of the 9th millennium, similar to that from *Asprokremmos*. This unique discovery brings together not only newly disco-

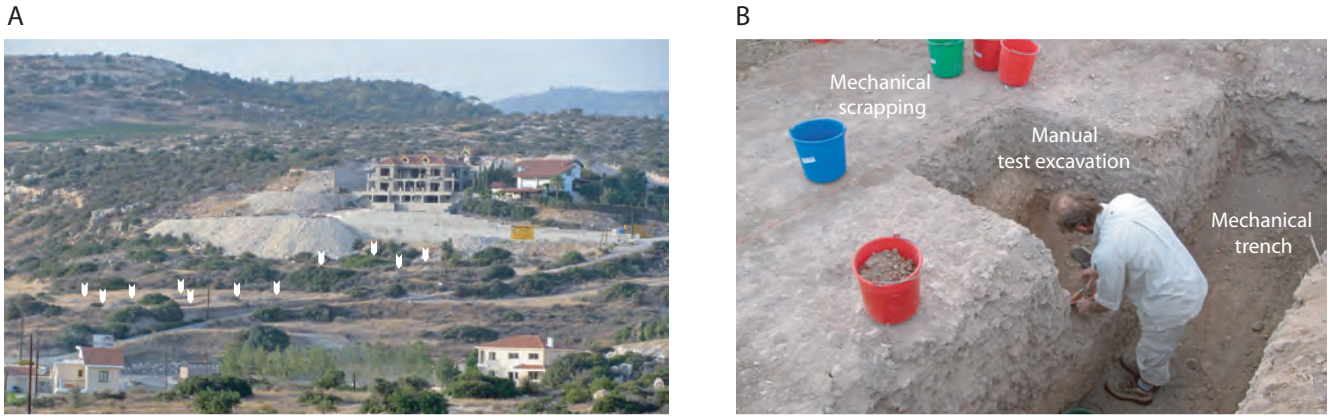

Fig. 2 Test excavation at *Klimonas*: A, the 11 trenches (white arrows); B, mechanical trenching and manual test excavation in Trench 168.5 (photos and computer graphics JDV).

vered information but also perspectives on the human groups which lived in Cyprus during the late PPNA and on their animal resources.

Survey Background; Aims and Protocol of the Archaeological Assessment

C. Petit-Aupert and collaborators detected the site of *Klimonas* in 1989, whilst carrying out a systematic survey of the Amathous region (Fig. 1). It is located between 135 and 145 m a.s.l., on a large terrace gently tilting to the south, less than 500 m east of the site of *Throumbovounos*, dominating both the Limassol plain and the Mediterranean Sea. Here surface surveys evidenced numerous flint scatter across a large area (8 plots; Fig. 1C). However, the main concentrations seemed to be located at two of these plots (168 and 169) which potentially represented the main unit of occupation. This impression was strengthened by the existence of a thick grey-brown layer in the profile adjoined to the road which contained a high density of anthropogenic flints (Briois *et al.* 2005: 42-47) .

Two periods were attested to by these surveys: (1) a very early Pre-Pottery Neolithic (with complete and fragmented rough or retouched blades, different kinds of angle burins and scrapers and two projectile points, type "Byblos points", with short tang); (2) a Neolithic occupation with Sotira potsherd aspects.

The trial evaluation conducted in October 2009 aimed to estimate the potential of the site primarily in order to ascertain if there were any undisturbed early PPN deposits. The general strategy consisted of a series of 11 trenches limited to two plots, 168 and 169, which were adjacent to the road profile where dense archaeological deposits were observed. The trenches were roughly arranged at the main cross points of three north-south lines and four east-west lines (Fig. 1D and Fig. 2A). A uniform approach to the excavation of each trench was adopted (Fig. 2B): (i) mechanical scrapping 2 m wide and *ca.* 5 m long down to the first archaeological layer, if any, otherwise to the bedrock; (ii) partial, 1 m wide, mechanical trenching of any archaeological layer down to the bedrock; (iii) manual test excavation of any archaeological layer found during mechanical scrapping.

Stratigraphic Observations

Roadside Profile (Fig. 3)

A natural north-south profile of plot 168 was created by the construction of the narrow road which adjoins its eastern limit (Fig. 2D). After rapid cleaning of this 48 m long profile we distinguished five groups of sedimentary layers (from bottom to top).

Sterile basal geological layers with PPN features (Fig. 3, layer 1 and feature A)
The basal geological layers were observed in the southern half of the profile. They lay on a bank of Havara-Kafkalla (1a) a calcrete which is known in Cyprus to date mostly to the Upper Pleistocene (Waters *et al.* 2009). They were composed of a series of three sterile colluvial layers: a light grey colluvium (1b), a light brown reddish silt with few stones (1c) and a whitish carbonated silt with very few stones (1d). A fire pit (A) which is most likely associated with the early Pre-Pottery Neolithic occupation of the site extended into 1b.

Sterile silt fillings of erosive gullies with Neolithic features (Fig. 3, layer 2 and feature B)
Fillings of erosive gullies with no archaeological material in them were cut by the profile more or less transversally, which indicated to at least three discordant erosive events. Such features were restricted to the southern half of the profile where they made incisions into 1a, 1b and 1c colluviums. Fillings were composed of a 35 cm thick series of greenish, reddish and light brown clayey silts (2a), eroded by 70 cm of carbonated silt lying on numerous rounded limestone blocks (2b), eroded further by more carbonated silt with numerous limestone blocks of various size (2c). Three thin lenses of light grey sediment (2d)

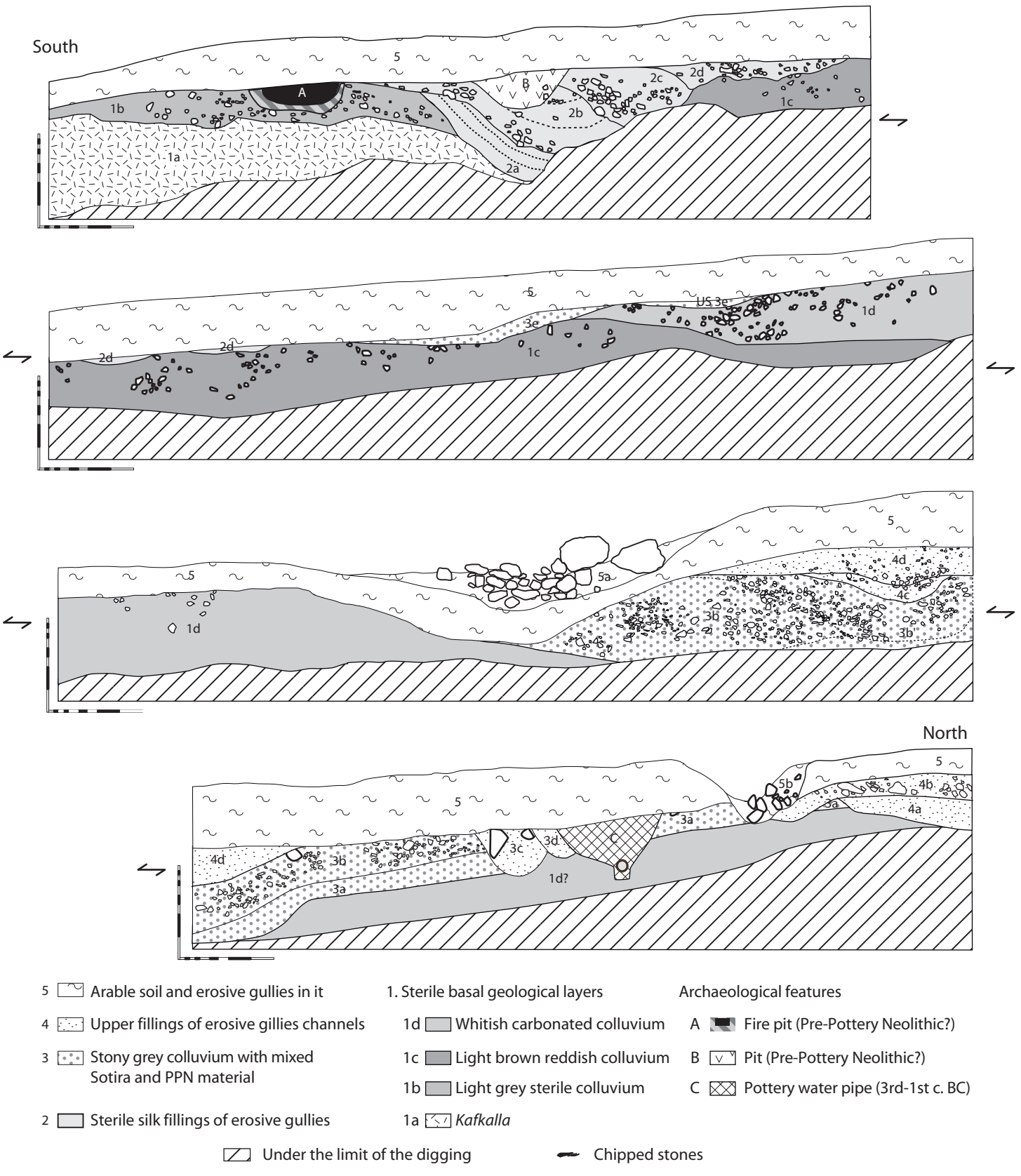

Fig. 3 *Klimonas* roadside profile from the south (top) to the north (bottom). (section drawing JG, IC, FB, JDV; computer graphics FB, JDV).

with some small stones but no obvious archaeological remains may be connected with these three erosive phases. Pit (B) had been (artificially?) excavated into these fillings at a later date. It was filled with a light, dusty, dark grey silt with some undated archaeological items which included a partially perforated thick cylinder fossil shell.

Stony grey colluvium with rich mixed Sotira and Pre-Pottery material (Fig. 3, layer 3 and feature C)
This sedimentary complex was composed of a basal homogenous silt layer with no stones (3a) lying directly on the sterile basal colluvium (1d) in almost all the upper third of the profile. Two small lenses of greyish silt with some small limestone blocks but no obvious archaeological material in them may be connected to the sedimentary complex. This basal layer had been eroded by one (3b) or perhaps two (3b) large gully channels refilled from the same grey colluvium which included mixed Sotira and Pre-Pottery remains, and numerous, rounded centimetre limestone blocks. At a later date this deposit had been locally eroded (3c and 3d). At the base of the historical trench (C), which cuts through 3d, 3a and 1d, pottery water pipes joined with mortar were observed and sampled. They have been dated from around the 1st to 3rd century BC by P. Aupert and C. Dieulafait. Though archaeologically sterile, two small lenses of stony grey silts (3e) may be connected to this sedimentary complex.

Upper fillings of erosive gully channels (Fig. 3, layer 4)
At least four more recent erosion channels, similar to 3c and 3d, had been filled with a more arable sediment which included small quantities of mixed Neolithic archaeological remains. Sediment 4b contained numerous shards of historical pottery.

Arable soil (Figure 3, layer 5)
The arable soil (0.4 to 0.7 m) still contained an abundance of archaeological items. Its lower limit was, however, rather abrupt suggesting that it was deposited on a naturally or artificially levelled surface. The arable soil had been cut by recent erosive gullies in two places which were emphasized in the profile by large stone accumulations (5a and 5b).

The roadside profile clearly evidenced that:
- The sedimentation of the terrace, plot 168, consisted of a succession of colluvial deposits and erosive events furrowed by numerous erosive gullies flowing towards the south-east.
- Though very rich the archaeological deposits located in the upper part of the plot (sediment 3) appeared to be the colluvial fillings of these erosive channels. All of them should be suspected to be disturbed.
- On the contrary, the archaeological deposits and features (A and perhaps B) settled on the colluvial and erosive fillings of the lower part of the plot (sediments 1 and 2) were much more liable to contain undisturbed archaeological features.

Sterile or disturbed trenches

The northernmost (169.1, 169.2; Fig. 1D) and southernmost (168.4, 168.8) trenches rapidly reached the bedrock, as did trench 168.2, with the other six providing archaeological deposits.

The two trenches located in the northern half of the site (168.7 and 169.3) revealed a one metre thick colluvial accumulation covering rich archaeological deposits, though without any pottery (PPN). However, the small amount of animal bones, the mixture of unidirectional and bidirectional flint blades and cores, the absence of any clear anthropogenic arrangement and the presence of several sedimentological features of erosion suggested that these deposits resulted from the filling of erosive channels by colluviums. Due to possible disturbance, therefore, they were not further exploited. Fifteen metres further to the south trench 168.1 provided a 1.7 m thick homogeneous layer, mixed from the top to the bottom, containing numerous animal bones (namely *Dama d. mesopotamica*), lithics and pottery sherds from the Late Neolithic (Sotira), as well as large quantities of unidirectional blades together with lozenge arrowheads (early PPN). This layer corresponded with sediment 3 of the road profile (Fig. 3) located less than 10 m away confirming that this deep erosive depression also resulted from the accumulation of colluviums.

Trench 168.3
Under 20-40 cm of arable soil and a truncated scrap of whitish carbonated colluvium trench 168.3 provided a rich, and apparently, undisturbed grey archaeological deposit (Fig. 4). It was 30 to 50 cm thick and lay on top of an old sterile colluvium which could be paralleled with the 1b/1c colluviums of the roadside profile (Fig. 3). The upper part of the archaeological layer provided numerous features and artefacts. In the middle of the profile an accumulation of small rounded limestone blocks indicated a potential pit. Whilst the lowermost 15 to 20 cm provided a particularly dense accumulation of flint flakes, blades and cores suggestive of a knap-

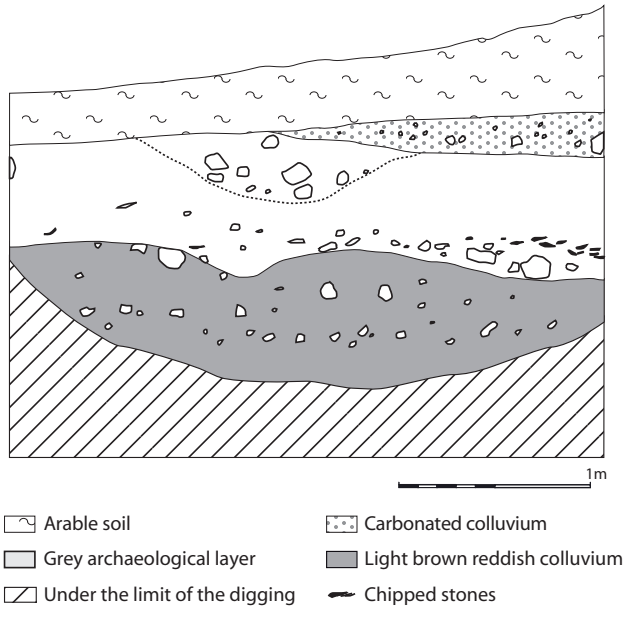

Fig. 4 *Klimonas*, Trench 168.3, western profile (section drawing FB; computer graphics FB, JDV).

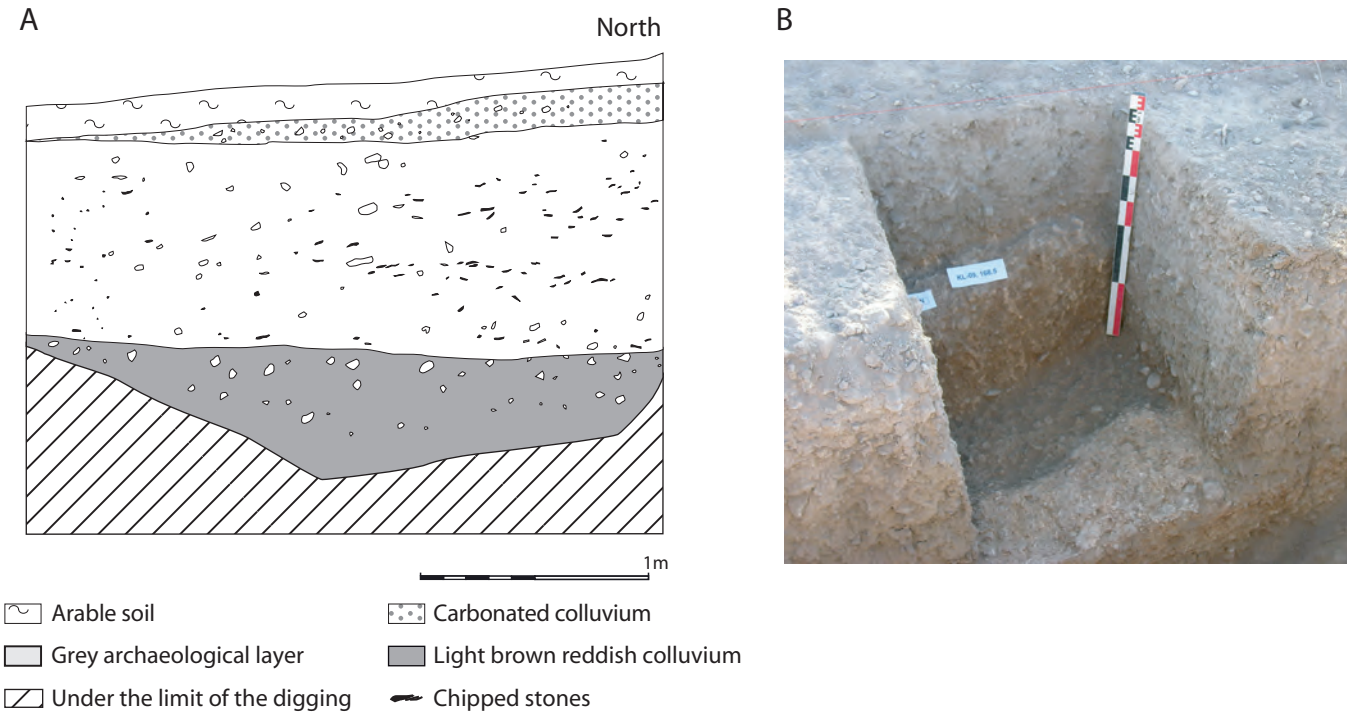

Fig. 5 *Klimonas*, Trench 168.5: A, western profile; B, manual test excavation with the archaeological feature at the bottom. (section drawing FB; picture JDV; computer graphics FB, JDV).

ping workshop. These were mixed with both well preserved animal bones and small limestone stones some of which were burnt. This basal flint deposit spread beyond the limits of the trench.

Trench 168.5

This 1.4 m deep trench evidenced a series of rich, undisturbed archaeological stratigraphic units lying on a probable archaeological feature (Fig. 5A).

Between 0 and -0.15 m: Heterogeneous compacted light-grey silt containing numerous flint remains (including an arrowhead) and some faunal remains. In the eastern part of the trench, a shallow (-0.2/-0.25 m deep) quadrangular pit with one historical potsherd indicated that this layer had been recently disturbed.

Between -0.15 and -0.3 m: Very compact light grey sediment with dense flint remains. Increase in animal bones. Some picrolite beads.

Between -0.3 and -0.45/0.5 m: The silt became more loose and turned from beige to ochre in colour against the eastern edge of the excavated square metre. It was still very rich in flint remains with numerous blades and an arrowhead at the bottom. Faunal remains were also more numerous and much larger. At -0.5 m, against the eastern profile, and at -0.57 m, the western limit of the trench, the filling abruptly turned to a more compacted fawn sediment. This very clear cut limit tilted slightly from east to west.

Between -0.55 and -0.6/-0.7 m: Grey silt with numerous rounded sandstones, abundant lithic material and faunal remains. This was actually a new stratigraphic unit differing greatly from the upper fillings. On the eastern limit of the test excavation this stratigraphic unit lay on a brown-yellow stony and gravely compacted sediment; the substratum colluvium (1b/1c).

Between -0.7 and -0.95 m: Further grey silt in the main part of the excavated surface, except against the eastern profile, where it met the sub-vertical limit of the substratum colluvium. At -0.95 m the excavation met the substratum in the western half of the sondage to form a well flattened surface (Fig. 5B).

Between -0.95 and 1.15 m: A channel, 30 to 40 cm wide and 2 cm deep, with an asymmetric section was excavated running alongside the vertical wall of the substratum. The filling was composed of grey silt and was rich in lithics.

The bottom of this test excavation evidenced an archaeological feature dug at the expense of the substratum (here a colluvium) with a right angled floor and wall, the latter being lined by a channel.

Trench 168.6

No manual excavation was performed in this trench, however, the mechanical digging extracted numerous archaeological items and evidenced a sedimentological succession similar to the ones observed in trenches 168.3 and 5. Beneath 15 to 20 cm of arable soil lay a grey layer with numerous rounded centimetric and decimetric limestone blocks and flint. These probable stratigraphic units lay themselves on a grey-greenish colluvium with large limestone blocks which followed a potentionally unnatural, irregular topography. This trench also attested to a dense early Pre-Pottery Neolithic archaeological layer present 17 m north of trench 168.5.

Conclusion: Delimitation of the Preserved Part of the PPN Site

The road profile and the 11 trenches gave complementary information which indicated that the terrace, on which the site is situated, is at least partly due to a thick deposit of Upper Pleistocene Havara-Kafkallah, in its lower part, on which lie a series of Late Pleistocene/Early Holocene colluvial layers. On the shoulder created by the Havara, the colluvium was eroded and no further archaeological deposits were preserved (trenches 168.4 and 168.8). Both the northern half of the road profile and the 6 trenches of the northern half of the site indicated that the upper part of the terrace had been furrowed several times during the Holocene by erosive channels ten centimetres to one meter deep running from WNW to ESE. They had been filled by colluvial deposits removing archaeological material from different Neolithic periods[2]. Conversely, the remaining trenches (168.3, 168.5 and 168.6) provided archaeological features or undisturbed and chronologically homogeneous archaeological Early Pre-Pottery deposits. The part of the site that survives, covering almost 700 m², could therefore be delimited (Fig. 1D).

Flint Industries (FB)

The lithic material collected during the 2009 sounding season came mainly from trenches 1, 3, 5 and 7 of plot 168, which together provided an important series. Presented here is the material from trenches 168.3 and 168.5, the most undisturbed and homogeneous of the pre-pottery Neolithic lithic assemblages.

