J.-M. Le Tensorer, R. Jagher & M. Otte (eds.). *The Lower and Middle Palaeolithic in the Middle East and Neighbouring Regions.*
Basel Symposium (May 8-10 2008).
Liège, ERAUL 126, 2011, p. 101-114.

CAPTURING A MOMENT: IDENTIFYING SHORT-LIVED ACTIVITY LOCATIONS IN AMUD CAVE, ISRAEL

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Introduction

Some fundamental principles of spatial organization are shared by extant humans regardless of ecological and cultural settings (David & Kramer 2001). Segregation of activities in space occurs in the context of mundane subsistence and maintenance activities and as a means of demarcating cultural and social relations within groups, e.g., by gender, age, familial relationships and social status (Binford 1978, 1982, 1998, 2001; Gargett & Hayden 1991; Hitchcock 1987; Kent 1990; O'Connell 1987; O'Connell *et al.* 1992; Yellen 1977). Evidence accumulated over the last two decades suggests that spatially-organized behavior within dwelling localities is not exclusive to recent modern humans, and that it possibly dates back to the early Middle Pleistocene (e.g., Alperson-Afil 2009; see also Pope & Roberts 2005).

Lithic and faunal concentrations in Middle Paleolithic (MP) occupation localities are seemingly structure-less, and were alleged to reflect the activities of small groups without clear social structure or definition of economic roles (Mellars 1989:358; see Mithen 1996:134-135; Stringer & Gamble 1993:152) or practicing higher levels of mobility (Hayden 1993). Yet a rapidly-growing body of evidence now indicates that by MP times, Eurasian hominins practiced differential intra-site spatial organization (for example, Adler *et al.* 2003; Alperson-Afil & Hovers 2005; Bonjean & Otte 2004; Hietala 2003; Speth 2006; Vaquero *et al.* 2001; Vaquero & Pasto 2001), argued in some cases to reflect modern spatial behavior (Balter 2009; Henry 2003; Henry *et al.* 2004). Such spatial patterning is most readily observed in 'high resolution' contexts, namely short-lived archaeological occurrences in which thin stratigraphic horizons remain well-defined and the anthropogenic signatures are nearly undisturbed (see Bailey 2007; Bailey & Galanidou 2009; Malinsky-Buller *et al.*, in press, for extensive literature on this issue). However, the majority of MP occupation sites present researchers with analytical challenges with regard to identifying spatial patterning and inferring its behavioral significance. Typically, the archaeological record in these sites constitutes a series of conflated remains from many episodes of occupation. This is especially true for the later Levantine MP in the region, when territorial constraints combined with ecological demands for specific forms of group mobility led to a settlement pattern of frequent repeated visits to locales within groups' territorial ranges (Hovers 2001). Even when discrete and obvious spatial features are apparent, they are still palimpsests representing several recurrent occupations (e.g., Kebara Cave; Hovers 2001; Meignen *et al.* 2006). In most late Levantine MP cave sites, spatial patterning is a latent feature of the archaeological record (Farizy 1994; Meignen 1994), calling for methods that "make apparent a structure that is otherwise not easily observed" (Read & Russell 1996:2). Such features may be discernible through detailed analyses of the distributions and spatial relationship between attributes of the various find classes averaging episodes of similar ways of using the site's space. Additionally, syn- and post-depositional site formation processes serve to blur the original distribution of physical remains of occupations that originally occurred over short and discrete spatio-temporal dimensions. Typically, a productive research strategy of inter- and intra- site settlement patterns in Levantine MP caves focused on long-term trends of variation and their causes rather than on attempts to identify and explain specific behaviors in space and time (Hovers 2001). Recent work on the lithic assemblages of Amud Cave provided an opportunity to address such issues from a different perspective.

The site

Amud Cave is situated on the margins of the Dead Sea Rift, about 5 km northwest of the Sea of Galilee in an east-facing cliff within the Amud drainage, at an elevation of 110m below mean sea level and some 30-35m above the present channel bed (Hovers *et al.* 1991, 1995). The cave is a karstic feature that developed along a tectonically-induced crack in the Middle Eocene limestone of the Bar-Kokhba formation (Zaltsman 1964). At present the cave consists of a small chamber (some 7x5 m), a large open 'middle' step (25x12 m), and a lower step that is actually a steep slope towards the channel bed (figs. 1 and 2). The current physical configuration of the cave is relatively recent and dates to the late Upper Pleistocene. Excavations at the site in 1961 and 1964, and again between 1991 and 1994 have established the existence and nature of the Middle Paleolithic occupations (Hovers 2004; Hovers *et al.* 1991, 1995; Inbar & Hovers 1999; Suzuki & Takai 1970).

Figure 1 - General view of Amud Cave from the East.

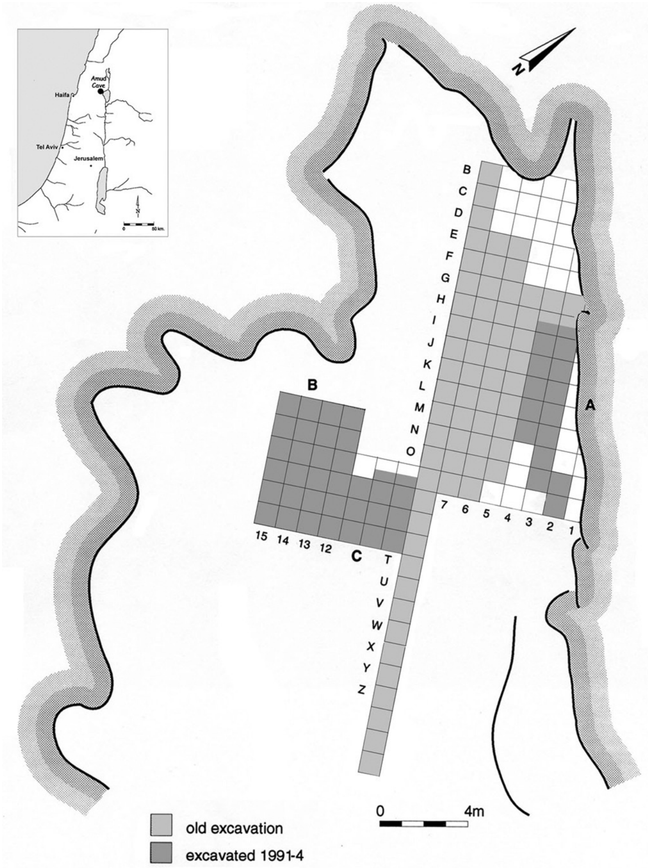

Figure 2 - Location map of Amud Cave and map of the excavated areas and of the excavation grid.