This industry was characterised by the almost sole use of translucent flint. The types of flint represented

	N	%
Burins	140	36.6
Retouched Flakes	60	15.7
End scrapers	47	12.3
Retouched Blades	34	8.9
Clactonian notches	33	8.6
Projectile points	24	6.3
Retouched notches	10	2.6
Denticulates	8	2.1
Awls/Borers	**6**	1.6
Pointed blades	5	1.3
Truncations	5	1.3
Scrapers	**3**	0.8
Backed blades	**3**	0.8
Blades with gloss	**2**	ß.5
Pièces esquillées	**1**	0.3
Notches on blade	**1**	0.3
Blades with tang	**1**	0.3
Total	**383**	

Table 1 Tool distribution from trenches 168.3 and 168.5.

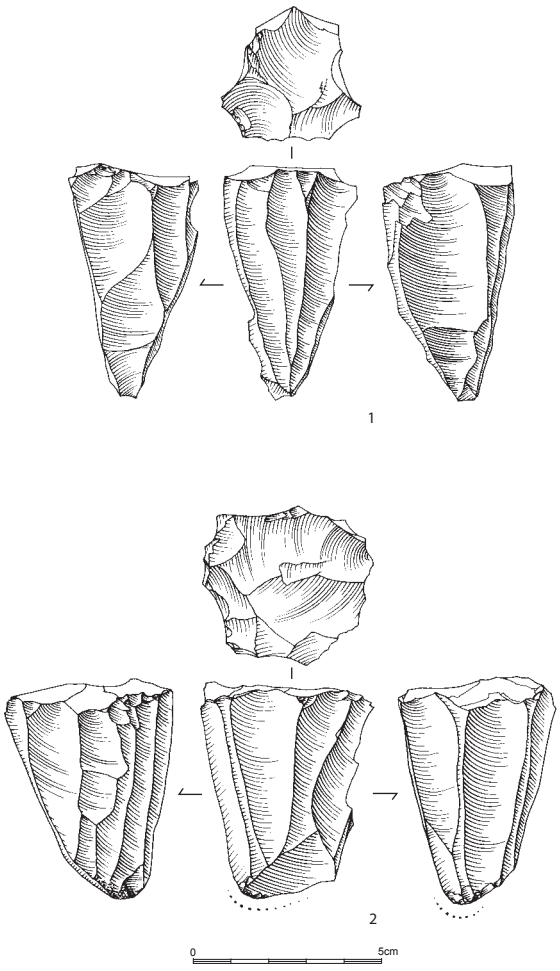

Fig. 6 *Klimonas*, Trench 168.3. Unipolar blade cores (drawing FB).

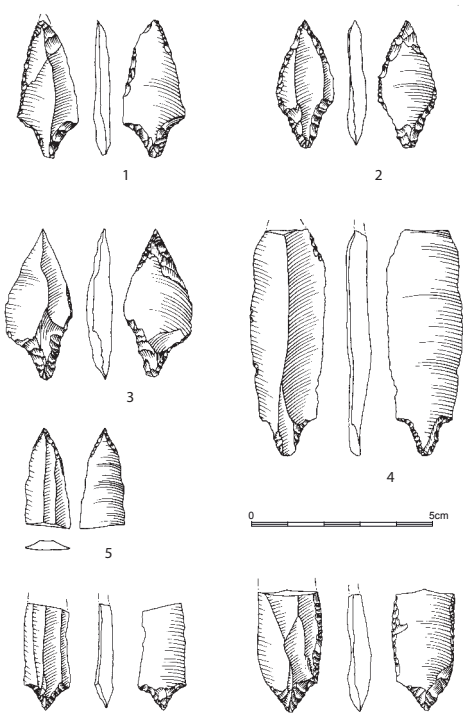

Fig. 7 Trenches 168.5 and 168.3. Projectile points and fragments (Drawing FB)

(blonde, brown, red-brown, green and grey) were similar to those used during the early phase at *Shillourokambos* (Briois 2003). This material, the source of which is located in *Athiaki*, a few hundred metres northwest of the site (Briois *et al.* 2005: 114 ff), is easily accessible in the slope deposits and in the bottom of the valleys located north to the modern village of Ayios Tychonas.

Numerous waste pieces, sometimes in heaps (168.3), testified to intense knapping activities on the site itself. The flint waste was largely dominated by flakes; however, the main part of the production was clearly oriented towards blades emanating from flint cores which were shaped on the site itself. Blade production appeared to have been exclusively unidirectional and aimed to produce small triangular blades of 4-5 cm long with a rectilinear profile. Larger blades were also present with some of them corresponding to the beginning of the preparation of the cores (cortical blades, semi-cortical blades or rough crested blades) themselves. Butts were mostly smooth but there were also facetted convex butts. Blade cores were represented by twenty examples or so though only in trench 168.3. They were conical and unidirectional and show a striking platform made by flat centripetal removals (Fig. 6). Many of them were abandoned seemingly after an extreme decrease in size, or following a succession of knapping accidents (hinged or plunging) which made them unusable; much rarer examples show evidence of reshaping of the active surface starting from the opposite striking platform.

The rich set of tools (383 specimens: 315 from 168.5 and 68 from 168.3) comprised numerous burins (36.6 %), end-scrappers (12.3 %), clactonian notches (8.6 %), and arrowheads (6.3 %) (Table 1). The burins were mainly burins on a breake though some dihedral burins and burins on a truncation were also attested. The scrapers were mostly reused blades, several of which were broad and/or thick.

A total of 24 arrowheads were excavated. Most were small with triangular bases or with a short tang made by bifacial oblique retouches (Fig. 7). The opposite extremity showed evidence of direct marginal retouches only, and unusually by inverse, skimmed and peeled retouches. Among ten remarkable specimens of blades a large blade with bilateral retouches (23 cm) was particularly significant. Only two blades showed a longitudinal gloss due to use.

Detailed analyses of the flint material from *Klimonas* confirmed the existence of the special lithic feature observed during the initial surveys (Briois *et al.* 2005). The material collected here presented many similarities with that collected at Ayia Varvara – *Asprokremmos* (McCartney *et al.* 2006, 2007, 2008, in press; McCartney 2010, 2011; Manning *et al.* 2010) .

Beads, Pendants and Bone Industry (JG, JDV)

Bone, shell and rock artefacts were plentiful for such a small excavated area. Trench 168.3 provided a suid tibia with two parallel grooves, made with a flint burin, on either side of the tibia crest in order to extract a long bone stick, however, the bone probably broke during the process and was abandoned (Fig. 8D). Trench 168.5 also provided evidence of bone industry in the form of the proximal extremity of a large bird's humerus sawn distally for extracting a bone cylinder, a polished blade of enamel from a male suid lower canine, a section of a polished bone needle, and a small polished long bone blade. Three rather large (0.12 to 2 cm) stone beads (discoid, oblong and keg-shaped) made from a light green picrolite also came from trench 168.5. Eight specimens evidenced the use of sea-shells for pendants and beads; three of them were small portions of polished *Dentalium* cf. *inaequicostatum*; three others were small *Turritella* sp. shells (0.24; 0.26 and 0.24 cm) with a perforation on the last turn made by sawing the shell, one of the holes shows clear wear due to suspension (Fig. 8B); a portion of a cylinder bead (2.5 x 1 cm) made from polished sea-shell and an apparently unworked fragment of a *Glycymeris* sp. seemingly cropped on the beach after the death of the animal.

		168.3 (0.15 m²)		168.5 (1 m²)		Total			
		NISP	Weight (g)	NISP	Weight (g)	NISP	%	Weight (g)	%
Fresh water tortoise	Cf. *Mauremys rivulata*			1	2	1	0.4	2	0.2
Bird	Aves			11	11	11	4.6	11	1.0
Unidentified carnivore	Carnivora	1	1	1	0	2	0.8	1	0.1
Domestic dog	*Canis familiaris*			2	1	2	0.8	1	0.1
Small wild boar	*Sus scrofa* ssp.	41	279	182	792	223	93.3	1071	98.6
Total identified		42	280	197	806	239	100.0	1086	100.0
Unidentified small vertebrate		2	1	18	6	20		7	
Unidentified large mammal		52	102	296	358	348		460	
Unidentified vertebrate				16	6	16		6	
Total unidentified		54	103	330	370	384	61.6	473	30.3
Total		96	383	527	1176	623		1559	
Burnt bones		4		26					

Table 2 Faunal spectra of the trenches 168.3 and 168.5 (NISP, Number of Identified Specimens).

Animal Remains (JDV)

Five trenches provided a total of 976 faunal remains (168.1, 168.3, 168.5, 168.7 and 169.3) though 64 % of them (84.1 % of determinate specimens) came from trenches 168.3 and 168.5, where bones were also less fragmented. Bones were generally well preserved with few of them showing significant root or chemical soil attacks, quite unlike the faunal material at *Asprokremmos* which was badly eroded (McCartney *et al.* 2011). They were covered with a thin manganese sheen and then with a millimetric carbonated crust. Numerous long bone diaphyses showed clear features of percussion of the fresh bone for marrow consumption. All were food refuse.

In trenches 168.3 and 168.5 only eight molluscs were represented (see above), and 38.4 % of the 623 vertebrate specimens *i.e.* 239 specimens (Table 2) were able to be determined. The average density of bone remains could be estimated from *ca.* 44 (168.5) to *ca.* 200 specimens/m²/10 cm. The most striking feature was the rather low taxonomic diversity: a freshwater tortoise, probably the Balkan terrapin (cf. *Mauremys rivulata*, already mentioned at *Shillourokambos* and *Ayia-Varvara* and still living in Cyprus (Vigne 2011; Vigne *et al.* in press), some medium and large size birds of undeterminable species (long bone diaphyses), the domestic dog (*Canis familiaris*), and a small suid (*Sus scrofa* ssp.).

The domestic dog was represented solely by a portion of lumbar vertebra and the distal half of a first phalanx (Fig. 8A) both pieces coming from the lowest layers of trench 168.5. Two other bones of carnivore (fragment of thoracic vertebra from trench 168.3 and a fragment of squamosal) could potentially have belonged to a dog. The presence of this species was also evidenced by three digested phalanges (Fig. 8C) and by intensive gnawing of the suid bones, long bone epiphyses being virtually absent. This situation was completely different from *Shillourokambos* (early phase B onwards) where dog remains were scarce and bone extremities well preserved (Vigne and Guilaine 2004).

Dog bones at *Klimonas* were small in size, like the ones which were associated, but not stratigraphically reliable, to the early phase A at *Shillourokambos* (Vigne 2011).

Suids represented 93.3 % of the NISP an overwhelming domination very similar to the early A phase at *Shillourokambos* (Vigne *et al.* 2003; Vigne *et al.* 2011). However, here suids were the only ungulate species in the pure Pre-Pottery layers of trenches 168.3 and 168.5[3]. The bone sample is large enough to conclude that the absence of goat is statistically significant (z test=5.8, $p=2.10^{-9}$ with reference to *Shillourokambos* early A).

All the skeletal parts of suids were represented though it seems that the rear skulls (including the molars; see, however, Figs. 8E-H) were in deficit. In trench 168.5 first upper and lower incisors gave the MNI (5 to 6). All age classes were represented but it was impossible at this time to determine between suid

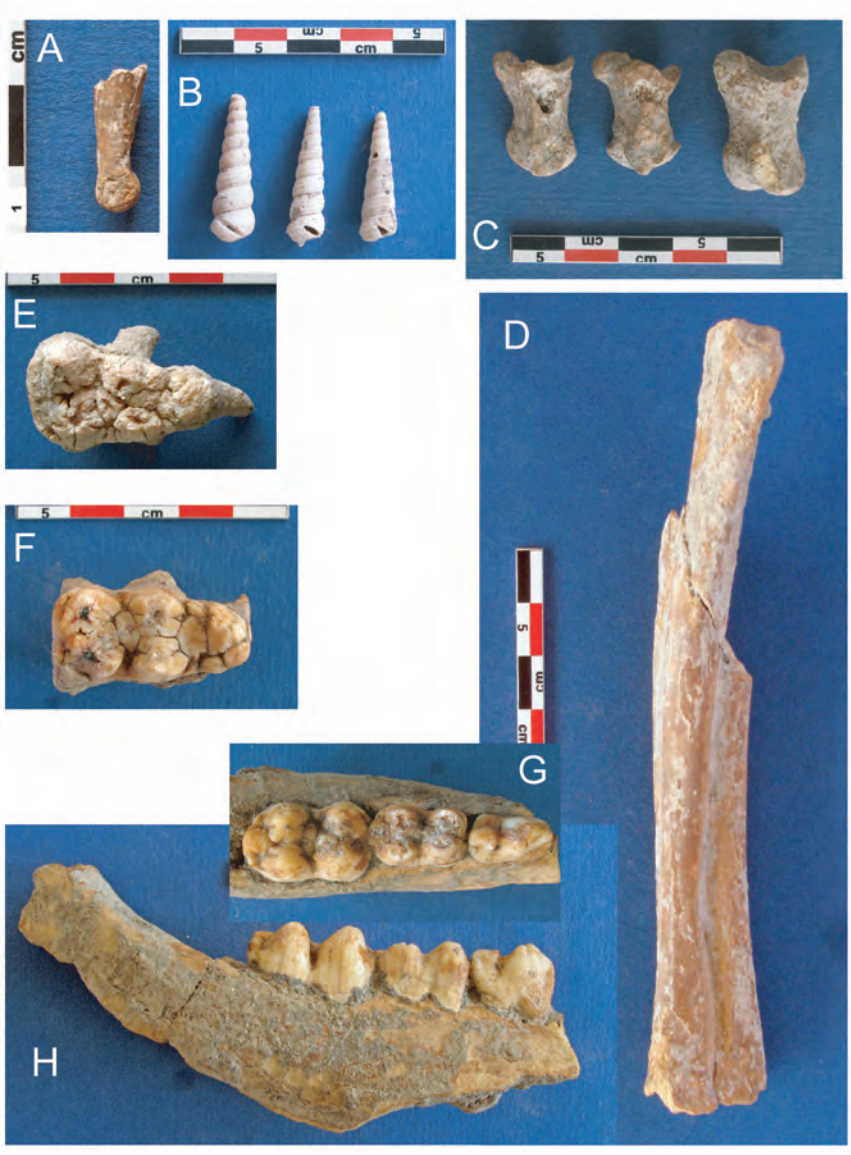

Fig. 9 Some archaeozoological remains from *Klimonas*: A, first phalanx of a small adult domestic dog (lateral view); B, three *Turritella* sp. shells holed on their last turn; C, suid second phalanges, the two on the right with heavy digestion marks; D, cranial view of the suid left tibia with parallel grooves for extracting a bone stick; E, occlusal view of a right upper third molar of suid; F, occlusal view of a right lower third molar of suid; G, occlusal view of a right suid mandible; H, lateral view of the same portion of mandible (same scale; photos and computer graphics JDV).

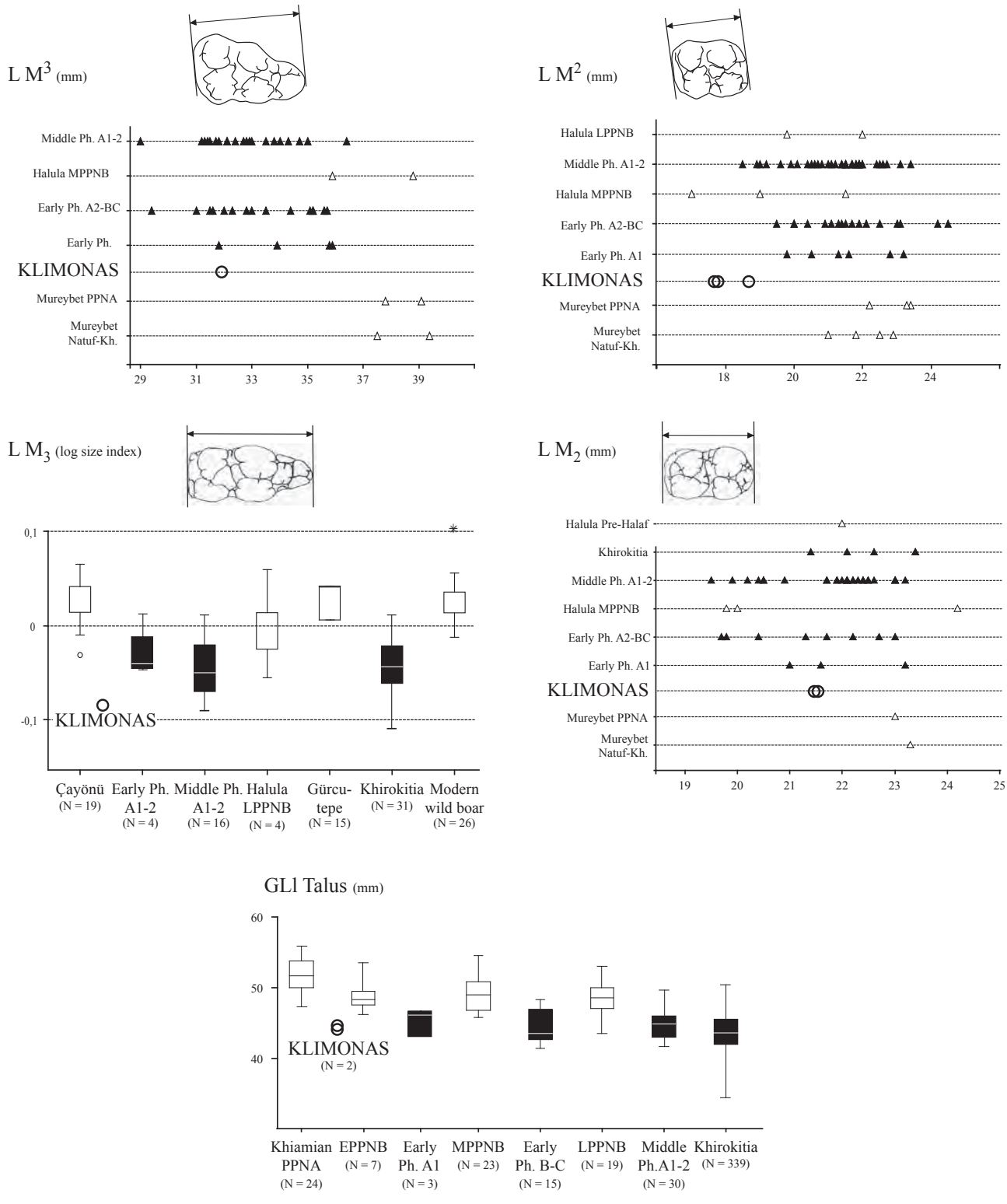

Fig. 10 Comparisons of some of the measurements of the suids of *Klimonas* with pre-Neolithic and pre-pottery Neolithic sites of the Near East mainland. Measurements were taken according to von den Driesch (1976). Early/Middle Ph., Phases of *Shillourokambos*, after Guilaine *et al.* 2011; PPN, Pre-Pottery Neolithic, after Davis (1994, Khirokitia), Gourichon and Helmer (pers. comm. and 2008; Mureybet), Helmer (pers. comm.; PPNB for talus), Peters *et al.* (2005, Figure 12 ; Çayönü, Gürcü Tepe, modern wild boar), Saña Segui (1999; Halula). For M/3, log size indexes were calculated with reference to the average length of the Israel wild boar (after Davis 1984), *i.e.* 38.5 mm; the 25-75 percent quartiles are drawn using a box, the median is shown with a horizontal line inside the box, and the minimal and maximal values are shown with short horizontal lines.Cyprus data are represented by solid black icons (excepted for *Klimonas*), whereas the mainland data are figured by empty icons.

hunting or breeding.

Fourteen measurements were taken from bones or teeth found in reliable archaeological layers. Preliminary observations (Fig. 10) indicate that these suids were very small in size, and comparable to one of the endemic small wild boar at Akrotiri-*Aetokremnos* (Vigne *et al.* 2009) and the suids of early phase A at *Shillourokambos*.

Rodents were not represented but their presence was attested to by the gnawing marks on a bone from the lower layer of trench 168.5. The only candidate species was the mouse either the endemic Cypriot mouse (*Mus cypriacus*) or, maybe, the grey mouse (*Mus m. domesticus*). The latter species, however, is not confirmable prior to 8500-8400 BC (well 116 at Kissonerga-*Mylouthkia)* (Cucchi *et al.* 2002).

The evolution of faunal density remains, from the filling of trench 168.5, suggested two different layers, at least, with a lower density peak *ca.* -90 cm and a second more important one *ca.* -40 cm.

Radiocarbon Dating (AZ)

Klimonas produced the most abundant material for radiocarbon dating in the form of suid bones, and as dating the remains from hunted animals was also the most direct way to date human presence here we decided to focus on bones in this area. Collagen, when preserved, is the most reliable support for bone radiocarbon dating. Unfortunately climatic conditions did not favour bone collagen preservation in *Klimonas*, a similar situation also occurred in *Aetokremnos* (Vigne *et al.* 2009). Other fractions, however, can be dated; either organic (decomposed collagen from burnt bones) or mineral (biogenic carbonate present in bone, tooth enamel and dentine apatite, as well as in calcined bone apatite) but they cannot be considered a priori immune to contamination or isotope exchange with the burial environment. An indirect way of checking for sample contamination consists of dating different bone fractions from the same individual (Zazzo and Saliège 2011). The underlying assumption behind the convergence criterion is that it is highly improbable that contamination would cause the same error in different fractions. A contrario, concordance in the ^{14}C dates obtained on different fractions of the same bone provides strong evidence of the accuracy of the dates inferences.

In total two suid bones from trench 168.3, six bones and teeth from 168.5, and one charcoal (coming from a small branch of *Prunus* sp. determination Stéphanie Thiébault, CNRS) were selected for radiocarbon dating with the majority of dates being obtained from burned bones.

When bones are burned at low temperature (*ca.* 300°C) collagen decomposes and reduced carbon becomes trapped in its mineral (apatite) structure. This organic carbon can be extracted following an acid-alkali-acid pre-treatment, similar to the protocol used for charcoal. Unfortunately humic and fulvic acids can also become trapped in the porosity of the bone during diagenesis and this foreign carbon may not be completely removed during the alkali wash. Unlike with collagen there is no biochemical test for checking the integrity of the decomposed collagen other than the coherence of the date itself. Therefore in order to monitor possible contamination we dated both the alkali insoluble and the alkali soluble fraction when possible.

Three teeth of different suid individuals were also selected for dating. Enamel is the material of choice for stable isotope analysis as its high crystallinity and low porosity makes it resistant to diagenetic alteration.

Designation	Stratigraphic position	Fraction dated	Pre-treatment*	Extraction **	% C	$\delta^{13}C$ (‰. VPDB)	Radiocarbon age (BP)	Reference	Calibrated age BC			
									1 σ (68.2 %)		2 σ (95.4 %)	
									from	to	from	to
Trench 168-3												
KL09-1 burnt bone	n.a. (sieved)	insoluble	1	A	25.0	-24.3	9200 ± 52	AA88544	8466	8312	8551	8296
KL09-2 burnt bone	n.a. (sieved)	alkali soluble	1	A	41.4	-25.1	9087 ± 70	AA88547	8423	8236	8544	8014
KL09-2 burnt bone	n.a. (sieved)	insoluble	1	A	45.3	-24.0	9122 ± 63	AA88545	8431	8274	8537	8243
KL09-2 burnt bone	n.a. (sieved)	alkali soluble	1	A	40.2	-24.8	8966 ± 52	AA88548	8274	7998	8282	7967
Trench 168-5												
KL09-3 burnt bone	15/30 cm	insoluble	1	A	22.3	-25.6	8852 ± 51	AA88546	8203	7848	8221	7787
KL09-3 burnt bone	15/30 cm	alkali soluble	1	A	36.7	-25.8	8831 ± 55	AA88549	8175	7793	8210	7747
KL09-4 tooth enamel	30/55 cm	bioapatite	2	B	0.9	-12.7	7741 ± 46	AA88541	6627	6506	6645	6477
KL09-5 tooth enamel	30/55 cm	bioapatite	2	B	1.0	-12.5	7716 ± 47	AA88542	6595	6496	6637	6469
KL09-5R tooth root	30/55 cm	bioapatite	2	B	0.8	-14.0	7823 ± 46	AA88539	6691	6597	6814	6510
KL09-6 tooth enamel	55/70 cm	bioapatite	2	B	0.9	-13.8	7760 ± 47	AA88543	6643	6512	6677	6476
KL09-7 burnt bone	55/70 cm	insoluble	1	A	16.2	-27.0	9460 ± 54	AA88550	8815	8638	9120	8615
KL09-10 charcoal	75 cm	insoluble	3	A	40.4	-27.3	9544 ± 53	AA88551	9121	8792	9155	8743
KL09-9 calcined bone	85/100cm	bioapatite	2	B	0.4	-25.5	9085 ±52	AA88540	8319	8248	8446	8228

Table 3 Radiocarbon dating of Ayios Tychonas – *Klimonas*. * pre-treatment: 1: HCl (3N) for 48h - NaOH (0.1N) for 1.5h - HCl (0.1M) for 24h; 2: acetic acid (1N) for 4h under vacuum; 3: HCl (3N) for 6h - NaOH (0.01N) for 1.5h - HCl (1N) for 24h; ** extraction: A: degazing under vacuum at 200°C for 4h, followed by combustion at 450°C for 3h in the presence of oxygen; B: CO2 extraction with 100% ortophosphoric acid at 70°C for 25mn.

Few attempts at dating the carbonate fraction of tooth enamel have been published so far, with limited success (Hedges *et al.* 1995) .

One calcined bone was also dated. Carbonate remaining in calcined (*i.e.* heated above 600°C) bones after the acetic acid pre-treatment is believed to be extremely resistant to diagenetic alteraction, and has been shown to produce reliable dates, at least for the Holocene (Lanting *et al.* 2001). (Table 3)

The oldest dates from this series were obtained from charcoal (AA88551: 9,544±53 BP; 9,155-8743 cal. BC, 2σ), followed by the alkali insoluble fraction of a burnt bone (AA88550: 9,460±54 BP; 9,120-8,615 cal. BC, 2σ). These two samples were found in the lower part of trench 168.5. Together these dates attest to the occupation of the site during the first half of the 9th millennium BC and, possibly, at the very end of the 10th millennium (9,155-8,615 cal. BC, 2σ).

All the remaining samples were significantly younger, with dates ranging from 9,200±52 BP (second half of the 9th millennium cal. BC) to 7,716±47 BP (mid 7th millennium cal. BC). A recent literature survey (Zazzo and Saliège 2011) showed that the vast majority of the altered bone samples tend to give younger rather than older dates so it is tempting to reject the youngest samples on that basis. The youngest dates of the series (between 7,823±46 BP and 7,716±47 BP) were obtained from the carbonate fraction extracted from tooth enamel and unburned bone apatite. These results confirm that tooth enamel is not immune to isotope exchange as previously suggested, based on the dating of Paleolithic sites from England (Hedges *et al.* 1995). The alkali soluble and insoluble fraction from burned bones gave dates ranging from between 9,460±54 BP and 8,831±55 BP with calcined bone somewhere inbetween (9,085±52 BP). Whether this variability reflects the true differences in dates or indicates contamination is difficult to establish. Dates obtained from calcined bones are widely considered reliable so this result cannot be rejected on geochemical grounds alone. Comparison between the alkali soluble and insoluble fraction in three bones showed that the difference in years between the alkali soluble and insoluble fraction was small, less than 200 years, with the insoluble fraction yielding the oldest date. Radiocarbon dates obtained on hippo bones from *Aetokremnos* suggest that both the soluble and insoluble fractions from burned bones are not immune to contamination by organic soil matter and that this contamination can lead to a rejuvenation of dates of between a few hundred and a few thousand years (Simmons 1999).

Discussion and Conclusion

The first archaeological assessment at *Klimonas* revealed several kinds of archaeological deposits spread across a large area; stretched *ca.* 70 m north to south and at least 35 m east to west. However, the roadside profile and the northernmost trenches evidenced that, though very rich in archaeological material, the sediment deposits from the upper part of the terraces were the colluviums and fillings of erosive gully channels. These caused the amalgamation of sometimes high densities of archaeological material from various Neolithic periods, from an early phase of the Pre-Pottery Neolithic (the most dominant) to the Sotira Ceramic Neolithic.

Conversely, from the lower part of the terrace, reflected in trenches 168.3, 168.5 and 168.6, we recognised thick, rich and un-disturbed PPN archaeological layers. They have been preserved owing to less erosive activity, and to a bank of Upper Pleistocene calcrete (*havara*) at the southernmost limit of the terrace (trenches 168.4 and 168.8) which precluded them being driven down the slope. The extent of this well preserved archaeological layer covered a band 25 m north to south and at least 30 m east to west (with a potential extension into a nearby plot), *i.e.* at least 750 m².

Trench 168.3 cuts through a 30 cm deep knapping accumulation. Trench 168.5 evidenced a one metre thick succession of stratigraphic units containing rich archaeological material, exclusively referring to the Pre-Pottery Neolithic, and sealing a probable feature. In both these trenches the archaeological material was abundant, well preserved and diverse. Lithics were especially profuse and of high quality. We collected 17 small arrow heads, with tang, together with a large number of burins and scrapers. Trench 168.3 provided a large lithic series which allowed the reconstruction of several chaînes opératoires of blade production. Though far from being as numerous as lithics, beads, pendants and bone industry were surprisingly plentiful for such a small excavated area. Animal bone accumulation was dense and better preserved than at *Asprokremmos*. *Klimonas*, therefore, appears to have been much more than purely a hunting camp, and was probably a small PPN settlement.

Both lithic and faunal material evidenced that the deposits in trenches 168.3 and 168.5 were undisturbed and date to a phase of the Cypriot PPN. Unidirectional blade production clearly predates the earliest deposits at *Shillourokambos* (8,500-8,300 cal. BC) and refers to knapping traditions which characterize the PPNA and early PPNB cultural complexes on the mainland, namely those of the Middle Euphrates valley (Abbès 2002). The fact that no obsidian has so far been found in *Klimonas* (and in *Asprokremmos* too) also speaks for an occupation earlier than the one of *Shillourokambos*. Regarding fauna, the absence of any ungulate except the small endemic Cyprus wild boar which is, to date, only attested at *Aetokremnos* (*ca.* 9,700-9,400 BC) also indicates a phase comprised between this date and the earliest layers of *Shillourokambos* (*ca.* 8500 BC) where goat and cattle appear for the first time. The radiocarbon dates obtained here stretch from the very end of the 10th millennium to the end of the 7th millennium cal. BC. The fact that both lithic materials and animal bones preclude a date more recent than

8500-8400 BC indicates that the youngest dates obtained from tooth enamel and some of the burnt bones were probably due to diagenetic alteration. However, the oldest date obtained from a burnt bone gives a *terminus ante quem* for these deposits at AA88550: 9,460±54 BC, *i.e.* 9,120-8,615 cal. BC (2σ). This date is not statistically different[4] from the charcoal date obtained from a small branch of *Prunus* sp. (*i.e.* there is no risk of inbuilt age): AA88551: 9544±53 BP, *i.e.* 9155-8743 cal. BC (2σ). Altogether, the lithic and faunal material and the set of radiocarbon dates indicate that the fillings of trenches 168.3 and 168.5 at *Klimonas* date to the first half of the 9th millennium; more precisely to 9155-8615 cal. BC (2σ).

Lithic material, animal bones and radiocarbon dates at *Klimonas* were very similar to those from *Asprokremmos* (McCartney *et al.* 2006, 2007, 2008, in press; McCartney 2010; Manning *et al.* 2010). The core technology is dominated by well developed unidirectional blades debitage and the production is characterized by an abundance of arrowheads, primarily short with triangular bases or with a short tang, which is unusual in Cyprus. Suids are the only ungulate and overwhelmingly dominate the other vertebrate species of mainly bird and freshwater tortoises (Vigne *et al.* in press). At both sites, beads and pendants were rather numerous in relation to the later Cyprio-PPN sites. And finally, the time range defined by the two oldest dates of *Klimonas* overlaps the time range defined by the six dates obtained at *Asprokremmos* (9141-8569 BC, Manning *et al.* 2010) with no statistical difference between them[5].

The excellent preservation of the faunal remains at *Klimonas* strengthens the idea that these human groups based their animal subsistence on the exploitation of the local resources; principally a small endemic suid. This is an unprecedented example, within the Mediterranean Europe and the Near East, of the sustainable development of human groups based purely on one species of large game. The *Klimonas* suid was the same size as the ones of *Aetokremnos* and of the earliest phase of *Shillourokambos*. The three of them are likely representatives of the recently described small endemic Cypriot suid, which is supposed to have been introduced to the island short before the end of the Late Glacial (Vigne *et al.* 2009, 2011). In the present state of knowledge, the earliest undisputable evidence of pig domestication on the near mainland dates to *ca.* 8,500 cal BC (Nevalı Çori, Çayönü, South-East Anatolia) (Peters *et al.* 2005; Hongo *et al.* 2009). It is therefore more likely that the small size of the *Aetokremnos-Klimonas* suids resulted from several centuries of life on the island, rather than from a domestication process. Further analyses on the archaeozoological series of *Klimonas* will hopefully allow us to test this hypothesis.

The archaeozoological data retrieved has also enabled us to demonstrate that the domestic dog had already been introduced to Cyprus at that time, and to evidence that it was living with human groups possibly helping them to hunt or control small suids.

Although the archaeological information extracted from the two small trenches of *Klimonas* is of course much less significant than information gathered from several excavation sessions at *Asprokremmos*, it has provided us with intriguing confirmation that humans were living in Cyprus during the first half of the 9th millennium BC. It also confirmed that *Asprokremmos* was not an isolated settlement and, because it is located far from *Asprokremmos* (Fig. 1), suggests that, at that time, several human groups lived on the island during several decades or centuries at least. Therefore, documenting this period is of the utmost importance for understanding not only the early prehistory of Cyprus but also the behaviour of its human societies.

Pending questions are many: is the early 9th millennium an isolated episode of massive peopling in Cyprus or is it documenting only one period of a continuous occupation of Cyprus since the mid 11th millennium? The use of various materials, picrolite in particular, suggests that this community (whether at the level of *Klimonas*, or at the level of the island community of Cyprus) knew the resources of the island well, and were not new arrivals, still finding their way. What was the cultural origin(s) of the humans groups living at *Asprokremmos* and *Klimonas* and did they still intensively exchange with the mainland PPN societies? Did they hunt or already manage the small wild boar, as suggested by the numerous arrowheads, or had they begun to domesticate them? What plants did they use and did they begin to practice "pre-domestic" agriculture like some human groups did at the same time on the mainland?

Far from being solely dependant on the west Asian mainland, Cyprus appears to have had its own complex and original neolithization process, in which local cultural evolutions, technical inputs from the mainland, and adaptations to particular island conditions would have integrated to form a new, uniquely Cypriot, Neolithic way of life. The abundance and quality of the lithic and faunal material found during these test excavations augur for promising perspectives to address these questions. New excavations at *Klimonas* will be conducted in the near future.

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Endnotes

[1] All the dates in this paper will be given cal. BC. Calibrations have been performed using Calib 5.0, Stuiver and Reimer 1993; Reimer *et al.* 2004.

[2] The absence of any post-Sotira item indicates that these erosive events did not take place later than the Late Neolithic. The richness of archaeological material also indicates that this area was intensively settled during the entire Cypriot Neolithic. Probably due to the proximity of the important source of good quality flint material at the *Athiaki* site (see Briois *et al.* 2005, 114 ff).

[3] Suids are also overwhelmingly dominant (87 %; N= 31) in all other trenches except trench 168.1.

[4] 95 % confidence: Chi^2= 3.84 ; T= 1.23 ; Calib 5.0, Reimer *et al.* 2004.

[5] 95 % confidence: Chi^2= 14.1; T= 4.67; Calib 5.0, Reimer *et al.* 2004.

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The 2010 Excavation Season at Mishmar Ha'emeq in the Jezreel Valley

Omry Barzilai and Nimrod Getzov

Proto-historic Mishmar Ha'emeq was discovered and excavated in 2007 (Barzilai and Getzov 2008; Cinamon 2010). The major discoveries of the 2007 excavations included a unique ritual building related to a burial ground (Area H) dated to the Pre-Pottery Neolithic B period, and six rock-cut pit installations (Area G) as well as a grave (Area H) dated to the Pottery Neolithic (Yarmukian) (Barzilai and Getzov 2008).

In 2010 two more excavations were undertaken at the northern part of the site (Area I) prior to construction of a new residential quarter (Fig. 1). The investigated area was divided into four secondary areas of which the western most (I4-I3) were devoid of any archaeological finds. The excavation in I2 revealed a thin layer *ca.* 40 cm below the surface dated to the Pottery Neolithic period. This layer consisted of fist-sized angular burnt stones, pottery sherds, flint artifacts and animal bones, thus resembling the "stone surface" phenomenon (*e.g.* Barzilai 2010).

The excavation in sub-area I1 revealed to our surprise seven superimposed layers dated to the Pre-Pottery Neolithic B, Pottery Neolithic (Yarmukian/ Lodian), Early Chalcolithic (Wadi Rabah), Early Bronze Age I, Middle Bronze Age, Roman and Late Muslim (Ottoman) periods. In this short report we briefly present the Pre-Pottery Neolithic B, Pottery Neolithic and Early Chalcolithic occupations (Layers VII-V).

The lowermost Layer VII is embedded on top of virgin soil and was excavated in a limited area (12 m²). The archaeological remains consist of a lime plastered floor that was set on a foundation of small stones (Fig. 2). This floor segment likely belongs to a structure as decayed mud brick sediment was uncovered on top of the floor and next to it. The flint assemblage from layer VII is similar to the one recovered at Area H, in particular the bidirectional blades that were made on high quality flints (Barzilai *et al.* 2011). Notably no bidirectional blade cores were found. The tools include Jericho points and inversely retouched sickle blades (Fig. 3: 1-4). Other diagnostic artifacts include a green stone bead (probably made of amazonite) and polished bone tools (Fig. 3: 5-8).

Layer VI was exposed in the northern and southern part of sub-area I1 and in sub-area I2. The northern

Fig. 1 A plan showing the location of the excavation areas at Mishmar Ha'emeq.

Fig. 2 Mishmar Ha'emeq Area I1: Remains of a plastered floor from Layer VII.

Fig. 3 Mishmar Ha'emeq Area I1: Diagnostic flint artifacts, a stone bead and bone tools from Layer VII. 1 bidirectional blade; 2-3 arrowheads; 4 sickle blade; 5 stone bead; 6-8 polished bone tools.

Fig. 4 Mishmar Ha'emeq Area I1: Remains of a structure from Layer VI.

exposure included two walls that converge into a corner of a large structure (Fig. 4) to which Yarmukian pottery sherds were found associated (Fig. 5: 1).

Fig. 5 Mishmar Ha'emeq Area I1: Pottery sherds from Layer VI. 1 Yarmukian sherds; 2 Jericho IX sherds.

Although no architectural remains were found in the southern sub-area I1 it was richer in pottery sherds, mainly Jericho IX (Fig. 5: 2). Likewise the lithics from Layer VI consist of Yarmukian and Jericho IX sickle blades and points (Fig. 6). Due to lack of time these two sectors were not connected in the excavation therefore it is unclear if the Yarmukian and Jericho IX finds derived from the same horizon or not.

Layer V was uncovered in a limited area (5 m²) at the southeastern part of sub-area I1. The remains include two rows of stones with pavements (Fig. 7). It is unclear whether this feature represents the foundations of a structure or an installation. The pottery and flint artifacts from this layer are typical to the Early Chalcolithic Wadi Rabah culture (Fig. 8). The pottery includes thumb nail decorations whereas the sickle blades are backed and denticulated.

Fig. 6 Mishmar Ha'emeq Area I1: Pottery Neolithic flint artifacts from Later VI.

Fig. 7 Mishmar Ha'emeq Area I1: Structure remains from Layer V.

The recent excavations at Mishmar Ha'emeq contribute to the comprehension of the site's characteristics according to chronology. As for the nature of the site, apparently Mishmar Haemeq is a subterranean proto-historic Tell, as attested in area I1 where seven super imposed layers were exposed. The absence of archaeological finds in I3-I4, also noted in Areas E and F (Cinamon 2010), outline the north-western boundary of the site (Fig. 1).

Although the PPNB remains in Layer VII are few they clearly indicate a residential area within the PPNB village. While, the preliminary report of the 2007 excavation could not conclude if PPNB Mishmar Haemeq was a village or a ritual site, it is clear today that it was a permanent settlement with a ritual complex located at its margins.

As for the PN occupation in Layer VI, the remains of the structure suggest Mishmar Ha'emeq was also a settlement during the PN period. However it is unclear if the Yarmukian and the Jericho XI finds derive from the same phase or from different occupations at the site. A further excavation is needed in order to comprehend the cultural diversity and the chronology of this time period at Mishmar Ha'emeq.

And finally the discovery of the few Wadi Rabah remains suggests the site was occupied also during this time period.

In sum, the presence of all three periods (Pre-Pottery Neolithic B, Pottery Neolithic and Early Chalcolithic) at Mishmar Ha'emeq support a cultural continuity in the Jezreel Valley as was identified in the central Jordan Valley (*e.g.* Munhata) and the Akko Plain regions (*e.g.* Ard el Samra and Nahal Betzet 2) (Getzov *et al.* 2009; Perrot 1964) .

Fig. 8 Mishmar Ha'emeq Area I1: Flint artifacts and pottery sherds from layer V. 1 decorated Wadi Rabah pottery. 2 denticulated sickle blades.

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Early Pre-Pottery Neolithic Settlement at el-Hemmeh: A Survey of the Architecture

Cheryl Makarewicz and Katherine Rose

El-Hemmeh is a multi-period Pre-Pottery Neolithic site located in the Wadi Hasa, Jordan, in the shadow of the prominent volcanic plug of Jebel Hammat edh-Dhikr. Situated on an alluvial fan within easy reach of the water supply flowing in the wadi, Hemmeh was ideally positioned to take advantage of arable soils and a consistent water source required for cultivation. As part of a long-term research project investigating the subsistence and social systems that contributed to the transition from gathering to plant cultivation, recent excavations at Hemmeh have focused exclusively on the earliest PPN occupation of the site.

PPNA deposits at Hemmeh were first identified in 2004, when an exploratory excavation unit (3 x 2 m) revealed a portion of a semi-subterranean stone structure (Structure 1) and an associated clay floor that contained a molded hearth feature (F1) (Makarewicz *et al.* 2006). Two Hagdud truncations and a small basalt cup similar to those identified at Wadi Faynan 16 were recovered from this structure (Shaffrey 2007), and the hearth yielded a radiocarbon determination dating to the latest portion of the PPNA (9,450 ± 60 uncal bp; 9120 - 8570 cal BC). Exploratory excavations continued during 2007 to partially expose two more structures and considerable depth of stratigraphy. These deposits also yielded well-preserved botanical and faunal assemblages.

In order to better capture diachronic shifts in the character and spatial distribution of architecture, subsistence strategies, and mortuary practices throughout the earliest PPN at el-Hemmeh, five new 5 x 5 m excavation units were opened during the 2010 season. Excavations revealed a complex sequence of architectural construction, deconstruction, and decay, trash dumping events, and human interment. Here, we briefly report results from the 2010 excavations and provide a preliminary description of the architectural remains and internal features.

Structural Remains

The earliest PPN settlement at el-Hemmeh is located on the western face of an eroded alluvial fan. The steep slope produces an *ca*. 25-30 cm drop in hill surface elevation per meter. Consequently, deposits that lie just under the modern surface at westernmost extent of the excavation unit are almost two and a half meters below surface deposits located only 10 m away to the east. An as-yet unquantified amount of the site's western margin, downslope, has been eroded away.

Twelve early PPN semi-subterranean stone structures, ranging in diameter from 2 m to 4 m have so far been identified at Hemmeh (Fig. 1). Structures 2 through 8 and Structure 10 were partially excavated during the 2010 season, but only the uppermost wall courses have so far been revealed for Structures 9, 11, and 12. Although additional excavation work is required in order to precisely define stratigraphic relationships between structures, and between structures and extramural spaces, documented stratigraphic relationships make it clear that not all structures were occupied at the same time and that there are several broad phases of early PPN construction at Hemmeh.