A cumulative 4.5 m thick column of sediments consists of Middle Paleolithic deposits (unit B), unconformably overlain by unit A, dated to the Holocene. Unit B was originally divided into four stratigraphic sub-units (B1–B4 top to bottom), with the lowest one deposited directly on bedrock (Chinzei 1970). This framework was confirmed in the course of the more recent excavations, with some further subdivisions of the stratigraphic sub-units into layers in the various excavation areas (Hovers 2004; Hovers *et al.* 1991). The Middle Paleolithic hominin remains were recovered from sub-units B1 and B2 in Area A (Hovers *et al.* 1995). Of these, two were identified as Neanderthals on the basis of their morphological characteristics (Hovers *et al.* 1995; Rak 1993; Rak *et al.* 1994).

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Sub-units B1, B2 and B4 are rich in stone artifacts (Hovers 2004) and faunal remains. Sediments of these layers are composed for the most part of ash derived from anthropogenic activity. In places, these sediments are reworked by geochemical and biological agents as well as human trampling, both on a stratigraphic macro-scale (Valladas *et al.* 1999) and a taphonomic, geochemical micro-scale (Hovers *et al.* 1991; Madella *et al.* 2002; Rabinovich & Hovers 2004; Shahack-Gross *et al.* 2008). Sub-unit B3, which consists of coarse-grained stony debris with little matrix, is archaeologically sterile and represents a hiatus in the human occupation of the cave, one that is clearly reflected in the radiometric age estimates. The occupations of subunits B1–B2 are estimated to have taken place within a relatively short time span ca. 55 Ka, whereas sub-unit B4 dates back to ca. 70 Ka (Rink *et al.* 2001; Valladas *et al.* 1999).

The cave's bedrock floor is rugged with an uneven topography. Along the M/N grid line a rock step runs northeast southwest and divided the cave's bedrock into two steps (i.e., the higher and middle steps; see above), separated by a steep slope ca. 1 m high. There are also rock ledges along the north and south walls. The boundaries of the northern ledge were completely exposed in the 1990s excavation. This ledge, 3-4 m wide and 1 m high above the cave's bedrock, terminates abruptly toward the south on a fault line (roughly the 4/5 grid line), and toward the east, roughly on the M/N grid line (figures 2 and 3). The whole central part of the cave is sunken relative to its elevated periphery.

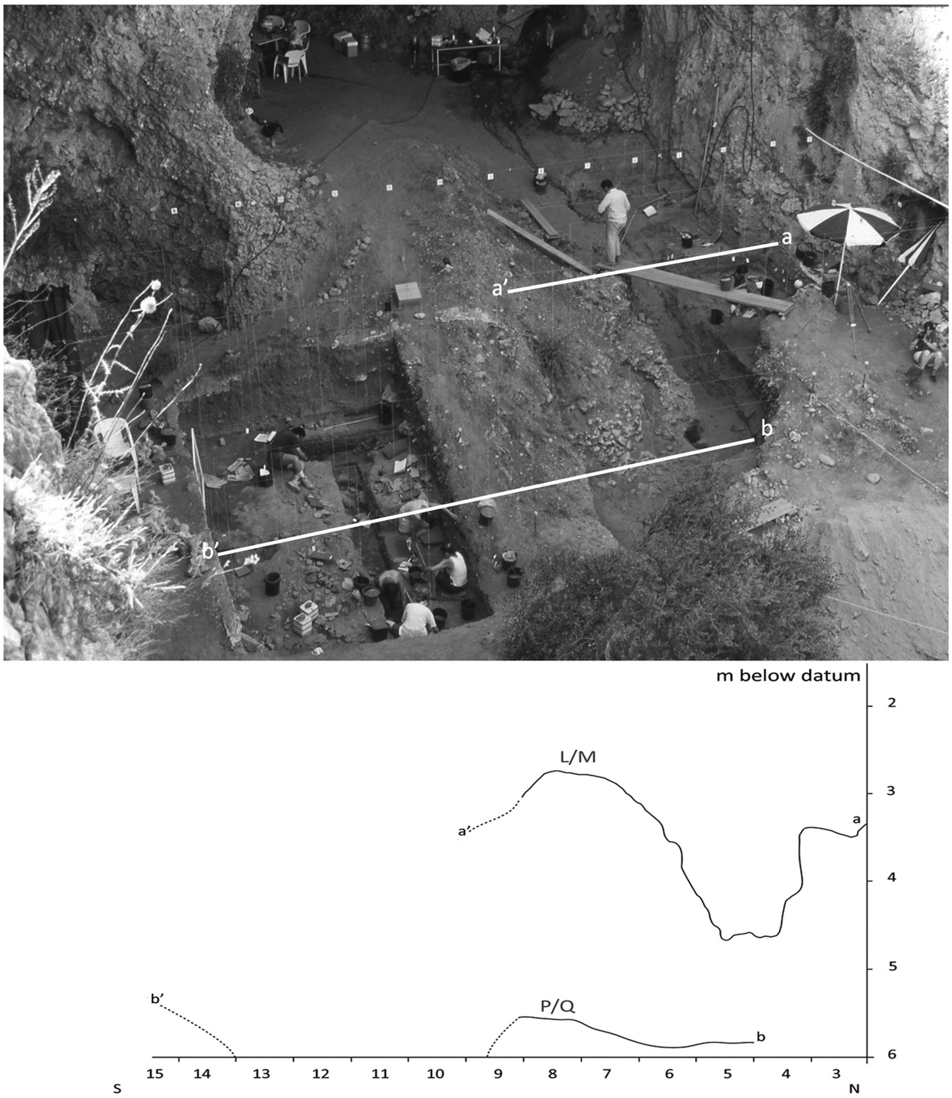

Figure 3 - (a) Areal view of the excavations in Amud Cave (1992), showing the areas of excavation and their physical configuration. The north face of the original excavation trench follows the steep face of the rock ledge along the north wall in Area A. (on the right). This photograph shows the cave prior to the removal of sediments in Area C and in the easternmost part of Area A. The location of bedrock profiles in figure 3b is shown. (b) Bedrock profiles along two grid lines, showing the configuration of the bedrock along a north south axis in two part of the cave. the horizontal axis shows grid squares, the vertical axis shows elevation below datum. Vertical and horizontal scale are not identical. (after Alperson-Afil & Hovers 2005).

This central part is further divided into two separate "basins" by a rocky projection that runs some 14 m on the upper step along the 8/9 grid line. It runs 5 m into the middle step, where it wedges out. Such a juxtaposition of bedrock features created natural divisions of the cave's space that was encountered by the site's first occupants. The shape and topography of the various areas changed as sediments and debris originating from human occupation and natural processes accumulated to form stratigraphic sub-units B4- B1.