The construction technique employed at Hemmeh was broadly similar for each structure, with the possible exceptions of Structures 4 and 10. In general, a steeply cut foundation pit was dug, often into pre-existing (also early PPN, thus far) cultural deposits, and then a two-coursed stone wall set in tempered mud mortar and supported by the pit wall was built. The uppermost courses of the stone wall usually extended 10-30 cm above the exterior ground level and supported a roof and, in some cases, *pisé* superstructure built on top of the walls. While the placement of a stone wall in a foundation pit is a shared feature of many early PPN structures so far identified at Hemmeh, several structures exhibit different styles of stone coursing.

Structures 2, 3, and 4

Structures 2, 3, and 4, each *ca*. 2-3 m in diameter, exhibit similar architecture styles. Each structure features upright foundational stones that support upper courses, two-rows wide, of smaller irregularly shaped stones held together by clay mortar. The stone walls of these structures are preserved to heights ranging from *ca.* 40 cm to 1.5 m. These walls appear to have been capped with a low-lying *pisé* superstructure built up on top of the stone walls, suggested by the significant volume of clean *pisé* melt deposited within each structure. Further intramural deposits suggest that a lighteight roof made out of packed mud, cereal and grass chaff, and other organic materials likely covered each dwelling. For Structures 3 and 4, roofing was supported solely by the walls, while a central posthole held up a roof in Structure 2.

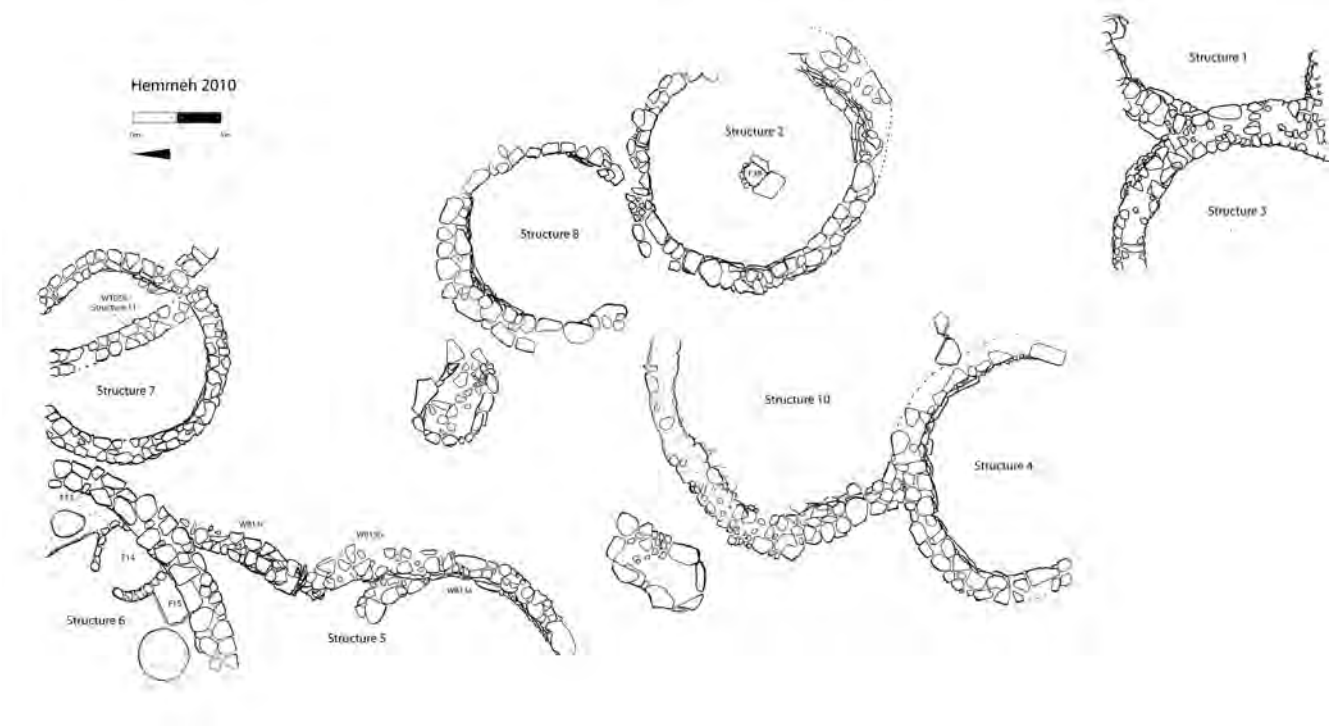

Fig. 1 Horizontal plan of early PPN structures at el-Hemmeh.

Structure 2

In terms of the number of interior construction events and features, Structure 2 is one of the more dynamic buildings, so far encountered at Hemmeh. The interior space of Structure 2 underwent several different remodeling events when new features were added and/or old ones remodeled. Structure 2 was also regularly re-floored, with at least ten floor flooring episodes visible in a section profile created when illegal digging damaged the site. The looting occurred during the 2007 season, when a large pit was dug into the southern portion of Structure 2 - as well as other areas of the site - exposed during excavation, destroying floors and, unfortunately, a human burial. The thin clay floors observed in the profile were sometimes laid down successively, but more frequently, alternate with a very thin layer of pise melt, aeolian dust and, occasionally, redeposited ash. The deposition of melted *pisé* and aeolian dust suggests the brief disuse of Structure 2 at regular intervals; ash generally accumulated during occupation phases.

A number of interior features, installed at various times and associated with different flooring events, were located in Structure 2. The oldest feature so far identified is a substantial posthole (F39) positioned at the center of Structure 2 (Fig. 2). The interior of the posthole is lined with two elongated stones and smaller angular stones set in a clay mortar.

A small *ca*. 40 x 25 cm semi-rectangular bin was later installed directly against the eastern curve of the Structure 2 wall sometime before the hearth and final floor were built, but after the posthole was constructed (Fig. 2). This bin (F38) is a partial sub-floor installation and extends *ca*. 20 cm below the final floor surface; a large flat stone and a series of angular stones firmly set in clay mortar builds the edges of the bin *ca*. 5 cm up above the floor. As part of a later flooring event, the volume of the bin was more than doubled when a moderately sized stone wall *ca*. 50 cm in height was installed on top of the raised stone edging of the bin.

A raised circular platform (F36) built of small angular stones set in a dense mud mortar was also located in Structure 2. The platform is *ca*. 80 cm in diameter, and abuts the inner face of the western portion of the Structure 2 wall. Like the bin, this platform was installed sometime during the mid-point of the life cycle of the structure. The exact stratigraphic relationship between the platform and the bin will be determined in future seasons during excavation of the Structure 2 floor layers.

Just to the north of the posthole is a raised, circular molded clay hearth (F40). The installation of the hearth appears to be the final construction event in Structure 2, as the hearth sits upon the terminal floor of the structure. The clay of the hearth was baked from exposure to heat and stained with ash, and although some charcoal pieces were embedded in the clay, the hearth had been swept clean of substantial ashy accumulation before its burial and no deposits of ash were excavated from within it.

Fig. 2 Structure 2 bin (F38) and posthole (F39) features.

Fig. 3 The stone platform feature (F7) located in Structure 3.

Fig. 4 Platform/shallow bin feature (F5) located in Structure 4. Note that this feature construction and associated clay floor are associated with relatively late occupation of the structure and covers the foundation stones of the Structure 4 wall.

Structure 3

Structure 3 is a well-preserved circular stone building *ca.* 2 m in diameter and preserved to a height of 1.5 meters. Although only a quarter of Structure 3 was excavated during 2010, several phases of occupation and a substantial stone platform feature were identified. The platform (F7) is *ca*. 1 m in diameter and reaches *ca*. 15 cm above a compact clay floor, and consists of a ring of stones firmly set in a clay mortar, with small angular stones and flat fine-grained basalt slabs also set in mortar, filling the ring (Fig. 3). Two overturned groundstone items were also incorporated into the platform, while another stone exhibiting multiple divots created by pecking was also recycled and used in the platform. One of the groundstone items, a small limestone bowl, yielded well-preserved starch remains (Weber, personal communication). However, since the working surface of the bowl is faced down into the platform, the grains recovered from this groundstone are likely not derived from activities associated with the use of platform. Multiple basalt pestles, a bone spatula, and a clay ball were also found on the floor next to the platform. At least five successive clay floors were laid down while the stone platform was in use. As was observed in Structure 2, extremely thin layers of *pisé* melt were deposited between each of these floors, suggesting periods of temporary disuse followed by reoccupation.

Eventually, the stone platform and associated floors fell into permanent disuse, and Structure 3 appears to have been abandoned for a relatively long period of time. The interior space of Structure 3 was turned into a midden, and subsequently, the roof and possibly *pisé* superstructure began to decay. While Structure 3 appears to have been briefly occupied again with the creation of informal trampled surfaces (Floors 733 and 837), the space was never used intensively again.

Structure 4

Structure 4 is a circular structure *ca*. 3 m in diameter defined by a low stone wall that reaches *ca*. 40 cm in height, although this wall appears to have supported a *pisé* superstructure. The very low density of architectural stones present in the matrix of *pisé* melt layer that formed with the structure was abandoned suggests that the wall never reached the heights seen in Structure 2 and 3. Approximately 50 % of Structure 4 was excavated; the remaining half was destroyed during the installation of a modern water cistern on the site over a decade ago. Structure 4 appears to be free-standing, but additional excavation work is required in the extramural deposits outside of the structure in order to determine the complete construction sequence. Structure 4 was re-floored multiple times, usually after a period of disuse when the structure was turned into an ash and midden dump. Floors are relatively thick (*ca*. 1 cm) and are made of a compact clay. Interior features are remarkably sparse in Structure 4. Only one feature, a shallow raised clay lined bin or platform *ca*. 1.2 m x 50 cm in size, furnished the interior of the space for a single occupation phase (F5; Fig. 4). This construction utilizes the eastern portion of the structure wall and several large stones set in clay arcing out from the wall. The compact clay bottom of the feature is raised ca 5cm relative to the structure floor. Notably, the uppermost course of another round stone structure (Structure 12) was identified underneath Structure 4.

Structure 5

Structure 5 is unusual in that, unlike other early PPN structures so far encountered at Hemmeh, its wall fabric was heavily remodeled several times. The original footprint of Structure 5 was defined by a circular semi-subterranean, two-course wall construction preserved to a height of 1 m and *ca*. 2 m in diameter (Wall 813). The original floor associated with this first phase of construction has not yet been identified. Eventually, the northern half of Wall 813a was completely removed except for the lowermost courses, and the structure was expanded northward with the installation of a relatively straight wall

Fig. 5 A general view of the mortuary installations (from left to right F13, F14, F15) located in Structure 6 after the removal of interred human remains.

(Wall 813b). However, there is a slight curvature visible at the northern extent of the wall, which may indicate that Wall 813b originally turned to the west and increased the diameter Structure 5 to *ca*. 3 m. Subsequently, this portion of Wall 813b would have been removed in order to further expand the structure. This is a plausible scenario that would make room for the installation of Wall 813c, which abuts Wall 812b to the north, in order to extend Structure 5 to over 6 m in length. However, the awkward angle and join between Walls 813b and 813c and the *ca*. 25 cm difference in the bottom depths of these walls with Wall 813b grounded lower, is perplexing. It is possible that Wall 813c is actually an earlier construction than Wall 813b, perhaps forming another structure, and the southern portion of Wall 813c was removed in order accommodate Wall 813b, which served to join Wall 813a with Wall 813c. A clay floor was subsequently installed across the entire, newly enlarged, interior space of Structure 5. Additional excavation on the eastern side of the 813 walls will help clarify the construction sequence of Structure 5.

Surprisingly, the interior space of Structure 5 is largely devoid of substantial features. On the southern end of the structure, the use of an informal hearth (F9) is suggested by a concentrated burn event that baked one of the clay floors. A circular arrangement of postholes (F8) located near the hearth may have supported a raised platform or a small enclosure.

Structure 6

Much of Structure 6 has been destroyed by hillslope erosion and only a portion of the remaining construction was excavated during the 2010 season, but it appears that the structure was circular and relatively large. Defined by a two course wide stone wall *ca*. 50 cm in height, Structure 6 cuts into the northern end of Structure 5.

Structure 6 yielded some of the most intriguing finds of the 2010 season. Although it is not within the scope of this preliminary paper to present and discuss in detail all of the data, three unique mortuary installations containing human burials were discovered. These installations, which all appear to have been installed simultaneously, include a molded clay platform (F13) into which several cuts were placed, a stone cist feature (F14), and a small rectangular bin (F15) (Figs. 1 and 5). Contained in the pit sunk into the platform (F13) was a single skull from a young juvenile individual. The skull displayed several pathologies and/or modifications that require further investigation.

A complete individual, possibly a young adult, was interred in stone cist feature (F14). The feature itself is *ca.* 80 cm in diameter and built up of carefully coursed small stones to a depth of *ca.* 70 cm. Built into the wall at bottom of the cist is a slab of fine-grained basalt bench. The individual was placed in a sitting position on the bench, and the legs and much of the arms and torso covered with white lime or gypsum plaster. The

Fig. 6 Child burial interred in a small bin (F15) located in Structure 6.

cist and the interred individual were capped by spread of concave mud plaster, around which angular stones were placed to form a circle traced the edge of the cist below. An intentional gap *ca.* 30 cm wide was left in the northern portion of the stone circle, and a small (*ca*. 20 cm high) black upright stone placed at the end of the gap. This entire complex was further capped by three basalt slabs *ca*. 1 m in length and several smaller basal pieces.

A third complete individual, a small child, was interred in a small stone bin (F15) built out of upright stone slabs and *ca*. 40 x 20 x 20 cm in size (Fig. 6). This individual was also placed in a sitting position, and the legs and much of the torso and arms covered in white lime or gypsum plaster. The bin and individual were capped with two white limestone slabs supported by a mud foundation. At some point in time later, these features were covered by multiple flooring events.

Structure 7

Structure 7 is a semi-subterranean circular structure *ca*. 2 m in diameter and defined by a stone wall preserved to a height of 90 cm in some areas. Compared to other structures, the stonework of the Structure 7 wall is remarkably organized, and consists of tabular stones secured in mud mortar laid down in neat coursing. The structure was re-floored with hard packed clay numerous times; flooring events are separated by thin layers of *pisé* melt indicative of brief periods of disuse. Extending along the eastern quarter of the structure is an impressively large (*ca*. 2 m x 1 m x 70 cm) subterranean bin feature (F17; Fig. 1). Interestingly, rather than requiring new construction, the subterranean bin feature exploits what a pre-existing wall (W1056) that likely formed part of an earlier structure (Structure 11). The bin appears to have been maintained throughout the entire life of Structure 7, as the floors lap over, but do not extend beyond, Wall 1056.

Cutting into the easternmost edge of Structure 7 is a later wall construction (W946). Curving to the east and into the section profile, this double coursed stone wall forms the circular Structure 9. No floors or installations were found in association with this structure, which appears to have been damaged by colluvial erosion.

Structure 8

Structure 8 is a circular semi-subterranean construction *ca*. 2 m in diameter and is defined by a low stone wall preserved to a height of 50 cm. Structure 8 is unique in that it contains a break in the wall that suggests an access point into the interior space. Like other early PPN structures at Hemmeh, the life history of Structure 8 is characterized by alternating cycles of use and disuse. Sandwiched in between clay floors were ash dumps, middens, and very thin layers of degraded *pisé* melt. In at least one instance, the structure was abandoned for some time - suggested by relatively thick midden and *pisé* melt deposits - before being rejuvenated with a new floor. Structure 8 floors are generally thin and delicate, and some exhibit concentrations of red and orange discoloration caused by intense heating, probably from informal hearths. No internal features were installed in Structure 8.

Structure 10

Structure 10 is a large circular structure *ca*. 4 m in diameter, and preliminary stratigraphic analyses suggest that Structure 10 is one of the earliest PPN structures so far identified at Hemmeh. It is the only structure built using primarily *pisé* wall construction, although there is some internal stone facing. A massive layer of melted *pisé* identified in the interior of Structure 10 suggests that the original *pisé* construction was quite substantial. The remains of three human infants, two complete individuals and a third represented only by a vertebral column, were interred in this *pisé* melt layer. Interestingly, no burial cuts or fill were identified in association with these interments. Instead, each individual was solidly encased in melted *pisé* construction material and, while also taking into consideration that the delicate remains of the infants are in full articulation, suggests that the construction debris was very rapidly deposited over the interments. It may be that the *pisé* walls of Structure 10 were intentionally toppled inward and, as part of the activities associated with the closing of the structure, the infants placed within the destruction debris.

Concluding Remarks

The 2010 season has revealed an extensive early PPN occupation at el-Hemmeh. An intensive radiocarbon dating program is certainly required to help clarify the cultural-chronological sequence at Hemmeh. While the single radiometric determination from Structure 1 is a PPNA date - albeit a late one -, this certainly does not exclude the possibility that some of the structures date to the earlier PPNA, or perhaps later to a locally derived EPPNB. The architectural style seen at el-Hemmeh of relatively high coursed stone walls is certainly very different from earlier PPNA sites such as ‘Dhra and Netiv Hagdud (Bar-Yosef 1997), but arguably hints at similarities with the walls and molded heaths of Shaqarat Mazyed (Kaliszan *et al.* 2002). It is also worth noting that remarkably few diagnostic formal tools have so far been recovered from Hemmeh, and are represented by only two Hagdud truncations from Structure 1

(Makarewicz *et al*. 2006), and a single el-Khiam point from Structure 6 (Paige, personal communication). The poor representation of 'projectile points' is also seen at the later PPNA sites of ZAD 2 and WF 16 Trench 3 (Edwards *et al*. 2004; Pirie 2007). Further excavations in the earliest PPN deposits will help clarify the stratigraphic relationships within the site, and position el-Hemmeh in the early PPN architectural and technological sequence of the southern Levant.

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A Fourth Season at Yutil al-Hasa (WHS 784): Renewed Early Epipaleolithic Excavations

Deborah I. Olszewski and Maysoon al-Nahar

During the 2010 field season, the Western Highlands Early Epipaleolithic Project (WHEEP) returned to the site of Yutil al-Hasa (WHS 784) in the Wadi al-Hasa in west-central Jordan. Our previous work at the site in 1984, 1993, and 1998 revealed three different phases of occupation (Coinman *et al.* 1999; Olszewski *et al.* 1990, 1994, 1998). These include the Late Upper Paleolithic (Late Ahmarian), the Early Epipaleolithic (Nebekian), and the Late Epipaleolithic (Early Natufian). There are also bedrock mortars and cupmarks in the bedrock ledge above the site; some of these are patinated and may have some antiquity, although we cannot definitively associate them with one or more of the occupations at Yutil al-Hasa. We focused the 2010 excavation in the areas of the site containing Early Epipaleolithic deposits (Fig. 1).

Yutil al-Hasa is located in the main Wadi al-Hasa drainage, where the drainage narrows and topography steepens. The site is on a southeast facing slope and contained at least one rockshelter. Today large boulders representing rockshelter collapse characterize much of the area in which the prehistoric occupations were situated. Across the drainage from the site are paludal sediments likely representing ponding or marsh contexts, which would have been present at the time that Yutil al-Hasa was occupied by hunter-gatherer groups.

During the previous excavations, the Early Epipaleolithic occupation was encountered in Areas C and E. These represent the upper deposits in the lower rockshelter (Area C) and a thin layer of occupation on the bedrock ledge that forms the roof of the lower rockshelter (Area E). It is not clear if Area E was also a rockshelter, although there are numerous large boulders that appear to be roof fall from the upper bedrock ledge that forms the top of the finger ridge on which the site is situated. This may indicate that an upper rockshelter also was present during the Early and Late Epipaleolithic occupations at Yutil al-Hasa. In 1993 and 1998, Area C was investigated with two adjacent 1 m x 1 m units, both of which were dug to about 1.5 m in total depth below ground surface. In 1993, Area E was investigated with one 1 m x 1 m unit, which reached 90 cm in depth in the north end and 58 cm in depth in the south end. Previous units in Area C did not reach bedrock; the unit in Area E reached bedrock.

Description of the 2010 Excavations

During the 2010 excavation season at Yutil al-Hasa, we opened units in Areas C and E, and also in a new portion of the site, Area F. Area F represents the extension of the lower rockshelter to the southwest from Area C. Modern ground surface elevations in Area F suggest that it is approximately at the same elevation as Area C, and thus has the potential to yield additional Early Epipaleolithic materials, rather than the underlying Late Upper Paleolithic, as in Areas A and B from the 1984 and 1998 excavation

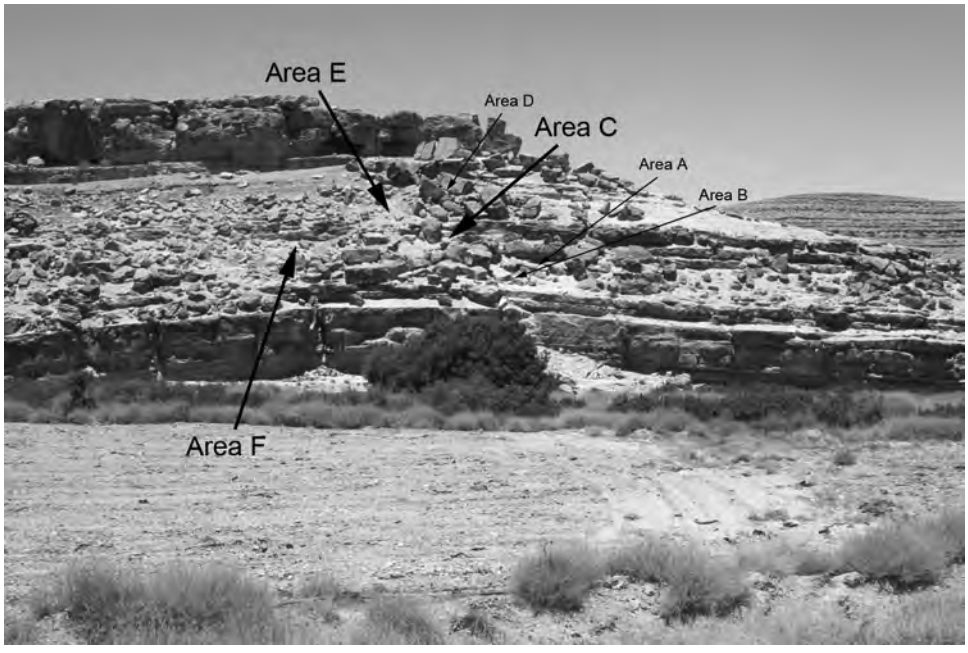

Fig. 1 Excavation areas at Yutil al-Hasa (WHS 784). Areas C, E, and F contain Early Epipaleolithic; new units were excavated here in 2010. Areas A and B contain Late Upper Paleolithic, and Area D contains Late Epipaleolithic (Early Natufian).

seasons (Clark *et al.* 1988; Coinman *et al.* 1999).

A topographic map was made using coordinates calculated by the total station and associated GIS software. The map includes the 2010 excavation units, the approximate locations of the excavation units from 1984, 1993, and 1998, the three main bedrock ledges, the 38 bedrock mortars and cupmarks above the site, and much of the large boulder rock fall that likely resulted from rockshelter collapse over time. A portion of this map is shown in Fig. 2.

All excavation was done in 50 cm x 50 cm quads. Size of the units varied depending on area available and the constraints of boulders encountered subsurface. Increments of 3 cm were dug in each quad and then point provenienced by "bucket" coordinates calculated using a total station and GIS software. A bucket therefore contains all sediment and artifacts recovered from a 3 cm increment within a 50 cm x 50 cm quad. The dimensions of all rocks larger than about 10 cm also were recorded using the total station. The three units in Area C further had all artifacts and fauna larger than 2.5 cm point provenienced using the total station. All sediment was screened through 2 mm mesh and artifacts collected and bagged for washing, labeling, and analysis. Samples for flotation, pollen, phytoliths, and geoarchaeology were taken from each unit. Because of constraints on areas available for excavation, units were placed to maximize excavation. This resulted in each unit falling within two or more grid 1m x 1m blocks. We report the units here using a conventional name for each, rather than the grid block names because several apply to each unit.

Area C

Three units of varying sizes (C2010-1, C2010-2, and C2010-3) were excavated in Area C (see Fig. 2). As noted above, all artifacts and fauna larger than 2.5 cm that were recovered from these three units were point provenienced using the total station.

C2010-1 (1 m x 1 m) is situated about 1.5 m south of Unit C98-1 from the 1998 excavation season; it was dug to a depth of about 1.10 m and yielded seven natural levels. There are clear distinctions between the upper and lower portions of this excavation unit. Compared to other units at the site, nongeometrics and microburins are relatively rare. About one-third of the nongeometrics are attenuated curved (arched backed) and curved types, with the remainder being relatively evenly distributed between pointed, La Mouillah, Ouchtata, backed and truncated, and truncated types. The distribution of microliths is similar in Levels, 2, 3, 4, 5 and 7. However, microburins are found only in Levels 1-4. This coincides with a distinction in raw material used to manufacture lithics with about two-thirds of the lithics in Levels 5, 6, and 7 made on chalcedony, while upper levels have a greater frequency of fine-grained and phosphatic flint. Beyond this, cores and core fragments are more common in Levels 5 and 7 than in the upper levels. There are several examples of endscrapers, burins, retouched pieces, and notch/denticulates from throughout the sequence. Faunal remains are particularly abundant in Level 7 compared to the overlying levels.

C2010-2 (50 cm x 50 cm) is adjacent to Unit C from the 1993 season and approximately 1.5 m north of and 1.75 m east of C2010-3; it was excavated to a depth of 70 cm and contained four natural levels. Although this unit is situated relatively close to both C2010-1 and C2010-3, its levels are different and cannot be easily compared to other units at the site. The sediments in C2010-2, however, do closely approximate the strata described for Unit C (which is adjacent) from the 1993 season. Unit C2010-2 has an interesting distribution of lithics, which are particularly abundant in Level 2/2 dark. This deposit contains about half of the nongeometrics, and more than two-thirds of the microburins found in this unit. In fact, the Level 2/2 dark deposit microburins constitute 51 % of the microburins found in all areas of the site, suggesting a concentration of activities here focused on microlith production. Level 3 also contains a large quantity of nongeometric microliths and microburins, although not to the extent found in Level 2/2 dark. About half of the nongeometrics from this unit are attenuated curved and curved bladelets; there are three Qalkhan points from Levels 2 and 3. Cores and core fragments are found mainly in Levels 2 and 3. Some

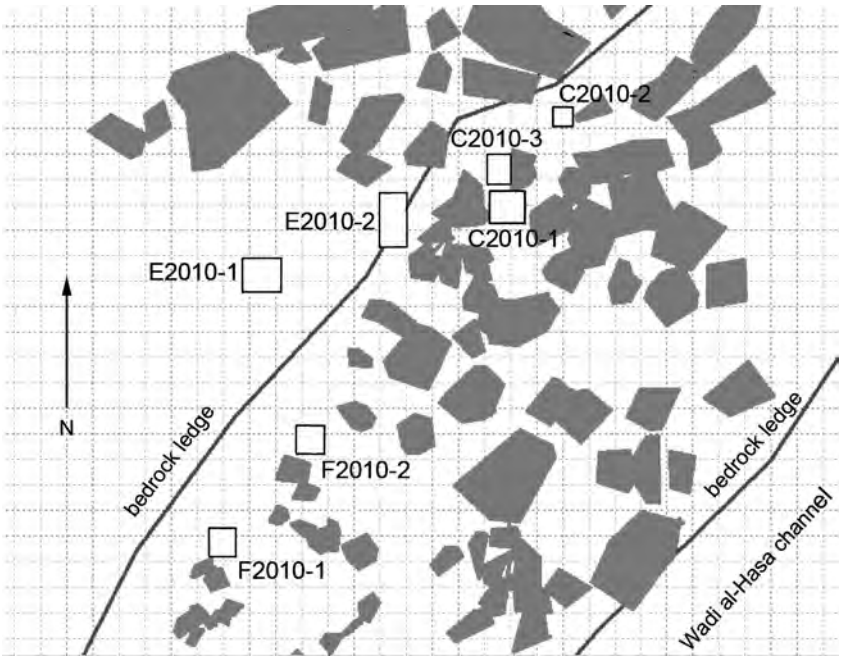

Fig. 2 Plan view of a portion of the Yutil al-Hasa (WHS 784) map showing the 2010 excavation units. Light grey areas are boulder rockfall likely representing collapse of a lower and upper rockshelters. Grid is in 1 m increments.

of the larger tools include endscrapers, burins, and truncations, but most are retouched pieces and notch/denticulates. Fauna is found in all levels, but is most abundant in Level 2/2 dark.

C2010-3 (80 cm E-W x 1 m N-S) is approximately 60 cm north of C2010-1; it was excavated to a depth of approximately 75 cm in the southwestern and southeastern quads. Most of the four levels in this unit can be directly correlated with those in Unit C2010-1, as these units are in close proximity. Lithics are relatively evenly distributed between all the levels in this unit. However, the small number of microburins (with two exceptions) are from Levels 3 and 3a, and the nongeometrics are exclusively found in Level 4. About one-third of the nongeometrics are attenuated curved and curved bladelets; there are also a few Ouchtata bladelets. Cores and core fragments are mainly found in Level 3. The pattern of microburins being restricted to deposits overlying Level 4 is similar to that seen in C2010-1. However, the fact that microliths are not found below Level 3a in C2010-3 is a different pattern from that observed in C2010-1. The small amount of fauna recovered from C2010-3 is mainly from Level 4.

Area E

Two new units (E2010-1 and E2010-2) were excavated in Area E. E2010-1 is 1 m N-S and 1.5 m E-W; this is due to the fact that the eastern two 50 cm x 50 cm contain a large disintegrating boulder and it was not possible to excavate in the NE quad, so we extended the unit to compensate. E2010-2 is 1 m E-W and 2 m N-S. The extension of this unit to the south was to facilitate exposure of the bedrock ledge at the base of the unit in an effort to locate the Early Epipaleolithic horizon found on this surface in the 1993 Unit E.

Unit E2010-1 was dug to a depth of about 70 cm in the easternmost quads and is situated approximately 2.5 m southwest of Unit E from the 1993 excavation season, but about 1 m in elevation above Unit E. Due to its upslope position, there is abundant colluvial (downslope) washed materials including rocks of various sizes; it contained four natural levels. Nearly all of the nongeometric microliths found in this unit are from Level 3, and include attenuated curved, curved, and Ouchtata types. The same is true for the small number of microburins in this unit; all but one are from Level 3. Only one core and one core fragment were found. A small amount of fauna was recovered from Levels 1 and 3.

In Unit E2010-2 there are five natural levels and excavations reached bedrock across the unit. Lithics are found in Levels 1, 2, 3, and 5, with most of the materials being present in Level 2. These include a small handful of nongeometric microliths indicative of Early Epipaleolithic occupation in this upper (rockshelter) portion of the site. Most of the nongeometrics are attenuated curved and curved bladelets. Microburins are present in small quantities, mainly in Levels 1 and 2. There is abundant shatter and numerous core fragments. Very little faunal material was recovered from this unit, all of it coming from Levels 1 and 2.

Area F

The two units (F2010-1 and F2010-2) opened in Area F represent testing in a new area of the site. We situated these to examine if the Early Epipaleolithic occupation extended into this part of the collapsed rockshelter. Both units are 1 m x 1 m in size, and both are at essentially the same elevation as C2010-1.

Unit F2010-1 is at the farthest southwestern portion of the site, contains three natural levels, and was dug to a depth of approximately 40 cm. It is about 3.5 m southwest of F2010-2 and 12 m southwest of C2010-1. The majority of the lithics derive from Level 3 in this unit. There are six nongeometric microliths from this level, including attenuated curved, curved, and one Qalkhan point, as well as a small number of microburins. Most lithic materials from Level 3 are debitage including small bladelets and small flakes. The small amount of fauna present is from Level 1.

Unit F2010-2 lies between F2010-1 and C2010-1; it is about 8 m southwest of C2010-1. There are five natural levels in Unit F2010-2, which was dug to a depth of about 1.05 m. While cultural materials were found in all levels of this unit, the greatest quantities are from Level 4, and to a lesser extent, from the small portion of Level 5 that was excavated. Beginning with Level 2, attenuated curved and curved nongeometrics appear and are the most frequent nongeometrics in each level. A couple of Qalkhan points are present in Level 4, and Ouchtata bladelets are found in both Levels 4 and 5. Microburins are particularly abundant in Level 4 (about 80 % of the total recovered from this excavation unit). Nearly all the cores and core fragments are from Levels 4 and 5. As with the lithic assemblage, fauna is found mainly in Levels 4 and 5.

Stratigraphy and Lithic Assemblage

The 2010 excavations at Yutil al-Hasa (WHS 784) greatly augmented our understanding of the Early Epipaleolithic occupation at this site, building upon knowledge gained from excavations in 1993 and 1998. Based on the distribution of cultural materials, the occupation area of the lower rockshelter extended for a minimum of about 15 m southwest to northeast, and about 6 m northwest to southeast (*ie.*, from the back of the rockshelter toward the front [estimated front]). The dimensions of the upper portion of the site, a probable additional rockshelter, cannot be estimated based on currently available data.

Stratigraphy

The stratigraphy of the units excavated in Area C and in Area F (lower rockshelter) can be correlated to some extent. The clearest attributions are between levels in F2010-1, F2010-2, C2010-1, and C2010-3, as shown in Table 1.

Natural levels in C2010-2 are somewhat different, especially the Level 2/2 dark portion which is not replicated elsewhere (except for the adjoining Unit C excavated in 1993). However, although there are slight color differences, it is possible that Level 3 corresponds approximately to Levels 3 and 4 in C2010-1 and C2010-3, and that Level 4 in C2010-2 corresponds to Level 5 in C2010-1. This correlation is suggested by the elevation data and further analysis of the lithics from these strata in these units may help resolve this issue.

Strata in E2010-1 and E2010-2 represent the upper portion of the site (upper rockshelter area). Levels in the two units are likely colluvial deposits. In the case of E2010-1, these are loose sediment at the top of the unit followed by a dense concentration of large limestone cobbles and boulders with very few cultural materials. Based on the presence of lithics in particular levels and the level characterization, it is possible that Level 3 in E2010-1 is the same deposit as Level 2 in E2010-2. As the bottom of excavation in E2010-1 is about 50 cm above the top of E2010-2, there is a possibility that deposits such as Levels 3 and 5 in E2010-2 could underlie the cobble/boulder strata of E2010-1. There are cultural materials in the levels of E2010-2: Levels 2 and 3 in particular contain abundant shatter and core fragments that may indicate redeposition of lithics in this upper portion of the site.

F2010-1	F2010-2	C2010-1	C2010-3
1	1	1	-
2	1	2	2
-	2	-	-
-	3 upper	3	3
-	-	-	3a
-	3 lower	4	4
-	4	5	not excavated
-	-	6	not excavated
3	5	7	not excavated

Table 1 Correlation of Stratigraphy at Yutil al-Hasa (WHS 784).

Description of Lithics

The overall lithic assemblage from the 2010 excavations numbers 16,192 pieces, and is shown in Tables 2-4. Not including small elements (*e.g.*, small flakes and small bladelets), the debitage assemblage is about evenly distributed between blade/bladelets and flakes. There are a small percentage of burin spalls indicating the manufacture of some burins at the site (see Table 4) and a considerable number of microburins (Imbtr=46.8), especially from Level 2/2 dark of C2010-2. There is also a considerable amount of shatter, of which about 20 % is from the colluvial levels in Area E. One piece of possible ground stone was recovered from C2010-2, and there are a small number of manuports.

Single platform cores are the most frequent core type during the Early Epipaleolithic (see Table 3); this is a common phenomenon of lithic assemblages of this chronological period. As with the debitage, there is a relatively even distribution of blade/bladelet and flake cores. Core fragmentation is relatively high, and may

Debitage	N	%
Blades	763	4.9
Bladelets	1299	8.5
Flakes	1944	12.6
Small Bladelets	1407	9.2
Small Flakes	7054	45.9
Burin Spalls	77	0.5
Microburins	394	2.6
Shatter	2423	15.8
Total	**15,361**	
Ground Stone	1	
Manuport	3	
Total	**4**	

Table 2 Preliminary Analysis of Yutil al-Hasa (WHS 784) Debitage and Other Finds.

Cores	N	%
Blade	(8)	4%
single	6	
core-on-flake	2	
Bladelet	(22)	11%
single	16	
opposed	3	
ninety-degree	2	
core-on-flake	1	
Flake	**(34)**	17%
single	11	
opposed	1	
multiple	2	
core-on-flake	16	
tested	3	
other	1	
Mixed	(29)	14.5
single	17	
ninety-degree	5	
multiple	4	
tested	3	
Core Fragment	107	53.5
Total	**200**	

Table 3 Preliminary Analysis of Yutil al-Hasa (WHS 784) Cores.

Tools	N	%
Scrapers	26	4.1
Burins	12	1.9
Backed Pieces	6	0.9
Perforators	2	0.3
Truncations	13	2.1
Geometric Microliths	42	6.7
Nongeometric Microliths	447	71.3
Special Tools	1	0.2
Notch/Denticulates	38	6.1
Retouched Pieces	40	6.4
Total	627	

Table 4 Preliminary Analysis of Yutil al-Hasa (WHS 784) Tools.

reflect processes similar to those generating the abundance of shatter at the site.

The tool assemblage is primarily nongeometric microliths (see Table 4), suggesting that activities at Yutil al-Hasa may have been limited to a small range of tasks. Nongeometrics are dominated by attenuated curved (narrow double arched) bladelets and curved bladelets (which together make up about half of the nongeometrics); other forms include Ouchtata bladelets, pointed/spike bladelets, truncated bladelets, fragments, and a small number of Dufour, La Mouillah, and Qalkhan points. Some of the Qalkhan points appear to be unfinished examples. There are also a small number of geometric microliths, which mainly are trapeze or rectangle forms. These likely are linked to the manufacture of backed and truncated microliths found in the nongeometric class. The larger tools include endscrapers, retouched pieces, notch/denticulates, truncations, burins, and rare backed pieces and perforators. Sidescrapers are found in Special Tools.

Summary

The 2010 excavations at Yutil al-Hasa (WHS 784) opened seven units of varying sizes (see Fig. 2). These were placed to investigate the lower rockshelter and a probable upper rockshelter. The overall dimensions of the lower rockshelter Early Epipaleolithic are now known to be approximately 90 m^2 (essentially most of Areas C and F). The effort to find additional in situ Early Epipaleolithic occupation in the upper rockshelter was not successful, as the deposits in the new Area E units were mainly colluvial.

Cultural materials recovered were primarily lithics, with abundant evidence for microburin technique and the manufacture of nongeometric forms of microliths, especially narrow, double curved (attenuated curved) bladelets and curved bladelets. These are typical of the Nebekian industry. Other tools such as endscrapers, burins, truncations, and backed pieces are rare. Faunal preservation was not exceptional, however, some levels did preserve identifiable elements; analysis of these is on-going. Interestingly, as in the 1993 and 1998 excavations into the Early Epipaleolithic occupation, examples of fossil shark teeth were found in the new units in Areas C, E, and F; possibly these were collected and brought to the site by its inhabitants. Minute charcoal fragments were recovered from levels in Units F2010-2, C2010-1, and C2010-3. These will provide the first radiocarbon dates for the Early Epipaleolithic phase of occupation at Yutil al-Hasa. Pollen, phytolith, flotation, and geoarchaeological samples from the levels in the various excavation units currently are being analyzed.

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A Late Neolithic Dwelling at Wisad Pools, Black Desert

Gary O. Rollefson, Yorke Rowan, and Megan Perry

Introduction

Approximately 100 km ESE of Azraq, Wisad Pools (Fig. 1) consists of a series of natural basins in a short (*ca.* 1 km) wadi that leads from a plateau to another lying only 8-9 m lower in altitude. The landscape is characterized by a Late Miocene basalt cover (thus the name "Black Desert") overlying undifferentiated (or at least unnamed) Middle to Late Eocene limestone formations and perhaps the Early Miocene Qirma calcareous Sandstone formation (Rabb'a 2000). The landscape in the local area includes low hills and numerous extensive mudflats (*qi'an*) that collect surface runoff when precipitation in the rainy season pelts the denuded hard-packed silts and basalt blocks in the winter rainy season.

Although known to local Bedouins, to Jordanian and Syrian hunters, and researchers concerned with desert ecology for many years, the archaeological character of the Wisad Pools area was not acknowledged until 2002 when a survey included a stop at this concentration of prehistoric archaeological remains (Wasse and Rollefson 2005). Subsequent surveys and mapping followed in 2007, 2008 and 2009 (*cf.* Rollefson *et al.* n.d.-a) , and in 2011 we undertook continued mapping as well as limited excavation of structures that were densely distributed over an expanse of *ca.* 1.5 x 1.0 km.

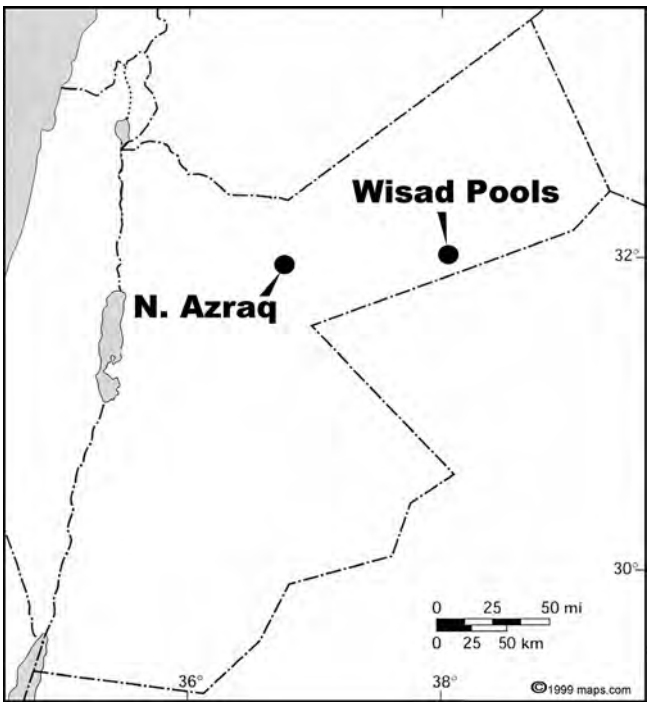

Fig. 1 Location of Wisad Pools in the Black Desert of Eastern Jordan.

There are hundreds of structures (Fig. 2), all constructed of local rectangular basalt slabs and more irregular blocks, that fall into several major types, including large multi-chambered tumuli (as evidenced by looting); smaller, lower mounds that also appear to be mortuary in nature; impressively massive towers, sometimes with attendant "chains" or "tails" of smaller (*ca.* 1 x 2 x 1 m) chambers or basalt piles of various lengths; what appear to be open-air buildings with interior features suggesting non-residential (ritual?) functions; "lanes" or pathways outlined by small basalt boulders that continue for tens of meters but that do not have obvious origins or destinations; small and large enclosures with walls of basalt boulders and slabs collected from the interiors of the enclosures, exposing floors of accumulated light-colored silts in the process; probable residential compounds with interior structures that may represent dwellings, animal enclosures, and storage facilities; circular platforms (*ca.* 2-4 m diameter) that perhaps represent either burials or work/storage areas; and lines of adjacent rectilinear chambers (each *ca.* 2 x 1 x 1m, from four to eight in a line), which may have been storage features for pastoralists who visited the location on a regular basis. Overall, we interpreted the site as being an enormous necropolis with occasional visits by pastoral groups that may have had no direct relationship to mortuary activity.