Despite its complex depositional history, two aspects of the archaeological record of Amud Cave reveal spatial patterning which indicates that its Neandertal inhabitants assigned differential roles to these naturally-defined areas. First, all the hominin remains from this site, found in the two younger stratigraphic sub-units B1 and B2 (both dated ca. 55 Ka; Rink *et al.* 2001; Valladas *et al.* 1999), were retrieved from a topographically-elevated rock ledge running along the north-eastern wall of the cave. Hovers *et al.* (1995) considered and rejected the hypothesis that this distribution resulted from taphonomic and post-depositional causes and concluded that it was the outcome of intentional behavior on the part of the site's occupants. Second, Alperson-Afil & Hovers (2005) explored the presence of latent spatial features by examining the distribution of lithic technological attributes between the elevated rock ledge and the sunken central area of the cave during the time of accumulation of sub-unit B2. They have shown that the lithic assemblages from the two areas differed in their composition and in the states of breakage, burning and patination of various artifact categories. These authors suggested that the area along the wall was used for early stages of reduction and for discard of exhausted and broken artifacts, whereas in the central area lithic production focused on later stages of core reduction, core rejuvenation and (probably) the use of lithic artifacts in mundane extractive contexts. While these inferences are "coarse-grained", in the sense that they average an unknown number of events over space and stratigraphic time units, they demonstrate that spatial organization of lithic-aided activities was part of the behavioral repertoire at this site.

Alperson-Afil & Hovers (2005) have shown that micro-artifacts (<20 mm on the longest axis) served as meaningful markers of the organization of activities during the times of sub-unit B2. During a more recent analysis, we noticed that some particular technological classes of small-sized artifacts found in the periphery of the central area of the cave in the western part of Area B are spatially clustered within a specific stratigraphic horizon (sub-unit B4) and stand out against the general distribution of micro-artifacts in the cave. We present here a study of this spatial concentration, combined with a comparative analysis of its technological characteristics in relation to other typo-technological classes in the lithic assemblage. While analysis of the lithic assemblage of sub-unit B4 is still ongoing, data on the large debitage are sufficient for the purposes of this study. The lithic assemblage from sub-unit B1, the analysis of which has been complete, is used for comparative purposes (the frequencies of various artifacts classes reported in this article differ from those reported in Hovers [1998] because the samples have been expanded since the earlier publication).

Spatial distribution of micro-artifacts

Sorting of small artifacts from sub-units B1 and B4 is now complete, and the data presented pertain to the total sample of this type of artifacts. Some 95% of the small artifacts in B1 and 92% of those in B4 are micro-flakes (tab. 1), the others being unintentional thermal debris ("pot lids") and chunks. Only a tiny fraction of the hundreds of thousands of flakes bears distinctive technological characteristics. This study focuses on core management pieces (CMP; as defined in Hovers 1997, 2009), which are artifacts that attest to core re-organization and modification in the course of reduction, namely micro-CTE, small éclats débortants and ridge bladelets (fig. 4). As these items are associated with different core technologies (Levallois or Discoidal and blade production techniques, respectively) we also examined the presence and distributions of unretouched bladelets (defined according to the metric criteria used in Levantine Epi-Paleolithic research [L<50 mm, W<12 mm; see Bar-Yosef 1981]) and very small Levallois points. Other micro-artifacts that are clear indicators of technological practices are tiny Kombewa flakes, typically derived from the use of "Kombewa cores" (cores-on-flakes; Hovers 2007).

Table 2 shows the absolute numbers of these items in Areas B and A, out of the micro-artifact assemblages of sub-units B4 and B1 in these areas, respectively. (Note that sub-unit B4 was encountered also in Area C, but counts of technological micro-artifacts are low both absolutely and relative to excavation volume.) The frequencies of small CTE are extremely low within the micro-artifacts of Amud Cave. An examination of the distribution of these artifacts in Area B (fig. 5) further shows a clear spatial clus-

	B1		B4	
	N	%	N	%
Chunk (burned)	-	-	218	0.1
Chunk (not burned)	2,310	2.2	4,980	1.6
Pot lids	3,506	3.3	17,475	6
Complete micro-flakes (burned)	608	0.6	1,194	0.4
Complete micro-flakes (not burned)	8,254	7.8	12786	4.4
Broken micro-flakes (burned)	12,271	11.6	105,106	35.7
Broken micro-flakes (not burned)	79,137	74.6	151,864	51.7
TOTAL	**117,959**	**100**	**293,388**	**100**

Table 1 - Counts of micro-artifacts in sub-units B1 and B4.

	B1	B4
Burin spall	3	5
Unretouched bladelet	22	31
Core Trimming Element (CTE)	2	3
Éclat débortant	9	27
Ridge Bladelet	1	5
Point	1	2
Kombewa flake	8	4
Retouched	4	5
Cortical Back micro-flakes	-	1
TOTAL	**50**	**83**

Table 2 - Technologically diagnostic micro-artifacts in sub-units B1 (Area A) and B4 (only Area B). There are 5 additional *éclats débordants*, but no other types of core management pieces, in Area C. The analysis focuses only on the artifacts from Area B.

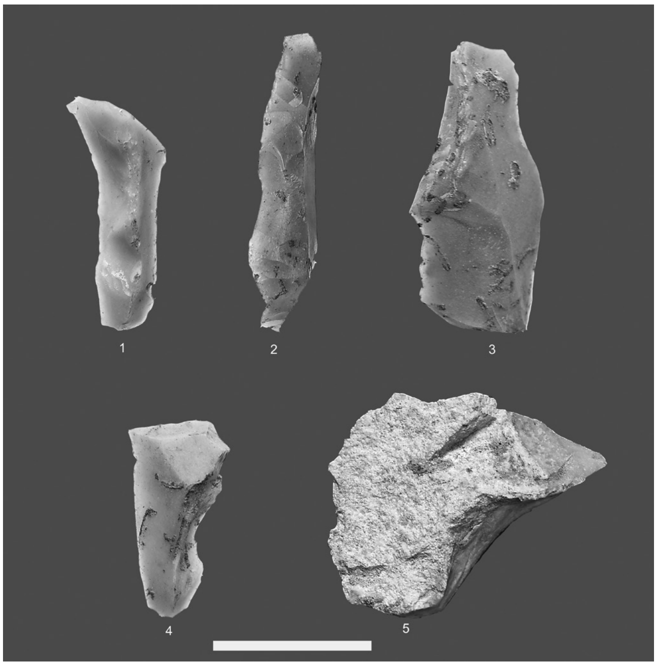

Figure 4 - Small core modification elements from sub-unit B4. 1-2: ridge bladelets; 3-4: *éclats débortants*; 5: Core Trimming Element. Scale bar is 1 cm. Compiled from photographs taken by Gabi Laron.