Surface artifacts are generally rare across most of the site, although the top of "Late Neolithic Hill" includes dense distributions of Epipaleolithic cores, tools, and debitage as well as highly concentrated clusters of Late Neolithic chipped stone artifacts that overlap Epipaleolithic chipping areas. To the north, near the uppermost pool in Wadi Wisad, looters working in a couple of areas have dug through Middle/Late PPNB chipped stone material in relatively high quantities also. But for most of the expanses between structures there is a light dispersion of usually small-sized debitage characterized by steep, broad, single-facet platforms. There are rare fragments of tabular scrapers usually associated with a structure. Taken altogether, this "background noise" of debitage could have dated to the Late Neolithic, the Chalcolithic, or the Early Bronze Age (or all three periods).

Based on research in other arid areas of the Levant and farther afield, much of the architecture seen at Wisad was deemed to reflect principally Late Chalcolithic or Early Bronze construction, especially the buildings that could be interpreted as mortuary structures (Steimer-Herbet 2004), and there certainly are many points of similarity across much of the desert region (*cf.* Braemer *et al.* 2001; 2010). We selected several

Fig. 2 Numbers refer to structures mapped in 2009. The W-66 complex is indicated by a white rectangle in the center of this aerial photo. (Photo: D. Kennedy).

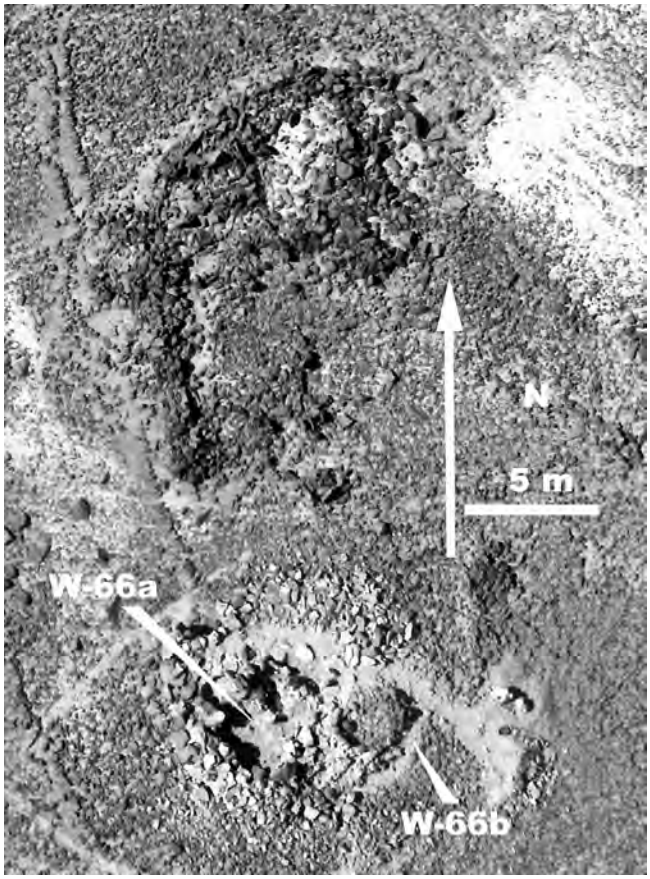

Fig. 3 Relationship of W-66a and W-66b is shown in this kite aerial photo. The role of the large structure (W-65) at the top of the photo remains unknown. Orientation of north arrow is approximate. (Photo: W. Abu-Azizeh).

constructions we took to represent tombs that appeared to have been looted in the past; one of them turned out not to be associated with mortuary practices at all, and it was built much earlier than the Chalcolithic period.

The Late Neolithic Dwelling and Platform

W-66 was a building complex that appeared to all outward appearances to have been a low tower tomb whose ceiling had been disturbed by looters. The dimensions of the larger circular element (W-66a; Fig. 3) were difficult to assess due to the collapse of many huge basalt blocks, up to a meter in length, 40-50 cm wide, and 10-20 cm thick, which were lying piled all around the virtually invisible exterior of the structure's wall. Adjacent to it on the eastern side was an even lower curvilinear platform (W-66b) paved with relatively small (*ca.* 30-35 cm average maximum dimension) basalt blocks.

W-66a

The top of the tumble of stones in the main part of the complex was less than 2 m above the present ground surface. Excavation of this unit revealed several phases of intensive occupation with intervening periods of little evident activity. The earliest phase represents a low circular or sub-circular one-room construction that incorporated a gypsum plaster floor, which lies 35 cm below the modern ground level to the west of

Fig. 4 a View of W-66a (left) and W-66b (right) towards the NE. b Condition of the top of W-66a before excavation. (Photos: G. Rollefson).

Fig. 6 A niche in the SE corner of W-66a; note the jutting stack of basalt slabs at the right, probably to stabilize the corbel stones. Two gypsum plaster patches are inside the niche, and another is at lower right. (Photo: M. Perry).

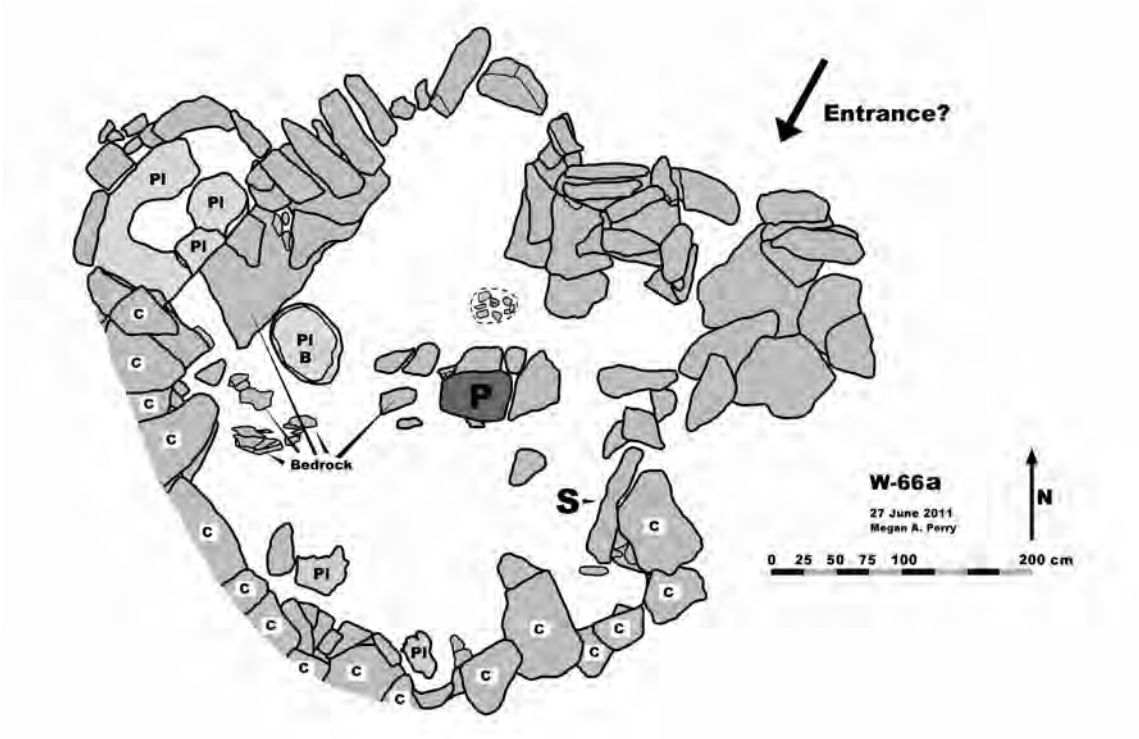

Fig. 5 Top plan of the earliest phase(s) of construction and occupation of W-66a. C = corbeling stone; S = possible anthropomorphic standing stone; P = central pillar; Pl = plaster; and Pl B = plaster basin. (Drawing: M. Perry and G. Rollefson)

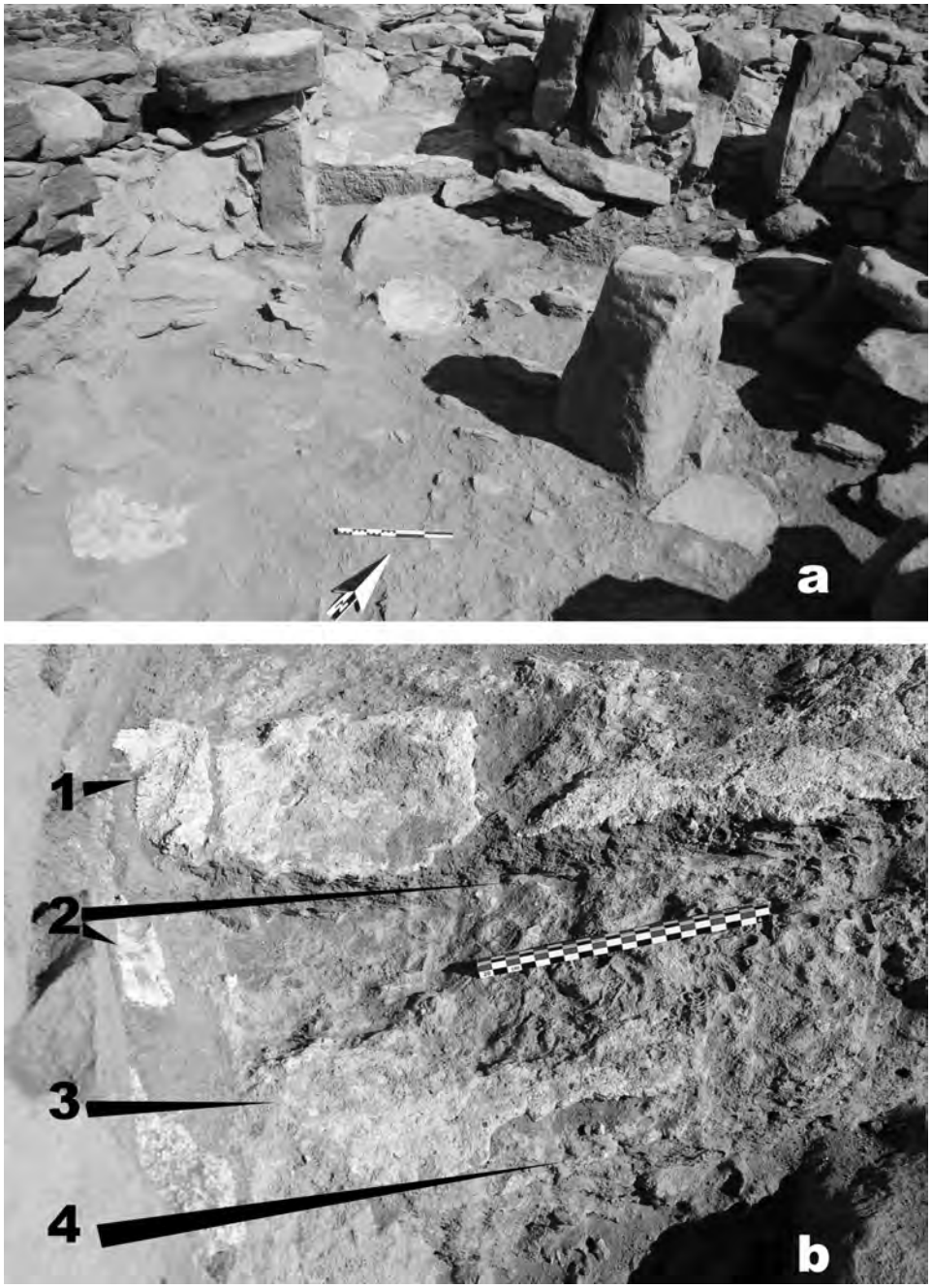

Fig. 7 a: View towards the northwest of the plastered alcove (top center). The plaster basin is between the pillar (center) and the basalt bedrock outcrop. Scale = 40 cm; b: close-up view of the plaster episodes in the alcove – numbers point to the different layers. Scale = 20 cm. (Photos: a: M. Perry; b: Y. Rowan).

the building (Fig. 5). The room measured *ca.* 4.25 m from the western edge of the large basalt bedrock slab in the northwest part of the room to the SE corner, although the room may have been extended by almost a meter at a later time (see below). The floor included a plaster basin near the western side of the room. The basin was elliptical with a major axis of 58 cm NW/SE and a minor axis of 44 cm SW/NE. The plaster of the basin was about a centimeter thick, which matched the thickness of the floor plaster preserved in several patches near the southern wall of the room. The basin was probably simply a depression excavated about 5 cm into the level floor surface and coated with plaster when the floor was laid.

Dominating the center of the room was a large basalt pillar 102 x 44 x 30 cm; having calculated the density of the basalt in the area to be 3.7 gm/cm^3, this feature weighs 500 kg. The western, southern, and southeastern walls show clearly that the construction here involved several straight wall segments consisting of stacked basalt slabs. Each segment was angled slightly in relation to its adjacent neighbors, so that the interior geometry (at least) was not curvilinear but polygonal. The height of the stacked slabs was approximately 50 cm, at which point the succeeding stones above were corbeled towards the center of the room, eventually reaching the central pillar that served as the central support for the last corbeling stones. The corbelling stones were huge, measuring more than a meter in length in many instances and with widths reaching 80 cm; average thickness was between 10-15 cm, with estimated weights up to a couple hundred kilograms each (though there were also some much smaller). At the "corners" of the segments of the polygonally-arranged walls there were occasional columns of smaller flat slabs stacked ostensibly in order to increase the stability of the corbeling (Fig. 6). The upshot of this design is that the inhabitants would have virtually had to crawl about in the room, with a roof only a meter high at its maximum and reduced to only half that dimension near the walls.

At the northwestern edge of the room, and possibly added at a later time during the initial phase of occupation, there is an alcove measuring 1.5 m SW/NE by 0.85 cm NW/SE. Gypsum plaster was used to surface the floor of the alcove at least four times, and the last plastering episode is 28-35 cm higher than the floor level in the main room (Fig. 7). The alcove is set relatively far from the pillar, adding a decidedly asymmetrical aspect to the structure.

At the opposite side of the room there is a flat standing stone 93 x 90 x 10 cm (*ca.* 300 kg) standing against

Fig. 8 View towards the east. The standing stone partially blocks the compartment immediately east of it. The "column" just above the word "stone" in the image is not original: we left it in place to support the corbel stone above it. (Photo: G. Rollefson).

Fig. 9 View towards the NE. The on-edge stones at the left and top were erected on fallen stones from the earliest phase of use. The pillar is at center right, the plaster basin and basalt outcrop at lower right. Note the dimpled surface of the floor due to the dense presence of insect pupation chambers. Entrance to this later series of use phases may have been from the area to the upper left of the pillar. (Photo: G. Rollefson).

the eastern wall. The top of this slab bears "shoulders", although these are natural contours and not the result of intentional shaping. The stone now leans considerably to the west as a consequence of the roof collapse; likely the corbel leaning against the upper part of the standing stone in Fig. 8 once rested on top of it. The base of the standing stone is at floor level, but it is possible this is a later addition to the room since it partially blocks access to the niche immediately behind it.

There was no dense accumulation of ash or fire-cracked rock inside the structure during this phase of occupation; however, there was a light concentration of charcoal and ash from a restricted area on a circular bed of cobbles just to the north of the pillar. If the occupation of the structure was seasonal, as one would predict if the patterns of precipitation were anything like modern ones, the small hearth may have furnished some heat and light during the winter nights.

The end of the earliest phase of habitation is marked by the accumulation of sediments atop the floor, after which there is no longer any use of gypsum plaster. Layer 5, which is practically devoid of stones, may have been accumulating over the original floor before abandonment, but after about 20 cm of sedimentation, the structure appears to have begun to deteriorate. Layer 5 is characterized by dense concentrations of cemented beetle pupation chambers (Fig. 9), suggesting a sustained interval of abandonment. Lithics and animal bone are relatively rare, and only two grinding stone items were recovered from this layer. In Layers 4 and 3 cobbles and boulders of around 35 cm maximum dimension appeared throughout the room, and handstones, grinding slabs, and chipped stone tools were densely dispersed throughout the layers. Moreover, in both layers there were frequent masses of animal bone of ovicaprid and equid sizes. Layer 2 was less heavily productive of bone and tools, although a cache of nine pestles of differing sizes as well as a huge handstone were placed in the upper reaches of the niche at the right in Fig. 6.

Layers 2 through 5 indicate that there were occasional uses of the shell of the structure of undetermined durations. During these sojourns the northern side of the building was probably altered considerably. The area to the northeast of the axis from the standing stone at the eastern wall and the northern wall of the north alcove (Fig. 5) did not provide any evidence of the wall structures and corbel arrangements noted for the first phase(s) of use in the other half of the structure. In fact, many of the on-edge slabs at the periphery of the north and eastern sides of the building suggest they may originally have been corbel slabs that were part of the initial occupational phase. Fig. 9 demonstrates that the erect stones on this side of the structure are at a minimum of 35 cm (and up to 60 cm) above the original floor. What had originally been a well-built lodging had become a work area for tool manufacture, butchering, and plant food processing.

W-66b

Adjacent to the east of W-66a (we did not have time to determine the stratigraphic relationship between the two) is W-66b, a platform 3.25 m in diameter and *ca.* 40 cm high, except for three larger standing stones (40-75 cm high, 40-70 cm wide, and 10-20 cm thick) on the eastern and western edges. The axis of the central stones of the two trios of stones was to the north of true east. The platform consisted of several layers of small (25 x 15 x 5 cm) flat stones placed on top of each other. Removal of the northern and western sectors in arbitrary layers indicated that the platform was probably a work area (much debitage and many chipped

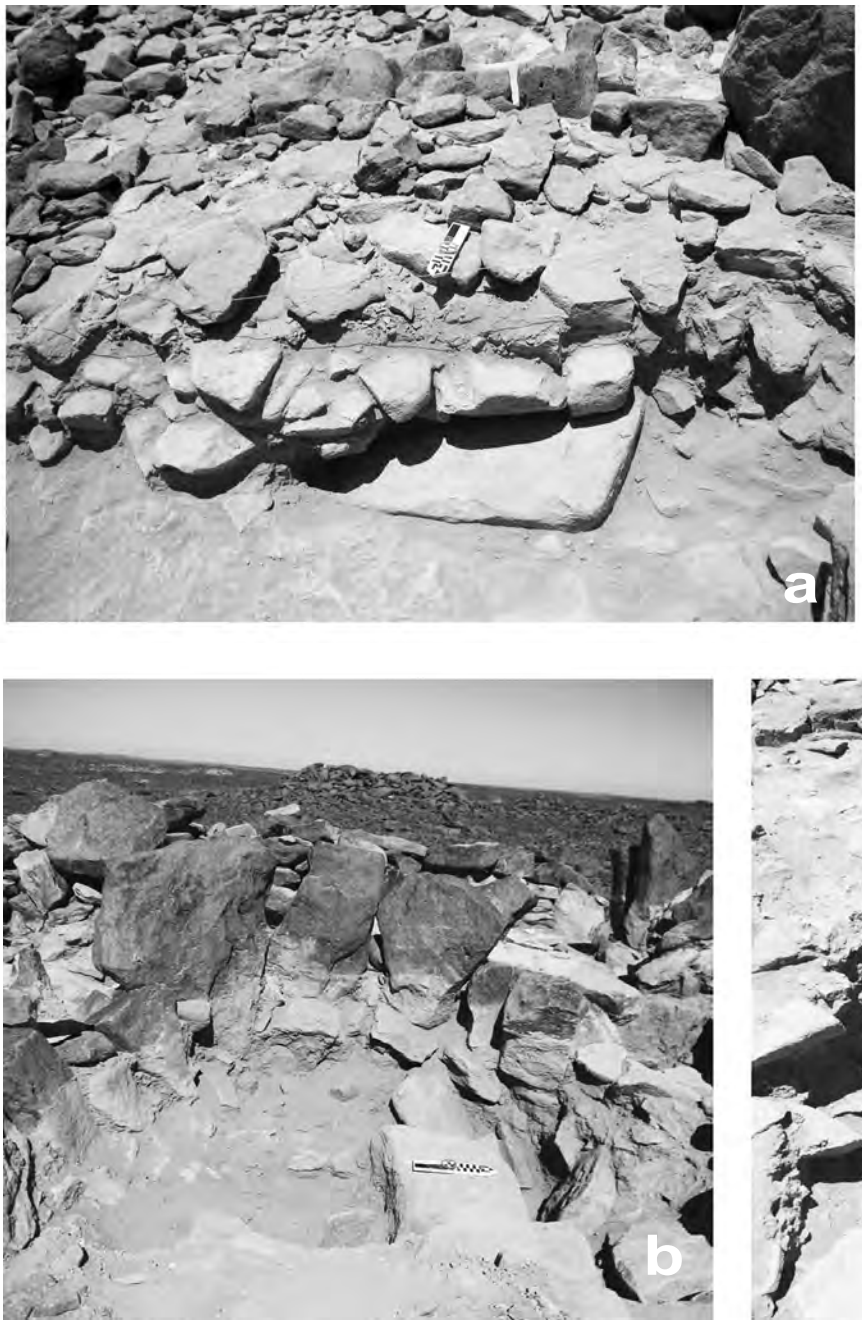

Fig. 10 Subsurface stone enigma in W-66b. a: Beneath several layers of flat stones of the platform is a horizontal large rectangular basalt slab; b: the horizontal slab in relation to the western trio of standing stones of the platform; c: The triangular arrangement of stones under the horizontal slab. (Photos: G. Rollefson and M. Perry).

stone tools, though rare animal bone) that may have also served to store goods above ground level during the rainy season.

During the removal of the layers of stones, a large basalt slab (98 x 37 x 10 cm) was found lying horizontally in a N-S direction directly over a small triangular arrangement (sides *ca.* 60 x 75 x 80 cm) of small flat stones; excavation within this delimited area encountered only sterile soil to a depth of 25 cm.

As mentioned, the precise stratigraphic relationship of the platform with the larger W-66a structure has not been determined, but in view of the typological character of the artifacts (particularly arrowheads), W-66b at least overlaps the use of one or more of the phases of W-66a. There was no indication of the use of fire in any part of the platform.

Artifacts

There has been no opportunity to undertake intensive investigation of any of the chipped stone, ground stone, potsherds, faunal remains, or small finds from the W-66 complex. Nevertheless, from the recovered in situ artifacts, it is clear that we are dealing with an early part of the Late Neolithic.

In terms of ceramics, one excellent example of a Yarmoukian herring-bone incised and painted fragment

that included a handle was found, virtually identical to one from ‘Ain Ghazal (Kafafi 1990: Fig. 10), though other potsherds remain to be examined. We retrieved more than 40 in situ arrowheads from inside W-66a and W-66b, all of them Haparsa, transverse, or other Late Neolithic types (Fig. 11); based on this information, one can conclude we are dealing with a period in the earlier part of the Late Neolithic, between 6,500-6,000 cal BC. Tens of thousands of pieces of debitage (including retouch flakes and debris) were recovered from the sieving of sediments through 5 mm mesh screen. There are also two figurines, one of an exotic fine-grained sandstone that might represent an ovicaprid or even a dog, and another of very fine-grained basalt not known in this region that could be a stylized human (Rollefson *et al.* n.d.-a). Faunal remains became very abundant in Layers 3 and 4, and although we are awaiting professional analysis, ovicaprids, gazelle, and equids all appear to be present. Beads of both Dabba marble and malachite were also found throughout the structure, as was a broken bladelet of dark speckled obsidian notched bilaterally at the base, very similar to the proximal end of a Helwan point.

Discussion

The four plaster episodes in the northwest alcove indicate that there were repeated visits to the building, and the five or more centimeters of silt accumulation between the plaster layers suggest there may have been relatively extended periods of absence, perhaps coinciding with prolonged periods of decreased rainfall that would have fed into the pools of the wadi (*cf.* Rollefson *et al.* n.d.-b). The use of gypsum plaster on the original floor and several times in the alcove is curious, since

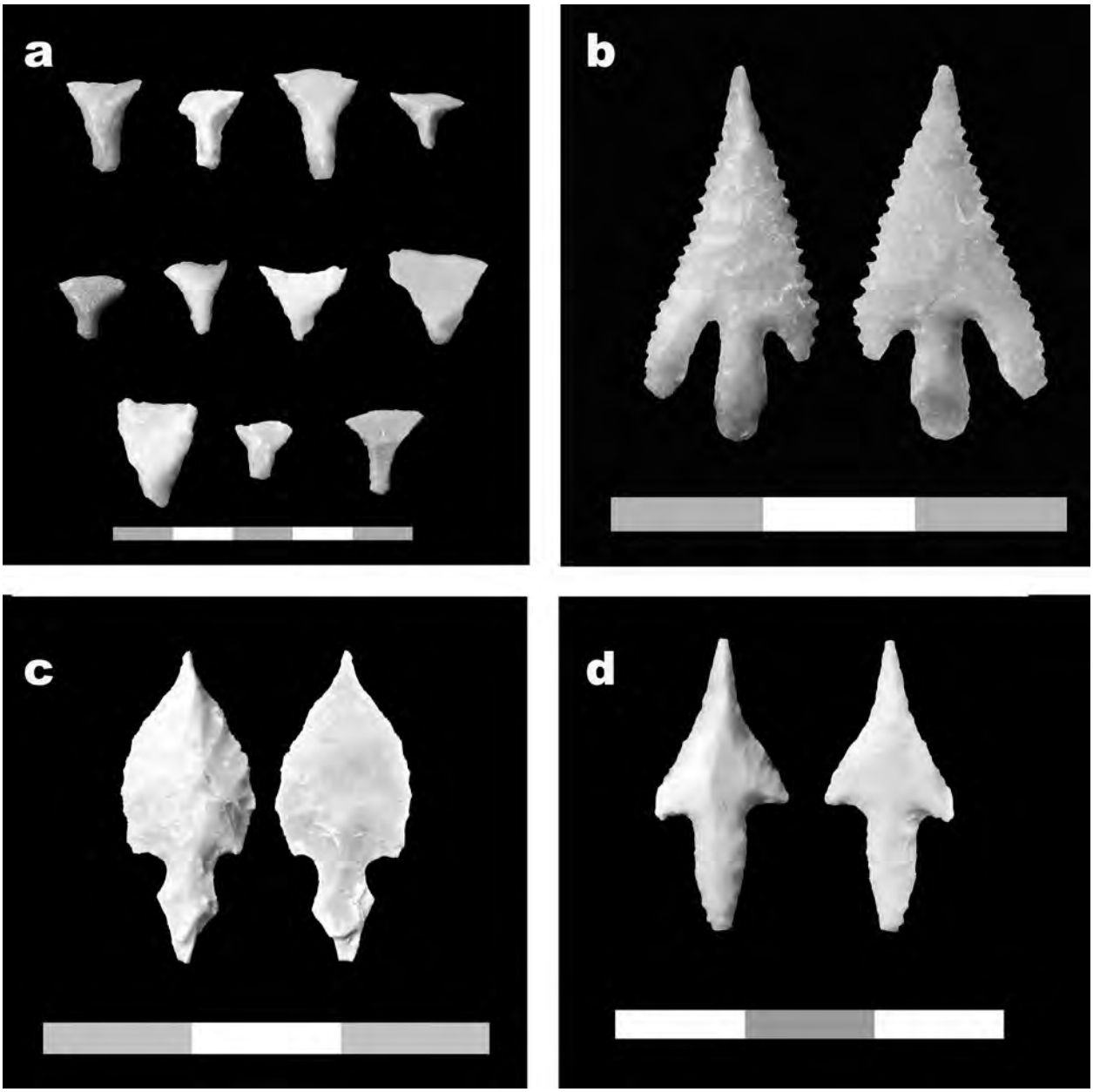

Fig. 11 a: transverse arrowheads; b and d: Haparsa points; and c: Late Neolithic arrowhead. (Photo: G. Rollefson).

gypsum plaster has no waterproof qualities that might have been desirable during the rainy season; perhaps this was simply to provide a brighter interior to an otherwise enclosed structure?

At this point in our analysis, the only report of early use of corbeled roofing comes from the EB-I site of Khirbet al-Umbashi (Braemer and Sorins 2011; Braemer *et al.* 2010), although in those cases the buildings were long and narrow and incorporated several pillars as corbel supports. Nevertheless, W-66 appears to be a model that dwellers of the Black Desert found to be effective shelters that would span several thousand years of use and modification.

Of particular interest is simply the fact that W-66a was not just a tent foundation or a simple hut, but a well-constructed permanent (in the sense of durability) building for long-term use, even if that term was interrupted occasionally by climatic vagaries that made return to the specific location impossible. The collapse of the sturdy structure also raises the possibility that there may have been one or more tectonic events during the latter part of the 7th millennium, and that later visitors were content with using the shell of the southern part of the building as part of a more ephemeral shelter for tool manufacture and food processing.

In any event, one must confront the climatic models that indicate a severe decrease in rainfall around the 8.2 kya "event" (*e.g.* Weninger 2009, and references therein), which suggests that a sudden decrease in temperature and precipitation may have resulted in intercontinental deterioration of environmental conditions sufficient to cause widespread abandonment of Late Neolithic settlements from eastern Europe through the Levant. The information from W-66 does not, in itself, indicate sufficiently that the 8.2 kya event didn't occur, but there is the possibility that the effects witnessed in the coastal regions of the Mediterranean may not have pertained to the same degree farther inland. The proxies used for paleoclimatic reconstructions come almost exclusively from the coastal/Mediterranean areas of the Levant, and we suggest they are not entirely applicable to the interior areas. We agree whole-heartedly with Braemer and Échallier (2004) that the landscape we see today throughout the Black Desert has been created as much by human/economic factors (especially overgrazing and fuel collecting) than by climatic change alone. What we have recovered from W-66 indicates that the Late Neolithic residents had ample resources to support large-scale investments of labor to construct permanent dwellings, even if they would only be used on a discontinuous basis. The landscape we see today in the Black Desert is one of dismal and bleak expanses of basalt and sand, but this is not what our Neolithic ancestors enjoyed.

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Insights into PPNB Architectural Transformation, Human Burials, and Initial Conservation Works: Summary on the 2010 Excavation Season at Shkārat Msaied

Moritz Kinzel, Aiysha Abu-Laban, Charlott Hoffmann Jensen, Ingolf Thuesen, and Marie Louise Jørkov

Introduction

Since 1999 the MPPNB site Shkārat Msaied has been excavated by a Danish team from the University of Copenhagen, and throughout eight consecutive campaigns app. 600 m^2 of the settlement was exposed (Hermansen *et al*. 2006; Kinzel 2011). The team returned in the summer of 2010 with two main objectives: to resume further excavation mainly in the southern area of the site, and to conduct preliminary preservation and conservation operations.

Shkārat Msaied is situated *ca*. 13 km north of Petra in the Nemellah region and consists mainly of circular architectural structures which are arranged in clusters. There are open spaces and passages in between the clusters and also smaller room arrangements, and semi-circular enclosures connected to some of the larger buildings (see Fig. 1).

The results from this season have led to some revisions of the occupation history of the site, as up to six construction phases are identified altogether. Some of the buildings – among others F – have more than two building phases, and most importantly some buildings such as building H bear clear evidence of alterations to more sub-rectangular layouts. Three further human internments containing more than 30 individuals were uncovered from building F. Simple, low impact conservation and preservation techniques of primarily the northern and centrally situated buildings were carried out. Using local material for conserving the constructions proved to be the most suitable at the time being.

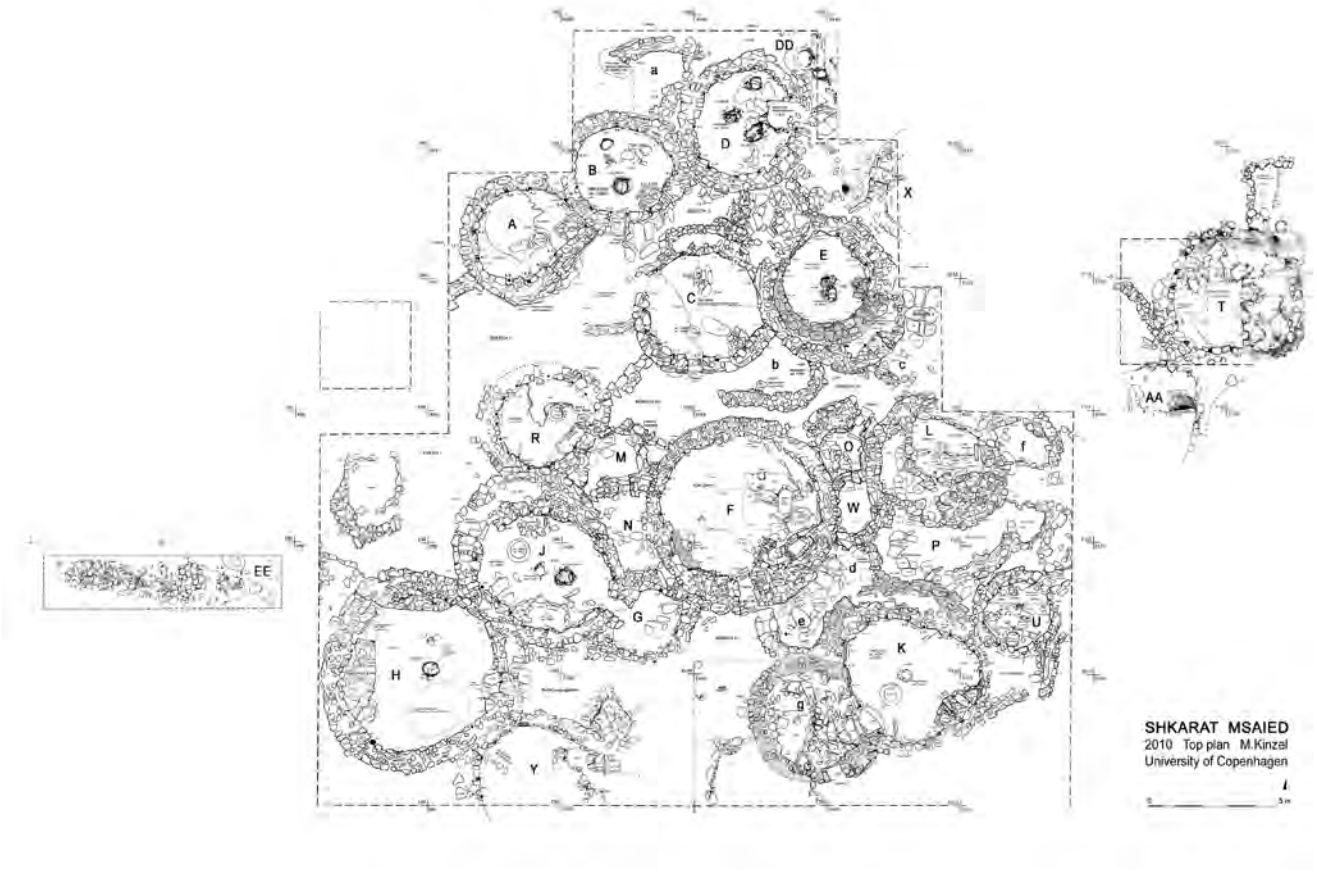

Fig. 1 Site plan, 2010 (after Kinzel 2011: Fig.2.007).

Building H

Building H is one of the largest buildings discovered so far having a surface interior of *ca*. 28 m^2. The floor surface was covered with plaster material and is intact in restricted areas. Damage to the floor is most probably caused by heat as a consequence of burning of the building.

A couple of large sandstone slabs were found among the collapsed wall and roof material. These stone slabs bear similar characteristics to the ones observed in building K and thus confirm the theory that large sandstone slabs were placed on the roofs used probably as work platforms (Kinzel 2011). One stone ring – measuring 40 x 40 cm – has a central circular hole measuring 17 cm in diameter. This stone ring might have been used in the roof construction as a frame of a ventilation opening (see Fig. 2). The other large stone feature worth mentioning measures 88 x 152 cm and is 8-13 cm thick (see Fig. 3). The stone slab has rounded edges with pecking marks in one end, and it is tempting to conclude that this stone was originally situated in an upright standing position similar to what has been observed in many of the other buildings such as F and K. Although the function and the original location of the stone slab are unclear, the context implicates that the stone slab seems to have been placed on the roof.

Eleven so-called "wall channels" or "post sockets" were identified along the inner face of the walls, as well as two door beams and a central roof post hole. Two entrances were documented; an eastern and a western entrance; the latter was blocked during the life span of the building. The eastern entrance had at least four stone slabs serving as a staircase leading down to the building. The entrances are quite wide compared to the other buildings, as they measure roughly 75 cm.

Building H has proved to be one of the largest buildings in the settlement. There is a question if it served a "special purpose" function as is the case with building F and K (Hermansen *et al.* 2006). The building might have been for communal activities, however the finds retrieved from this building do not particularly point to a specific activity as the finds include the regular ground stone tool inventory as well as chipped lithics.

The Missing Link?
Evidences of Sub-rectangular Constructions

It has previously been suggested that the partition walls belonging to the latest phase in building F were an attempt to create a more rectangular outline to the building. The walls run in a north-south direction on both sides of the building – *i.e.* the east and west (Kinzel 2004, 2011). This season alterations and additions in three buildings could also be of such attempt. In building H two wall segments – one in the west and one in the north – were added to the inner wall face of the encircling-wall of the building. These alterations to the building have transformed the outline of the building interior from circular to a sub-rectangular shape (see Fig. 1). In the area south of building F and west of building K a circular structure – Unit 'g' – was partly excavated, and seems to have been out of use, for part of building K was built into it and on top of the eastern half of the structure (see Fig. 4). Sometime during the use of building 'g', a wall segment was also added abutting the western wall, as it was observed in H. This gives the building a sub-rectangular or more polygonal outline. Finally, although badly preserved, unit DD, which is situated in the northern area of the site seems to be a rectangular or curvilinear building. A lime plaster floor, a few wall stones, and roof collapse material, together with a plaster feature and a post hole, are the only remains of this building. However, the dating of buil-

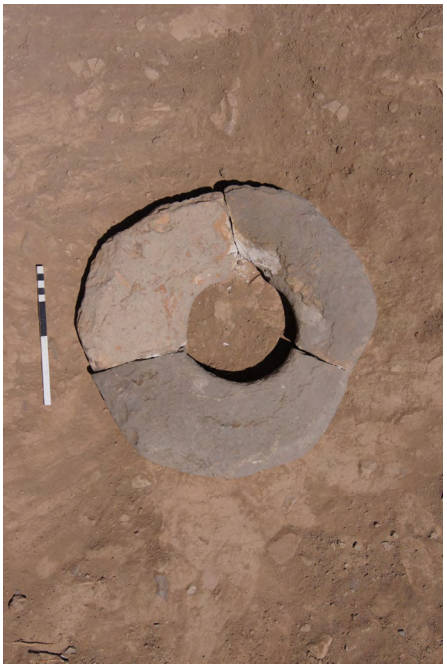

Fig. 2 Stone features in building H, stone ring.

Fig. 3 Stone features in building H: large stone slab with pecking marks and rounded edges.

Fig. 4 Building g (in relation to building K).

ding DD is still vague and conclusions have to wait until the ^{14}C samples are analysed.

Building F - Construction Phases

In most buildings two construction phases were identified, and in the 2003 season this was already established for building F. A white plaster floor under which most of the burials were interred belongs to the earliest phase. The later phase consists of a hard packed mud floor to which four partition walls belong as well as a stone circular construction situated at the centre of the building. This season, in the south-western part of the building, an even earlier plaster floor was uncovered. Part of an outer wall of the building was discovered which indicates that the original surface of the building was slightly smaller. Fill between the earliest occupation phase and the plaster floor is quite compact and clayey with an extremely low content of finds. This suggests that before expanding the size of the building and constructing the plaster floor, the building was thoroughly cleared and cleaned. Although only minor parts of the earliest phase have been excavated, it is suggested that the function of the building has clearly changed through its lifespan.

Human Burials

During the 2010 field season one burial cist (Burial 6) was discovered in the northeastern part of the building, and one intact burial of a child (Burial 8) in the south-western area of building F. Additionally, disarticulated smaller human and animal bones were found in the surrounding fill of Burial 6 and between Burial 4 and 3 (Fig. 5). The area around it and the top of burial cist 6 were covered with several flat sandstone slabs, as was also the case with the other burial cists (Burials 2-5). The bones found in Burial 6 and the surrounding area belong to a total 37 individuals (MNI) – 17 adults and 20 sub-adults. Based on the unorganized positioning of the remains, it can be determined that the burials are secondary, as the bone remains were placed in the cist after decomposition had taken place. The bones seem to have been directly dumped into the cist without sorting or properly organizing them.

Due to the poor state of preservation of the remains, little pathology could be observed. However, one child *ca*. 1 year old exhibited small porotic pitting in the orbital roofs (mild *cribra orbitalia* [CO]). This may be related to anemia or malnutrition, although the etiology behind CO is manifold (Ortner 2003). The lesion was healed, suggesting recovery. Another child – estimated to be at the age of 6 years, showed horizontal lines in the enamel surface (*enamel hypoplasia*) on some of

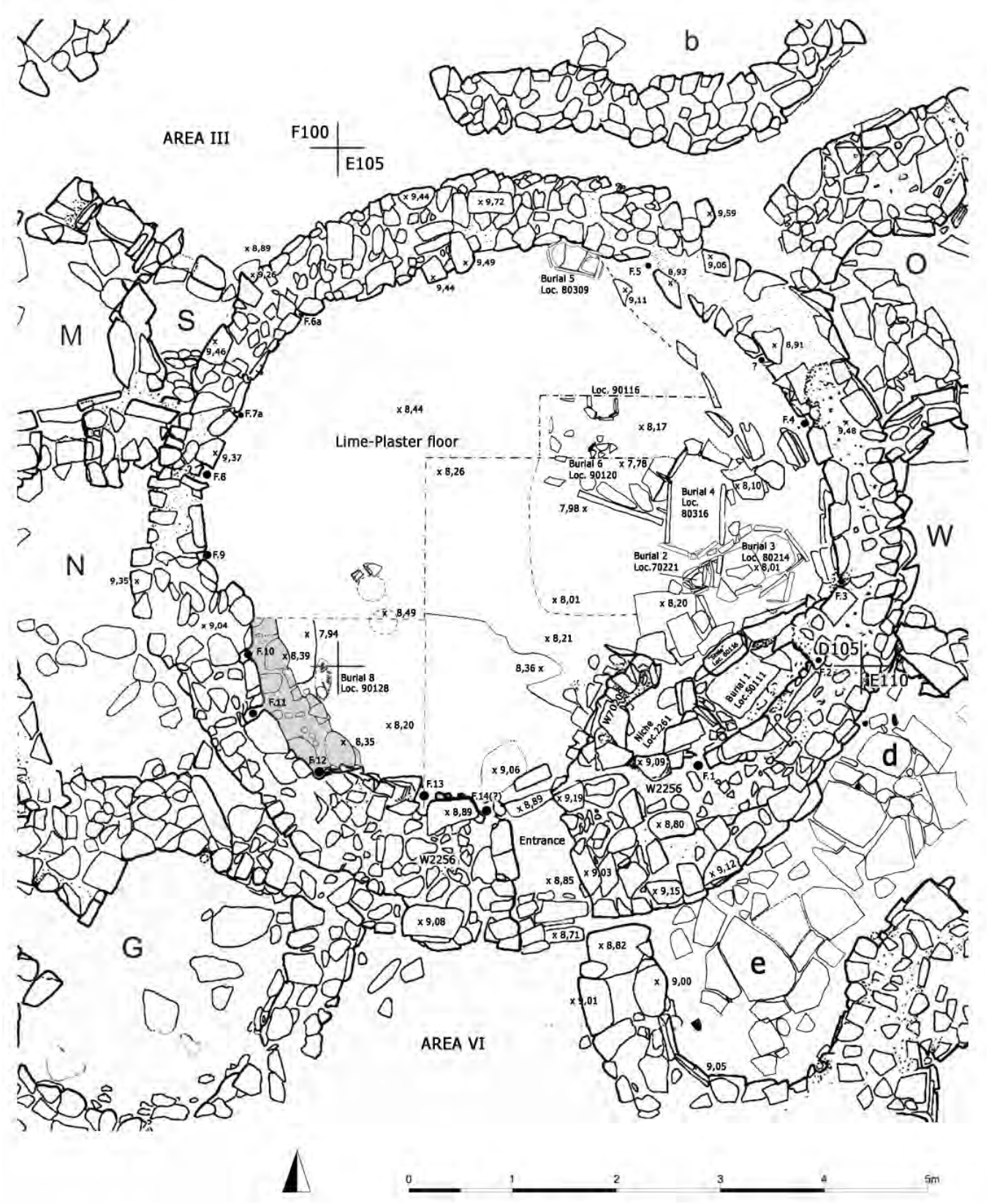

Fig. 5 Unit F plan drawing with indication of burial numbers (after Kinzel 2011: Fig.2.087).

the not fully developed teeth (permanent canines and lateral incisors in the *maxilla*). These lines indicate a disturbance in the formation of the teeth (enamel) and could be due to possible malnutrition, high fever or similar stress of the body (Hillson 1996). The position of the lines suggests the disturbance occurred when the child was 1-2 years old. A few single adult remains displayed degenerative joint diseases in foot bones or vertebrae, which could be due to overuse and stress on joints.