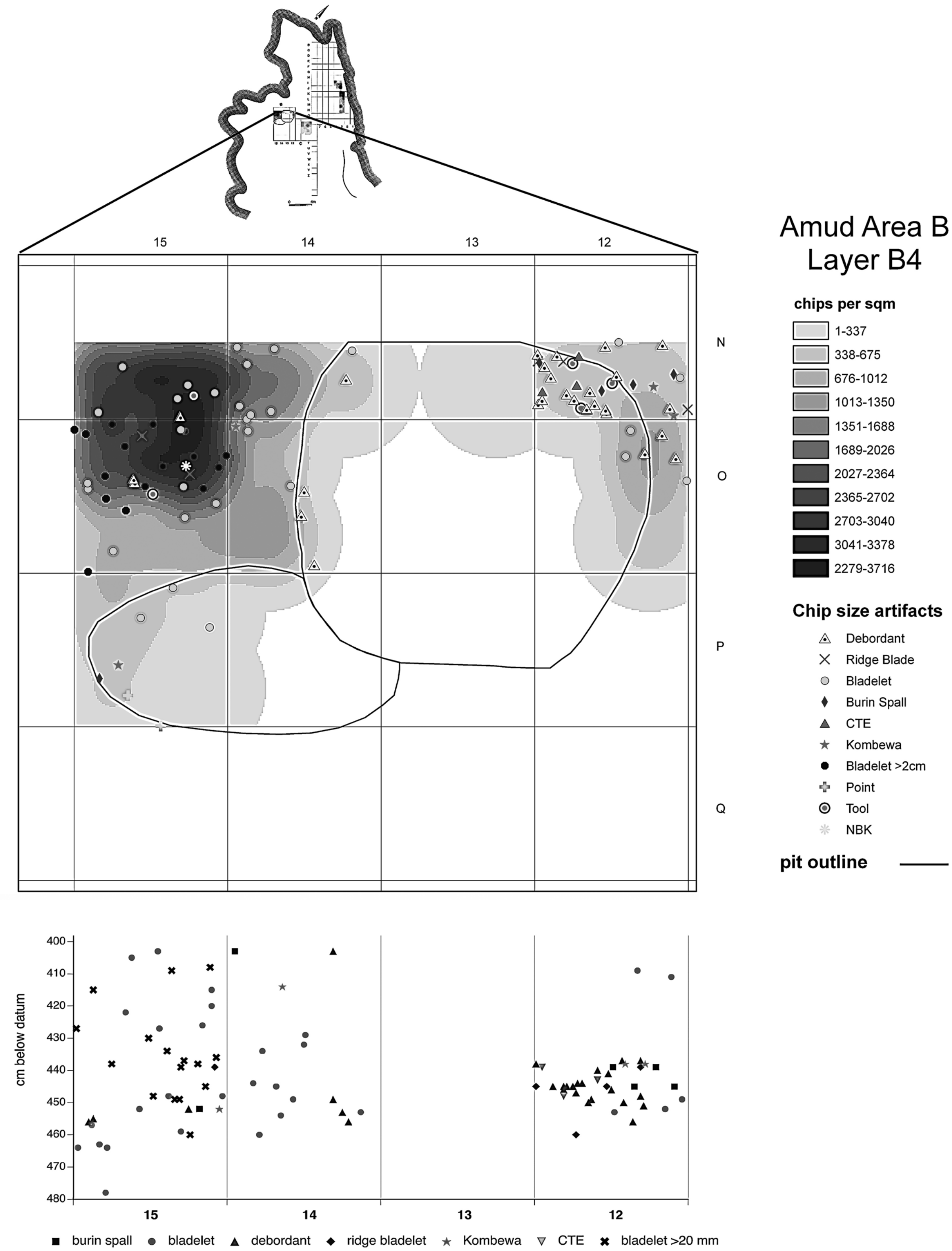

Figure 5 - The distribution of technological micro-artifacts in Area B. a: the lateral distribution of individual artifacts shown against a density map of all the micro-artifacts in sub-unit B4 in the area. The black lines show the contours of historical pits that cut through the Middle Paleolithic deposits. Finds of sub-unit B4 that are shown 'within' the pits are those that underlay them stratigraphically; b: vertical distribution of some categories of the individual artifacts shown in figure 5a. The distribution maps in this figure and in Figure 6 were created using ArcGIS Desktop 9.3.1. The density maps of micro-artifacts were created using GIS Kernel Density Tool in ArcGIS. Densities used in the maps are real densities as the number of micro-artifacts was calculated per excavated volume.

tering of certain types of the micro-artifacts. A clumped – both laterally and vertically – cluster is seen in square N12, where the majority of micro- éclats débordants and all of the very few CTE are concentrated within a vertical distance of ca. 10 cm. Note that the few éclats débordants in squares N-P15 occur within a very narrow vertical range. On the other hand, the majority of

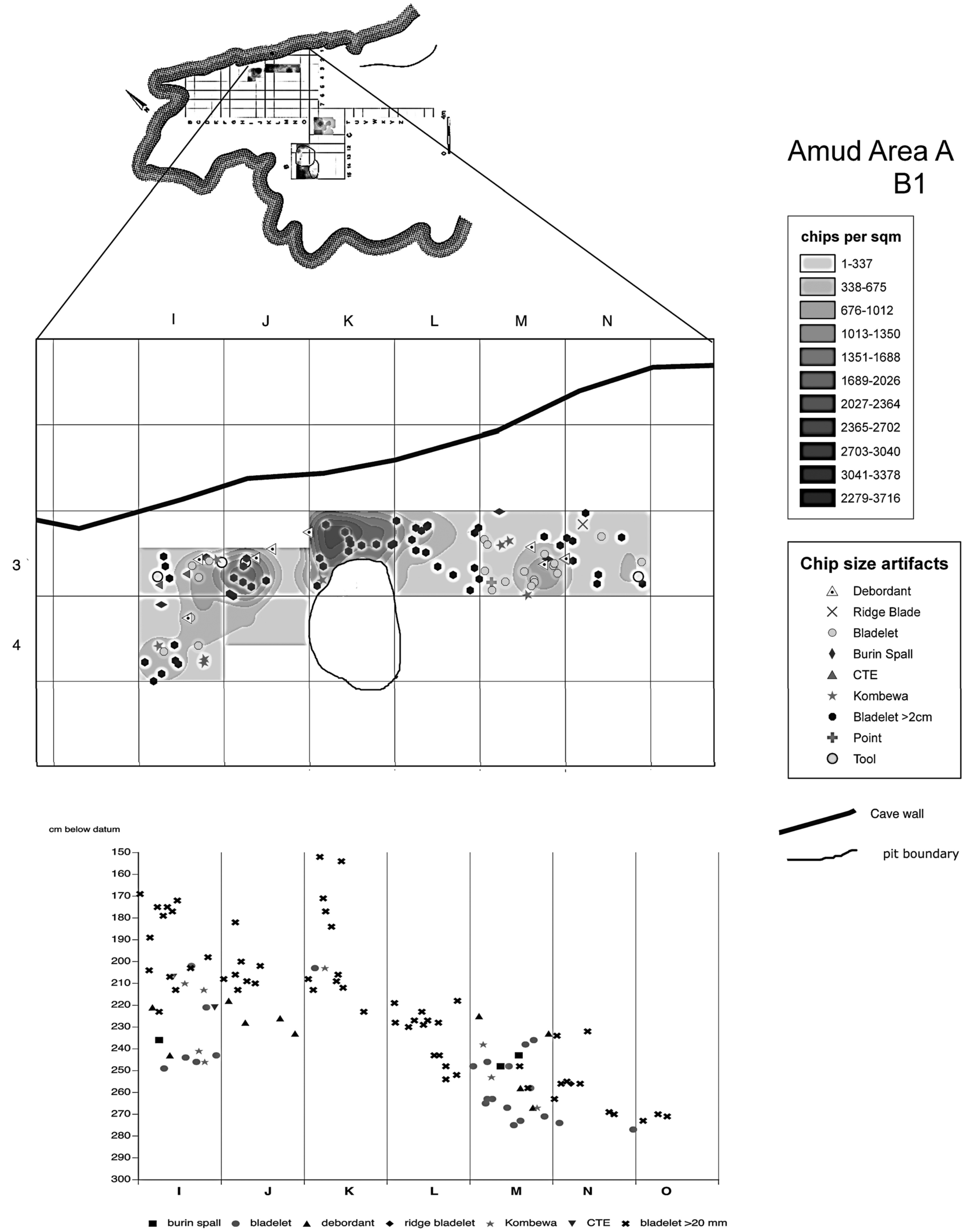

Figure 6 - The distribution of technological micro-artifacts in Area A. a: the lateral distribution of individual artifacts shown against a density map of all the micro-artifacts in sub-unit B1 in the area. Finds that are shown "within" the pits are those that underlay them stratigraphically; b: vertical distribution of some categories of the individual artifacts shown in figure 6. See caption of figure 5 for analytical procedures.

micro-bladelets and all of the larger bladelets are concentrated in squares N-P15, albeit over a larger vertical distance.

Given that background densities of micro-artifacts differ between the two clusters in Area B, the existence of clusters as such cannot be explained as a statistical artifact of numbers. (Statistical tests were rendered meaningless due to the small numbers of artifacts in the particular categories of micro-debitage). Moreover, one cannot explain the differential clustering of specific categories of micro-artifacts, as seen in figure 5, as

	Nodule cores+		Cores-on-flakes		Possible cores-on-flakes		All Cores	
	B1	B4	B1	B4	B1	B4	B1	B4
Frequency	33 (40.7)	8 (B)++ 31 (C)++ 39 (66.1)	33 (40.7)	5 (B)++ 10 (C)++ 15 (25.4)	15 (18.5)	1 (B)++ 4 (C)++ 5 (8.5)	N=81	N=59
Mean Length	43.2±11.4	43.9±10.1	49.5±12.9	48.8±12.4	49.4±11.4	34.7±8.0		
Meand Width	41.5±10.8	42.8±10.8	42.9±8.5	42.13±16.0	44.4±11.3	38.4±6.7		
Mean Thickness	19.5±6.7*	19.6±6.7**	15.7±4.2	13.6±5.0	17.7±4.5	13.1±3.1		
Length of last scar	24.9±10.9$	22.3±11.9^	22.2±10.8	22.3±10.3^^	25.6±10.2$$	16.7±3.1^^^		
Width of last scar	19.4±7.2$	23.3±8.8^	18.1±6.4	17.1±4.6	20.0±7.1$$$	19.7±7.2^^^		
Dominant last scar								
Mean Length							33.2±7.4	28.4±9.8
Min/Max values							23.3/58.8	12.0/44.8
Mean Width							23.0±7.7	24.6±7.3
Min/Max							16.6/50.5	12.2/39.9
Last Scar								
Mean Length							17.1±8.8	16.2±8.9
Min/Max							4.2/43.9	5.5/43.9
Mean Width							16.3±6.2	18.2±7.7
Min/Max							7.7/33.0	8.7/38.0

Table 3 - Characteristics of cores in the Amud Cave assemblages. + for this analysis, nodule cores are all Levallois and non-Levallois cores made on nodules and chunks. ++Area B and Area C, respectively; for this analysis, * n=32; ** n=38; $ n=28; $$ n=12; $$$ n=13; ^ n=34; ^^n=14; ^^^n=3.

	B1 (Area A)		B4 (Area B)		B4 (Area C)	
	Large	Micro-artifacts 1)	Large	Micro-artifacts 1)	Large	Micro-artifacts 1)
Éclats débordants	148 (51.4)	9 75.0)	114 (65.5)	27 (77.1)	114 (60.3)	5 (100.0)
Éclats outrespassés	18 (6.0)		4 (2.3)		20 (10.6)	
Combination 2)	4 (1.3)		1 (0.6)		1 (0.5)	
Ridge blades	2 (0.7)	1 (8.33)	5 (2.9)	5 (14.3)	8 (4.2)	
Other CTE	116 (38.9)	2 (16.66)	50 (28.7)	3 (8.6)	46 (24.3)	
Total CMP	**288** *(100.0)*	**12** *(100.0)*	**174** *(100.0)*	**35** *(100.0)*	*189 (100.0)*	**5** *(100.0)*
% CMP in assemblage	288/402 (7.2)	12/34 (35.3)	174/1886 (9.2)	35/55 (53.0)	189/2043 (9.3)	5/12 (41.7)
Micro-bladelet		22 (67.7)		31 (47.0)		7 (58.3)
Total micro-artifacts (in this analysis)		34 (100.0)		66 (100.0)		12 (100.0)
Bladelet 3)	60 (1.5)		16 (0.8)		4 (0.2)	
Unretouched blade 4)	594 (14.8)		134 (7.1)		187 (9.15)	

Table 4 - Frequencies of core management pieces by categories. Relative frequencies are shown in parentheses. 1: For data on micro-artifact frequencies see tables 1 and 2; 2: Combination of débordant and outrepassé on a single flake; 3: Items >20 mm, where L<50 and W<12 mm (percentage out of large debitage); 4: including Naturally Backed Knives of laminar proportions (percentage out of large debitage).

the result of natural processes that affected small-sized lithics selectively.

The situation differs in the deposits of sub-unit B1 in Area A (fig. 6). The linear outline of the excavated area probably distorts the geometry of spatial patterning and likely explains the linearity of the observed distribution of the larger bladelets; however it does not account for the two discontinuous clusters of micro-bladelets, for example. The vertical distribution of the selected micro-artifact classes, on the other hand, does not show clear clustering of the kind seen in Area B. The irregular "surface" of the distribution is due to the disturbed surface prior to excavation; the irregular lower outline is due to both biogenic and anthropogenic post-depositional disturbances and the uneven surface of the rocky ledge on which the sediments are deposited.