Burial 8 consists of an articulated skeleton of a 2-year-old child. This is the only complete intact skeleton

Fig. 6 Photo burial 8.

found in this building. The burial was oriented North-South with the face towards the west, and the child was placed in a foetal position (see Fig. 6). Similarly, a child burial was also found in the eastern area of building R, estimated to be 1 year old with the same foetal position close to the outer wall of the building. This burial is the first to be found outside building F, but this discovery does not change our previous interpretation of the function of building F as "an architectural frame for mortuary rites of the inhabitants" (Hermansen *et al.* 2006: 3).

So far a total of 55 inhumations (MNI) have been retrieved from building F alone, and it is expected to find further burials in the areas below the rest of the plaster floor.

The Finds

The finds consist mainly of chipped stone and animal bones as well as ground stone tools. The ground stone industry comprises a large number of grinders. The materials used to produce the grinders include limestone, granite and basalt as the most common. The grinding stones found were all fragmented. They are represented by seven examples, of which some seem to be unfinished and/or hardly used. A single mortar was found, as well as some pestles and pounders. The pestles are mostly of basalt, while the pounders are of various materials. Other stone objects deriving from this year's excavation include bowls, polishers and shaft straighteners (Harpelund 2011).

The chipped stone material has not been closely examined yet; however the material in general shows the bipolar knapping technology typical of the PPNB period. Some worked pieces were discovered among the chipped stone material. These mostly consist of arrowheads, primarily of the so-called Jericho type. A few sickle blades, borers, scrapers, knives and hammerstones were also identified among the assemblage.

A possible dump or flint workshop area was identified in the area west of building 'g' as a very high concentration of chipped lithics, counting more than 200 pieces from a very restricted space measuring no more than 90 cm^2 (see Fig. 1).

Preservation and Conservation Works

In order to avoid further damage to the uncovered archaeological remains, much effort was put on preservation and conservation this season. Most parts of the site were backfilled. The material used to backfill the buildings is of fine grained, sterile sand from the wadi adjacent to the site. The sand and its transportation was organized and conducted by the Petra Development & Tourism Region Authorities - Petra Archaeological Park & Cultural Heritage Department. According to the general guidelines for the preservation and presentation of sites within the framework of the "Neolithic Heritage Trail"-Initiative, to which Shkārat Msaied also belongs, it was decided to keep some of the structures without or with only a slight amount of backfill (Finlayson *et al.*2007; Kinzel 2008). For the completely backfilled structures, it was considered that the wall tops and upper wall parts be still visible in order to give visitors to the site a clear picture of the settlement layout.

Minor consolidation operations were undertaken, especially of the collapsed door demarcation stones and tumbled wall stones. These were repositioned and fixed by using simple soil/mud mortar as bonding agent. Also some voids in wall structures and open joints were filled with the same soil mortar. The mortar was produced with sieved soil taken from the excavation dump, wadi sand, and water. The mortar should only stabilize the structures as long as the final backfill is not finished. Sand material was then added both inside the buildings and outside in order to prevent fragile walls from further damage and collapse.

For the presentation of the larger houses in the southern part of the site, different concepts for presentation and preservation were discussed with the Petra Archaeological Park & Cultural Heritage Department. A final decision still awaits, although the buildings which bear a high risk of being further damaged, *e.g.* Building K, were also partly backfilled. The measures

taken during this season, *i.e.* cleaning, backfill, consolidation, access-regulation/fending should be seen as initial steps for more comprehensive site management and preservation investigations in the near future.

Acknowledgements. We thank our representative of the Department of Antiquities Talal Hamad al-Ammarin for his great support of our mission. Also our thanks go to the Petra Park Authority for their support and help to find adequate sand to start the backfill of the buildings and to organize the transport.

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2006 *Bridging the Gap between the Mediterranean and the Steppe: Lithic Technology in Late Neolithic Jordan*. PhD Thesis, University of Sydney.

Abstract

This dissertation considers the relationship between the Late Neolithic populations living in the Mediterranean region and badia of Jordan. In particular, this research will compare the lithic technology to determine if there is evidence of a single group of people moving between the two regions or if the populations in each region were predominantly independent of one another. The data generated from this research are applied to the debate over the appearance of ovicaprids in the badia, which proposes that they were either integrated into the economy of the existing hunter-gatherers (integration model), or that they were brought into the badia on a seasonal basis by Mediterranean villagers (fluctuating village model).

This dissertation can be divided into three sections. The first section introduces the research problem and provides the necessary background research, including an overview of the key sites and the material culture. The second section outlines the research methodology and presents the primary data, the analyses of the lithic assemblages from Pella and Umm Meshrat I. Finally, the primary data are compared with the assemblages from the badia.

This research demonstrates that the reduction strategies used in each region are disparate and the differences among the assemblages are not related to raw material constraints. Some similarities between the assemblages from the Mediterranean region and the badia were identified, suggesting that the populations may have originated in the same area. As there is a sudden appearance of sites in the badia in the Middle Pre-Pottery Neolithic B period and the knapping methods used at these sites includes techniques that were developed in the Mediterranean region, it is likely that the earliest Neolithic occupation of the badia migrated from the more verdant areas. Because the populations were largely isolated, their reduction strategies diverged over time, although some common techniques were retained. The conclusion of this research is that the populations living in the Mediterranean region and the badia were unique; thus, the lithic technology supports the integration model, whereby ovicaprids were adopted by the hunter-gatherers in the badia.

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2011 *Development, Continuity and Change: The Stone Industries of the Early Ceramic Bearing Cultures of the Southern Levant.* (Hebrew with English summary) PhD Thesis, Department of Archaeology, University of Haifa.
Supervisors: Prof. Mina Weinstein-Evron and Dr. Dani Nadel.

Abstract

This research focuses on the study of groundstone (henceforth=stone) assemblages and selected tool types of the Pre-Pottery Neolithic C (Final Pre-Pottery Neolithic B) and the Pottery Neolithic Periods. The study concentrates on a comprehensive analysis of the stone assemblages of the three major cultural entities of the Pottery Neolithic period, namely the Yarmukian, Lodian (Jericho IX) and Wadi Rabah cultures (the latter are considered here as representing the later parts of the Neolithic period). Pre-Pottery Neolithic C stone assemblages were examined here as a background to the appearance of the stone assemblages of the Pottery Neolithic period.

The chronological framework of this study ranges between ca. 7,000 and 5,200 years (cal. BC). This time span encompasses significant developments in the cultural and economic history of the southern Levant. These changes include, amongst others, the desertion of the large Middle and Late PPNB settlements; the establishment of new, usually small agricultural villages; changes in architecture; the digging of wells and the appearance of pottery vessels, which will become a part of the material culture from this point on. Significant shifts were noted in the flint industries, including a notable shift toward flake-oriented industries, changes in the frequency of arrowheads, as well as in their technology of production, typology and size. Changes also occurred in the sickle blades and bifacial tool assemblages, reflecting changes in the way communities exploited their environment. Important shifts were noted in the faunal and botanical assemblages in whom domesticated species gradually increase in frequency. At the end of the Pottery Neolithic period, during the time span of the Wadi Rabah culture, arrowheads virtually disappeared from most sites. This dramatic change accompanies the extremely low frequencies of hunted game in Wadi Rabah villages in the Mediterranean eco-zone.

These processes beginning in the early stages of the ‘Agricultural Revolution’ were apparently gradual. Some of them however would have far-reaching effects on social and economic processes locally and over a wider cultural and geographical arena. Possible examples include changes in the social importance of the ‘hunter’ versus the ‘herder’ and the ‘farmer’, increased importance of food producers and food

processors within the community, possible changes in social complexity, structure and hierarchy in some villages, as well as possible changes in the spheres of symbolism and beliefs. Some of these socio-economic changes are seen in the stone industry, specifically tools utilized in food processing, as well as various other crafts and tasks. Stone tools, such as grinding and pounding implements, vessels, mortars and bowlets, grooved items, weights and perforated pebbles, spindle whorls, maceheads, slingstones and flaked discs are conceived as distinct material culture items and as means through which Pottery Neolithic village communities exploited their environment and as tools to which social and economic significance and meanings were attached.

Their importance lies in the role they played in the seventh and Sixth Millennia (cal. BC) in the development of village communities during the Pottery Neolithic period. Different tasks and functions performed by these tools include the production, processing and distribution of food, and a wide range of applications such as processing materials other than food; the production and maintenance of tools; for shaping architectural features, wood, bone and stone implements, in the making of pottery vessels; weaving as well as fishing and hunting. Some of these implements may have been used in combat and ceremonies. Amongst the many uses of stone tools, only a few specific tools or tool types can be linked to particular functions. It seems that the versatile stone industry was employed in different modes of environmental and social adaptations with a wide variety of applications, specific raw material selection, technological choices in tool manufacture, techniques of tool use and stylistic preferences. The stone tools, however, constitute only a fraction of the social and economic fabrics of a whole range of cultural manifestations. Their social and economic significance is embodied in the reciprocal relationships with other kinds of material culture. The tools included in this research are but one part of a wide range of social and ecological adaptations of Pottery Neolithic village communities to their surroundings.

The main goal of this research was to study changes in the composition and characteristics of stone tool assemblages from the later parts of the Pre-Pottery Neolithic period through the end of the Pottery Neolithic period, in order to decode and understand their cultural significance. The study examines whether assemblages and selected tool types represent chrono-cultural changes during the Pottery Neolithic period, or rather reflect inter-site variability related to the geographic location of sites and their economic foci. In order to test the impact of the appearance of pottery on the stone assemblages, the research also investigates the nature of change in stone assemblages between the Pre-Pottery Neolithic C and Pottery Neolithic, specifically in the vessel group. To achieve the research goals, a standardized methodology was developed and employed. Through this systematic approach, selected assemblages belonging to the Pre-Pottery Neolithic C and to the three major cultural entities of the Pottery Neolithic period, the Yarmukian, Lodian and Wadi Rabah cultures and related assemblages were studied and analyzed. The detailed study encompasses over 3,000 stone tools retrieved from 13 sites and 20 chrono-stratigraphic horizons. These assemblages were examined through a specifically constructed detailed typological list, and their characteristics were recorded and analyzed through a comprehensive attribute analysis in order to enable the characterization and definition of the stone industries of each of the major cultural entities studied.

In addition to the typological analyses, other traits were investigated for each assemblage. These include selection of raw material for specific tool types; morpho-metric, technological and stylistic characteristics, as well as spatial information concerning the depositional context and discard patterns of stone items. In addition to the detailed analyses conducted on these selected assemblages, data regarding other relevant stone assemblages were collected from the available archaeological literature and integrated into the discussions. Relevant ethnographic literature on stone tools was also surveyed, and results and conclusions of a few experiments were incorporated as well. The entire data were examined in order to reach conclusions about the changes stone tool assemblages and specific tool types underwent from the later parts of the Pre-Pottery Neolithic C period through the end of the Pottery Neolithic period.

The study includes a preface (Chapter 1); a chapter surveying theoretical and specific background data regarding stone tool research, its advantages, limitations and accomplishments (Chapter 2); a chapter summarizing the chrono-cultural and geographic frameworks discussed in this study – from the last phase of the Pre-Pottery Neolithic period through the end of the Pottery Neolithic period in the southern Levant (Chapter 3). A comprehensive chapter is devoted to the methodology developed and terminology used in this study, including the typology that was utilized, the definitions of raw materials, technological data and other attributes (Chapter 4). Four chapters are dedicated to presenting the data collected from each assemblage studied or surveyed, and offer preliminary analyses and summaries of the recorded information. Each chapter deals with assemblages of one period or culture, namely the Pre-Pottery Neolithic C assemblages (Chapter 5), Yarmukian and other assemblages of the early part of the Pottery Neolithic period (Chapter 6), Lodian/Jericho IV assemblages (Chapter 7) and Wadi Rabah and other related assemblages attributed to the last phase of the Pottery Neolithic or the Early/Middle Chalcolithic period (Chapter 8). The final chapter (Chapter 9) summarizes and analyses the data presented in chapters 5-8 and discusses the results of the analyses, focusing on the nature and meaning of the changes in the stone assemblages and specific tool type during the Pottery Neolithic period. The standardized research protocol used in this study enabled incorporation and analyses of whole assemblages and specific tool types and their

characteristics in a single interpretive framework. The research of the stone tool assemblages from the periods under discussion shows that with the aid of a systematic methodology, stone tools can be analyzed and used to reflect on different social and economic aspects of archaeological and cultural entities. These observations can also be used to draw conclusions as part of broader studies, integrating data from other realms of material culture.

The results of the comprehensive study suggest that the stone assemblages of the Pre-Pottery Neolithic C represent continuity from those of the Pre-Pottery Neolithic B period, although the number and sizes of the assemblages studied preclude drawing clear conclusions on this matter. While some of the technological and typological characteristics of the stone assemblages of the early phases of the Pottery Neolithic period, specifically Yarmukian assemblages, signify continuity from the Pre-Pottery Neolithic C period, some of the attributes demonstrate unmistakable change. Stone assemblages of the Pottery Neolithic period reflect considerable investment in manufacturing stone tools, as well as in exploitation and use of 'expedient' tools. These clearly reflect different utilization techniques and purposes. Stone tool frequencies vary among assemblages but not in a systematic way. While chrono-cultural differences and similarities regarding the composition of stone assemblages and their characteristics were noted, the study clearly indicates that the relative frequencies of tool types and selection of raw materials are predominantly site-related and governed mostly by factors such as the geographic location of the site and its economic focus.

The study of Pottery Neolithic stone assemblages suggests that artisans were familiar with different raw material properties and the requirements dictated by tool function. This is reflected in the utilization of different carving and modification techniques suitable for specific tool types and raw materials. Furthermore, it seems that although stone tool assemblages present some general, chrono-cultural characteristics, conventions and constrains, their characteristics were also dependent on local demands and preferences for specific tools or raw materials.

One of the most intriguing conclusions of the study is that the appearance of ceramic vessels in the southern Levant did not have an immediate impact on the stone vessel industry. This may suggest that stone and pottery vessels were used differently or were made for distinct purposes, acting in different functional systems. Stone vessels are frequent in the stone assemblages and are one of the most significant components of this industry throughout the Pottery Neolithic period. However, a change in stone vessel characteristics (types, shapes, raw material selection) was noted in Wadi Rabah assemblages, in comparison with earlier assemblages of the Yarmukian and Lodian cultures. This seems to be part of a more general change in these assemblages, signifying the later parts of the Pottery Neolithic period and/or the beginning of the Chalcolithic period. These changes do not stand alone. They seem to be reflections of significant changes in the socio-cultural and economic patterns and foci of the later parts of the Pottery Neolithic period and the Chalcolithic period and represent the culmination of social and economic processes, which evolved from earlier stages of the 'Agricultural Revolution'.

The research demonstrates the potential embedded in stone tool research and its ability to contribute to improving our understanding of different socio-economic aspects of the cultures that flourished in this part of the Levant during the Pottery Neolithic period. Stone tools reflect a wide array of functions and techniques, which made major contributions to the development of agricultural villages during this time span. It seems that the importance of stone tools as a means through which Pottery Neolithic village communities exploited their environments provided these tools with special significance in both social and economic systems. This significance is linked to a growing dependence on self-controlled economic resources alongside technological achievements which improved the capabilities of food storing and processing during the development of the 'secondary product revolution'.

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2011 *Embodied Knowledge and Community Practice: Stone Tool Technologies at Fıstıklı Höyük.* PhD thesis, Department of Anthropology, Binghamton University
Supervisor: Prof. Reinhard W. Bernbeck

Abstract

This study explores questions of the formation and change of small-scale communities during the Late Neolithic Halaf period in southeastern Turkey. Through a technological and spatial analysis of ca. 5000 lithic artifacts from Fıstıklı Höyük (6080-5750 cal. BC), I have investigated issues of craft production and social organization. Based on the archaeological data, I was able to document communities of practice over the course of several occupational phases and interpret my findings in terms of routine practices, idiosyncrasies, and differential skill in the context of stone tool technologies of the Halaf tradition.

My thesis is part of a larger body of scholarly

work on village cultures of the Late Neolithic period in the Middle East. In my study, I have introduced the notion of 'communities of practice' (Lave and Wenger 1991; Wenger 1998) to contexts of lithic production at Fıstıklı Höyük in order to provide new understandings of the Halaf tradition. Doing so, I was able to discuss craft production in terms other than traditional approaches to standardization and specialization. My focus on practice-theoretical approaches has allowed me to propose a dissolution of a strict specialist/non-specialist distinction and develop a more realistic, dynamic understanding of technological practices.

Drawing on ideas from material culture and technology studies, as well as literature on apprenticeship, the notion of an apprentice who gradually grows into a community of skilled practitioners is central to my understanding of craft production (*e.g.*, Grimm 2000; Wallaert 2008). During this process, the artisan's gestures become more and more routinized and embodied, so that the steps by which the artisan produces objects are likely to be quite standardized throughout the production process and not just in some 'end product.' Yet, the practices of different artisans remain variable to some degree, depending on whether the community of practice to which a craftsperson belongs is larger or smaller, more or less constraining. I thus aimed at identifying small groups of artisans – or even individual craft practitioners – within classes of artifacts that are otherwise treated fairly normatively.

Applied to the archaeological context of Fıstıklı Höyük this means that if a number of skilled flintknappers worked together at the site, their sharing of skills and knowledge would have been expressed in relative similarity of artifacts. Consequently, it is 'likeness,' not absolute standardization, which becomes the defining criterion for a community of practice at Fıstıklı Höyük (*cf.* Castro Gessner 2008). The goal of my dissertation was to detect such likeness, or degrees of similarity, in lithic artifacts in order to trace communities of practice in the archaeological record. I set out to analyze how many communities of practice existed during each of the four Halaf occupational phases at Fıstıklı Höyük (Phase IV and Phases IIIc through IIIa); how these communities varied in terms of technological practices, including attitudes towards raw materials; and how they were organized spatially.

Methodologically, I looked at processes of lithic production with the aim of reconstructing chaînes opératoires (operational chains). Analytically, several similar operational chains – lumped into an aggregate chain – are understood as a correlate for a community of practice. Depending on the size and kind of a lithic operational chain, the scale of a community of practice is not defined from the outset, but identified empirically, so that a community could have formed on a scale below or above that of the whole settlement.

As a result of my research, I was able to demonstrate that a total of seven communities of practice existed at Fıstıklı Höyük, which engaged in expedient flintknapping activities. Over time, the number of communities increased and communities became more diverse (*i.e.*, they contained an increasing variety of formal tool types), although assemblages remained largely flake-based. Each of these communities was characterized by a high degree of similarity in terms of the technological practices of its members. Yet it was also possible to locate idiosyncrasies (statistical outliers) in the artifact assemblages. Based on my understanding that spontaneity and expediency were integral aspects of a Halaf life world, I have conceptualized these idiosyncrasies as practices of an individual artisan that were incorporated into a shared way of doing things rather than as categorical differences that distinguished one community of practice from all other communities of practice.

Another result of my analysis makes clear that variation in lithic practices may not always refer us to idiosyncrasies per se, but can also be explained in terms of differential skill (Bamforth and Finlay 2008; Bamforth and Hicks 2008). This is reflected in the archaeological record in the form of the merging or splitting of operational chains at moments when artisans chose to follow slightly different production paths. For example, it appears that at times more skilled artisans branched off from the main production sequence, following a separate operational chain; at other moments in the production process, artisans merged production paths when they worked closely together, applying a smaller range of practices that required less skill.

Last but not least, while it is clear that the communities of practice at Fıstıklı Höyük grew larger over time, this increase in size does not appear to be proportional to the growth of the settlement itself. Whereas there was one community of practice in the earliest occupational phase (IV), I could trace two communities of practice in each of Phase IIIc and IIIb, and three communities in the latest occupational phase (IIIa). However, based on a spatial analysis of artifact densities within the site, I was able to discern a differentiation of communities of practice in terms of the intensity with which they engaged in flintknapping activities. Communities of practice at Fıstıklı Höyük worked in the short term up until Phase IIIb; in Phase IIIa we find two communities working in the short term while a third and much larger community worked continuously or year-round. Short-term work also characterizes those communities of practice that were composed of artisans with higher skill levels, thus suggesting that in the Halaf tradition skill was located within a general habitus of spontaneity and not, as is often assumed, in the continuous work of so-called full-time specialists.

Notwithstanding these developments, communities of practice at Fıstıklı Höyük used spaces in a shared manner throughout all occupational phases. In other words, spaces within the site were either shared by several communities of practice or used in multifunctional ways, that is, for carrying out several successive production steps in the same spot. Of course, it is very well possible that these areas were not

only used for flintknapping activities, but that social events – including 'mundane' socializing – took place here as well. Working in such shared spaces would likely have exposed artisans to social scrutiny (Pollock and Bernbeck 2010). This might have contributed to a tighter web of social relations as well as to cooperation between artisans. As a result, we should understand social organization at Fıstıklı Höyük, and possibly also at other Halaf sites, as characterized by open social networks. In the context of such networks – highly flexible, dynamic, and fuzzy in nature – people operated on the basis of skilled practice, thus integrating routine flintknapping practices with idiosyncrasies and differential skill levels.

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