In this paper we do not attempt to explain the patterning in Area A, nor the differences between the areas. Rather, we use the comparison between the two areas and stratigraphic units to further explore the nature of the cluster in Area B. We hypothesize that the assemblages of Amud Cave do not incorporate large-scale, systematic production of micro-laminar or micro-Levallois elements resulting in micro-bladelets, micro-ridge blades or micro-Levallois points. If such were the case, we would expect higher frequencies of the micro-artifacts in the assemblages as well as evidence in the large-size component of the assemblage (e.g., cores for blade production and for the production of small items). This pertains also to the larger bladelets. If this hypothesis is not refuted by observations on the technological characteristics of the assemblages, the clusters in Area B should be addressed as unusual features within the cave's depositional sequence. We therefore examined characteristics of the lithic assemblage from sub-unit B1 and from the large samples of debitage and cores derived from sub-unit B4 in areas B and C. Our focus is on CMP and laminar/lamellar products, being the ones of interest in the current context, and on cores, from which such artifacts were presumably detached (tabl. 3 and 4).

The technological context of micro-artifacts in Amud Cave

In the absence of systemic refits, analysis of the Amud Cave assemblages relies on a detailed attributed analysis (e.g., Hovers 2009: appendices 2-3). The assemblages of Amud Cave are assigned to the Levantine Mousterian. The dominant formal flaking system is Levallois, with an emphasis on the production of flakes and triangular flakes (Hovers 1998, 2004; Ohnuma 1992). Elongated flakes and blades are relatively common in the upper stratigraphic sub-unit B1, but are never the dominant products (unretouched blades and blade-proportioned naturally backed knives are 14.8% of the total debitage).

As a rule, cores are under-represented in all the Amud assemblages. Amongst the cores, cores-on-flakes occur in relatively high frequencies in all the stratigraphic sub-units, particularly in sub-unit B1 (tab. 3; and see Hovers 2007). Regardless, part of the lithic reduction procedures took place on-site, as attested by the presence of CMP in all the assemblages (Alperson-Afil & Hovers 2005; Ekshtain 2001; Goder 1997; Hovers 1998). Nodule cores were typically modified using various Levallois flaking methods (63.6% of the nodule cores in B1; 60% in B4 (Area B), 90% in B4 (Area C). The use of preferential Levallois flake removals prior to core discard is more common in the B4 assemblage compared to B1 (fig. 7). Exploitation of cores-on-flakes in both assemblages was more commonly carried out by unipolar and convergent flaking, which may be related directly to the morphometric properties of the blanks.

By default, cores-on-flakes are thinner than nodule cores in each of the assemblages; however, they do not differ markedly

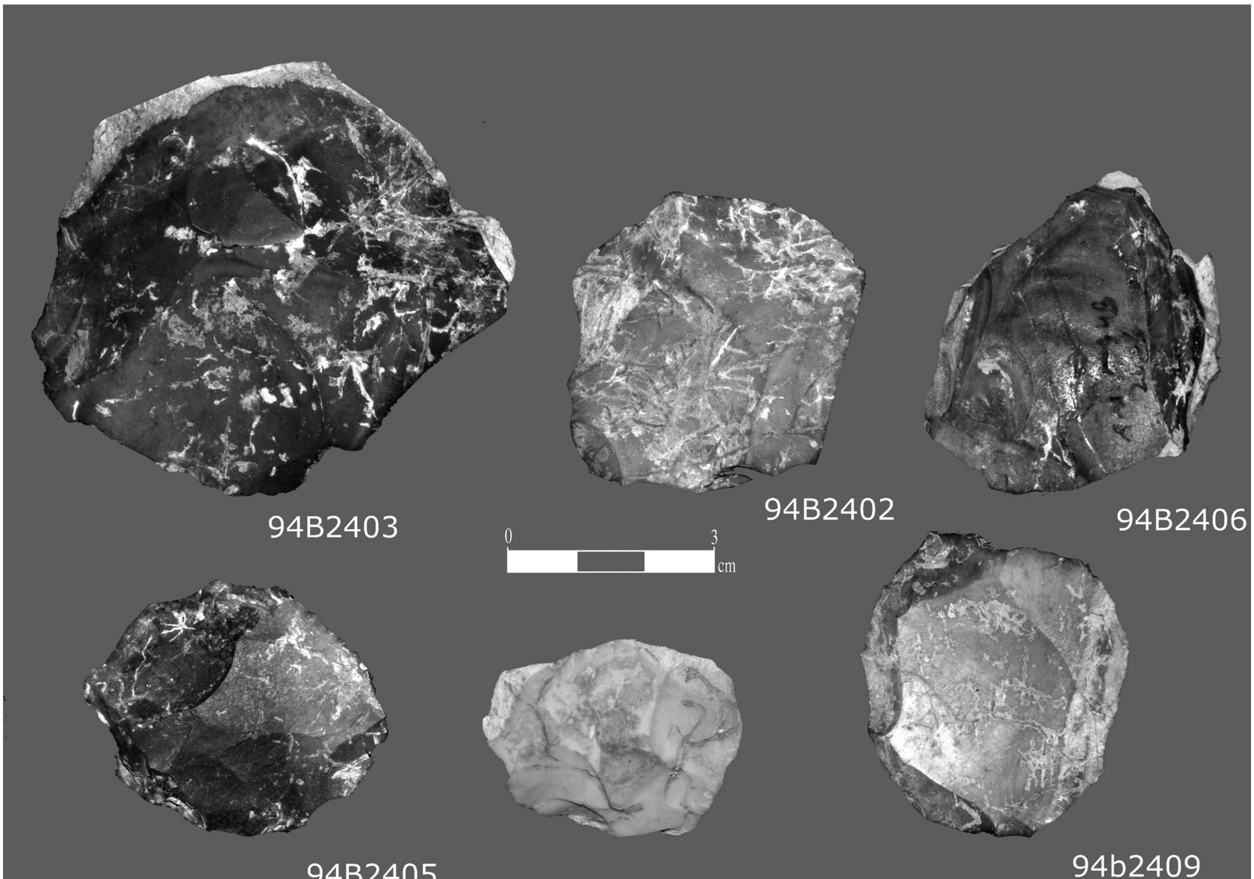

Figure 7 - Cores from sub-unit B4, Area B. 94b2403: Levallois core for points (convergent method, recurrent); 9B2402: Levallois core for points (bipolar, preferential flake); 94B2406: Levallois core for point (convergent, preferential); 94B2405: Levallois core for flakes (recurrent); Levallois core for flakes (centripetal, recurrent); 94B2409: Levallois core for flakes (centripetal, preferential). Artifact numbers are the unique ID numbers used for the identification and registration of each artifact in the assemblages.

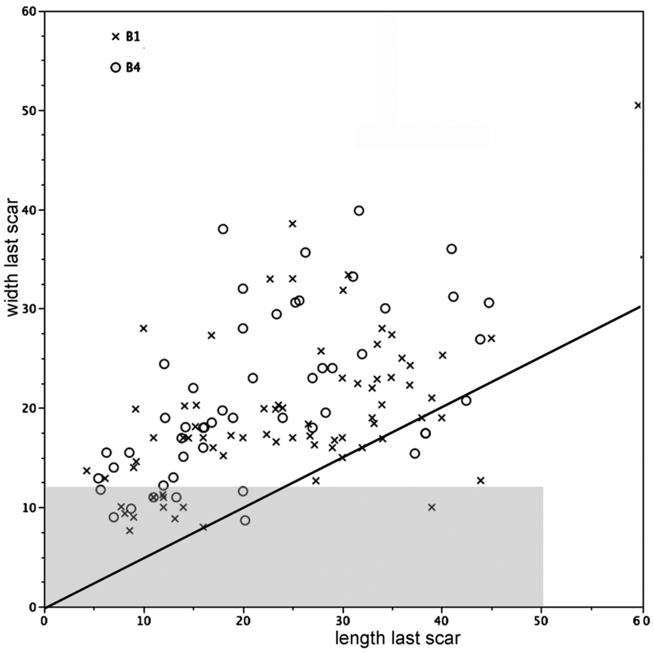

Figure 8 - Scatterplot of last removed negatives from cores in sub-units B1 and B4. The line shows the cutoff between blade- and flake-proportioned artifacts (below and above the line, respectively) for each length measurement. The gray rectangle marks the size range that define bladelets. Note the very few number of blade or bladelet negatives.

in their mean length and width (tab. 3). These data suggest that the exploitation of cores for Levallois flaking terminated when a certain size or proportion of the core was reached. Notably, when the largest Levallois ("dominant") flake was also the last one removed from the core, flakes from cores-on-flakes (as represented by the scar patterns on the core) were only marginally smaller than those removed from the nodule cores (the difference is not statistically significant). Cores-on-flakes very likely underwent much shorter reduction sequences than the nodule cores, yet their exploitation was terminated according to the same morphometric criteria that affected the use life of nodule cores (see Hovers 2007, 2009 on Amud and Qafzeh assemblages, respectively). Consistent with the paucity of non-Levallois blade cores, ridge blades are extremely rare in the large debitage, although some of the blades in this assemblage were produced through the use of laminar technologies (Ashkenazi 2005) similar to those identified in some early Levantine Mousterian assemblages (Meignen 2000). The majority of blades are morphological rather than technological blades, derived from Levallois flaking.

On both nodule and on-flake cores, reduction sometimes continued after the removal of the last "formal" flake, and small flakes were detached, a phenomenon known in other Levantine Mousterian assemblages (e.g., Goren-Inbar 1990; Hovers 2009). Many of these flakes fall within the size range of micro-artifacts (tab. 3, fig. 8) In the last stages of core reduction, as documented through the morphometrics of flake negatives on the cores, very few blade- or bladelet- proportioned artifacts were removed (fig. 8). Given the paucity of cores in the Amud assemblages on the one hand and the large number of micro-artifacts in the assemblages on the other (tab. 1), it is likely that the majority of micro-artifacts in these assemblages did not derive solely from the last stage of core reduction documented by flake negatives.

Bladelets appear in extremely low percentages among the micro-artifacts in both the B1 and B4 assemblages, and formal bladelet cores are completely missing. Only two cores with bladelet scars, one in each Area A (B1) and B (B4), were documented. The same holds for single platform, semi-rotated non-Levallois blade cores (e.g. fig. 9), which might have been also sources of bladelets.

In general, the relative frequencies of various CMP categories of micro-artifacts (tab. 4) mimic those seen in the large debitage. Within the large-size component of each stratigraphic sub-unit, éclats débordants are the major single type of CMP, followed by non-descript core trimming elements. However, while the large éclats débordants mostly derive from Levallois flaking (65.3%

Figure 9 - Three views of a semi-rotated blade/let core (94b2408) from sub-unit B4, Area B.

in sub-unit B1 and 59.3% in sub-unit B4, Area B), the majority of micro-débordant flakes in Area B are non-Levallois. This difference is not an outcome of the size of the artifacts, since Levallois characteristics could be identified on other micro-artifacts in Amud Cave.

Discussion

Micro-artifacts in the Amud Cave assemblages seem to be part of the technological system practiced at the site, with Levallois being the dominant flaking system. The paucity of blade cores, ridge (crested) blades and the association of blades with a predominantly flake assemblage suggest that non-Levallois formal blade production was not a major goal of lithic reduction procedures in any of the Amud assemblages. Bladelet production appears to be a negligible, unsystematic procedure both quantitatively and technologically. This is a common feature of many Eurasian and African sites (e.g., Villa *et al.* 2005). In this respect Amud Cave differs from some Eurasian Middle Paleolithic assemblages where particular chaînes opératoires for small debitage, including bladelet production, were identified (e.g., Dibble & McPherron 2006; Slimak 1999, 2008). The situation in Amud also differs from that described, for example, in Sibudu Cave, South Africa, where bladelet production is regarded as a deliberate component of the technological system despite their small numbers in the assemblage (Villa *et al.* 2005). In the case of Amud Cave the hypothesis of incidental bladelet/micro-bladelet production as by-products of the main lithic production system(s) cannot be rejected and remains the most parsimonious explanation of the occurrence of these artifacts in the Amud assemblages.

Against this technological background, the concentration of bladelets and especially of micro-bladelets in the southern part of Area B stands out, despite their vertical dispersion. Similarly, the micro-éclats débordants in the tight cluster found in B4, Area B, stand out spatially as well as technologically when compared to their large-size counterparts in the same assemblage.

This combination of spatial and technological data leads to the suggestion that the latent spatial patterning revealed in our analysis is valid and related to behavior rather than taphonomic processes. Area B, on the periphery of the southern sunken "basin" in the cave, was used during B4 times for some specific activities. One such activity, constrained in space and time, related to the exploitation of small cores, or rejuvenation of exhausted cores that reached small dimensions. Another activity is linked to lithic production that led to an increased occurrence of bladelets; or a deliberate bladelet production in this part of the cave, contrary to other parts of the site. Either way, bladelet-related lithic activities are not as well constrained spatially as is the evidence for core modification, and probably do not represent a single event.

This interpretation of the data raises two issues on different levels of interpretation. First, there is the question of identifying the behavior(s) that led to the observed spatial patterning at the site. The second point touches upon the broader question of the relevance of localized, high resolution spatial patterns to the understanding of the broader behavioral processes that shaped the archaeological record.

The patterning of many of the technological characteristics identified in the spatial concentration of micro-CMP are consistent with models of childrens' lithic-related activities. A growing body of literature has recently focused on theoretical aspects of childhood as a social and cultural construct and reflected on the changing perceptions of this construct in paleoanthropological research (e.g., Baxter 2005, 2008; Brookshaw,2009; Högberg 2008; Kamp 2001; and references therein). Based on sociological, pedagogical, psychological and ethnographic studies, it has been argued that children were active members in prehistoric societies and were likely to have left their unique marks, creating a record that (theoretically at least) can be distinguished from that of adults. Learning of any technological activity occurs through observation, imitation of experienced producers and users of artifacts, and play. Hence production of material culture by novices and learners relies on social transmission of knowledge in a social context (Brookshaw 2009; Högberg 2008; She, 2006; Stout & Semaw 2006). Either explicitly or implicitly, children are presumed in most of these studies to have been novice stone knappers. Pigeot (1990) identified in the Upper Paleolithic site of Etiolles master stone knappers, occasional knappers, and novices, and suggested that one dwelling area in the site represented a context of educational stone knapping (for another example, see Roux *et al.* 1995).

These studies form the basis for expectations about stone tools made by children. Stone tools made or used by children are relatively small so as to fit the hands of their makers or users, but it should be shown that the 'microlithization' is not related to raw material scarcity, increased mobility or other factors that may adaptively select for small artifacts. Raw material will tend to be low-quality because inexperienced knappers are more prone to unintentional breakage and children as users tend more than adults to misplace or damage the artifacts they use or play with. This raises the possibility of equifinality between children's knapping and expedient lithic technology (Shea 2006). Högberg (2008) pointed out that children mimic the procedures they see when adults knap, so their products are likely to fall within the range of adult-made artifacts, but the technical skills will be notably different. Spatially, novice lithic production may take place in peripheral locations in relationship to more experienced or master knappers, as shown by Pigeot (1990) and Grimm (2000). On the other hand, the lithic-related activities of children in a habitation locality are also a form of site formation processes. When children pick raw material or artifacts for their lithic experiments, they may disrupt earlier deposits and mask the original spatio-technological patterning (e.g., Hammond & Hammond 1981).

The spatial cluster in Area B of Amud Cave meets many of these expectations when its location in the cave's space is considered and when it is evaluated against the technological make-up of the large-sized lithic assemblages. This is especially true of the tight cluster of micro-CMP, which show affinities with the overall technological concept of the assemblages in the cave, yet their production required a less formalized technological knowledge (i.e., non-Levallois flaking). As the dexterity necessary to grip and control small objects only develops (among modern humans) in ages 9-11, this may suggest that a novice(s) responsible for core modification by micro-éclats débordants was not a toddler. Recently, Ekshtain (2006) compared the frequencies of flaking accidents and the technological processes leading to them in Amud B1 and Qafzeh XIX, which are not situated near raw material sources, and in the site of Berigoule in France, located at the raw material source. Based on this analysis, she suggested that the relative paucity of flaking accidents in the Amud B1 assemblage compared to Berigoule may be ascribed to social restrictions on the access of inexperienced knappers to raw material. Such measures might have been necessary for the Amud Cave inhabitants due to the cave's location away from raw material sources and to the difficult access to the cave, which made unconstrained apprenticeship economically prohibitive.

A diametrically-opposed interpretation of the same phenomenon may be that production of these small artifacts, too, was the work of a more skilled knapper, given the motor skills that may have been necessary for its execution.

The technologically-distinct cluster of bladelets in Area B (fig. 5) suggests that bladelets production was deliberate to some degree, unlike the overall aspect of the B1 and B4 lithic assemblages. The occurrence of well-shaped tiny crested blades (fig. 4) and a relatively well-shaped blade/let core (fig. 9) would support such a scenario If that was the case, the cluster may show the presence of more experienced knapper(s) in this part of the cave. Given the vertical dispersion of the bladelets, it is difficult to tell whether this is a single flaking episode that had been subjected to taphonomic processes, or a number of repetitive flaking episodes that took place in the same area. While temporal resolution in this case is less satisfactory than for the cluster of tiny débortants flakes, these data do underline the specificity of this area in the cave in the context of a particular technological activity.

The suggestions that the cluster in Area B was produced by either skilled knappers or by novices are, of course, two polarized views of the specific activity that took place in this part of Amud Cave over a 'real time' span during the deposition of sub-unit B4. The nature of the archeological record is such that tests of expectations about children's activities are hardly ever conclusive (Shea 2006). Until such time when we can test each of these ideas, reconstructing the nature of these activities has to remain speculative at best. However, in the framework of this paper, the specific interpretation of the activity is secondary to the affirmation that a single activity area associated with particular technological practices is in fact recognizable within the dynamic depositional context of a site such as Amud Cave. Based on the extreme rarity of similar technological artifacts, we suggest that this might have been an episode of unique activity.

These results do not preclude the possibility that other activities took place in constrained areas of the cave during the time of any of the stratigraphic sub-units. Post-depositional processes may have homogenized many of these features into the coarser-grained record that is visible at Amud Cave. The cluster that we identified in Area B is therefore exceptional in the preservation of the unique behavioral signature. However, it may not be the only one that survived in this cave. Ongoing similar analyses, applied to other unusual categories of artifacts, may reveal additional areas of highly specific technological activities. It is perhaps paradoxical that in a site that has been intensively inhabited for several thousands of years at least, the signatures that might be easiest to pick up are those of unusual activities or of culturally non-conformist individuals.

This brings us to the second, more general question raised by the spatio-technological pattern revealed in Area B. Although prehistoric archaeology builds on the actions of individuals, it averages them by default into long-term temporal trajectories, thus providing the discipline with the time depth that is its forte. Bailey (2007:209), among others, warns that attempts to obtain the highest possible resolution and to recognize temporally and spatially restricted activities, "… may end up with individual episodes too small or limited in number to sustain any generalization…" It is of course true that when detached from a more general context, high-resolution occurrences should be suspected as historical anecdotes rather than true representations of long-term evolutionary trajectories (e.g., Speth & Clark 2006). The highly specific nature of the behavioral episodes that we discuss in this paper cannot and should not be expected to tie in directly with large-scale evolutionary trends. Yet if, as we suspect, additional spatio-technological "anecdotes" will be identified in the record of Amud Cave, we stand to gain a better perspective on behavioral variation, particularly on unusual, "out of the box" technological practices. Such specific occurrences may provide us with an understanding of the place (physically as well as culturally) of unusual individuals in the social matrix of the MP hominins that inhabited Amud Cave. Moreover, it may shed light on the variation that constitutes the building blocks of long-term change and on the processes of innovation and cultural transmission among the site's Neandertal occupants.

Our aim in this paper was to explore the conceptual and analytical options that can be used to recruit a coarse-grained record to address questions of social and cultural behaviors in a Levantine MP site. As preliminary as the current work is, we hope that it shows that such an endeavor, while certainly a tall order, is not a futile effort.

Acknowledgements

The research of lithic technology and the spatial studies at Amud Cave was supported by The Israel Science Foundation (grants 514/04 and 63/08) and Irene Levi-Sala CARE foundation. We are grateful to Nira Alperson, Adi Ben-Nun, Michal Birkenfeld and Ruhama Piperno for their advice and assistance with GIS-related issues. We thank Nuha Aga-Said, Hila Ashkenazi, Rebecca Biton , Yaron Cohen, Masha Krakowski, Maya Oron, and Zohar Turgeman for their help in sorting and analysis of Amud's huge lithic assemblages.

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