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HUMMAL (CENTRAL SYRIA) AND ITS EPONYMOUS INDUSTRY

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Introduction

Recent research reveals that the production of elongated blanks is an important part of the Early Middle Palaeolithic industries in Near Eastern sites dated between 270 and 160 ka ago (Mercier *et al.*2007; Mercier & Valladas 2003; Grün & Stringer 2000; Clark *et al.* 1997; Rink *et al.* 2003). The excavation at Hummal located in the arid steppe of Central Syria showed the similarities to the laminar assemblages found on this site and the others Early Middle Palaeolithic blade assemblages from Levant.

Hummal is one of several sites in the El-Kowm area (including Nadaouyieh Ain Askar (Jagher 1993), Ain Juwal, Arida A and Umm el Tlel) where the laminar assemblages were discovered and the only one with the stratified deposits under systematic excavation since 1999, on the other sites the position of laminar assemblages cannot be specified, these have all been recorded in secondary positions. In all cases the assemblages with the laminar characteristics were related to the artesian spring occupied by the people of the Palaeolithic (Le Tensorer & Hours 1989). Blade industries were located in the stratigraphy at Hummal only between the Yabroudian and Levantine Mousterian.

In 1980, L. Copeland and F. Hours conducted a first study campaign, at the invitation of J. Cauvin who at the time was the Director of the French Permanent Mission in El-Kowm. The project was devoted to the geomorphology and the Palaeolithic of El Kowm. A new culture was identified which was labelled "Hummalian" (Besançon *et al.* 1981, 1982).

Since then, the Hummalian industry has been the subject of several publications (Bergman & Ohnuma 1983, Copeland 1985; Hours 1982), although these were based on material from the old stratigraphy established in the Eighties. A new series of stratigraphic and sedimentological studies of the Hummalian infill revised the observations from 1980-1983. This paper introduces the new Hummalian sequence established from the results of the excavations carried out during the 1999-2005 seasons. Additionally, the studies on the Hummalian industry uncovered from the new stratified layers will be presented here with a proposed aim of defining the Hummalian industry based on these results.

The New Hummalian Stratigraphical Sequence

The earliest work on the stratigraphical and sedimentological sequences of the Hummal site at El-Kowm (Le Tensorer 2004) shows that the previous studies of the lithic material from the Ia layer were carried out on assemblages that were not in situ. A new series of studies carried out during the 1999-2005 seasons on the sequence of Hummal shows that the materials from these new excavations are, unlike the previous work, considered to in situ. This means that a far greater understanding of the lithic industries is now possible. This is of course an ongoing situation and with future field work the stratigraphy presented here will perhaps be further elucidated. In fact, the Hummalian levels that are recognised between the Yabroudian and Mousterian in the sequence presented here also appear in a similar position on the new South Profile, constructed from the 2009 fieldwork.

The sequence also contains a massive sand deposit of several meters in the heart of the doline. These sands αh contain a vast quantity of Hummalian artefacts (more than 3000 artefacts). Archaeologically these artefacts are not in situ, however the geological observations made on the ground show that it intercalates between the Yabroudian and Hummalian layers (Le Tensorer 2004). The TL dating gives an average age of 200 ka for the αh assemblage (Richter *et al.* 2011) which has comparable technological and typological features to those in layer 6b.

The stratigraphy of Hummal is composed of micritic loam precipitated directly in water, supplied by the well. The water level on the surface fluctuated appropriately with climatic changes and tectonic processes. Soil formation took place during times of reduced water levels. Through the phase of low water level the soil formation-taking place (Le Tensorer *et al.* 2007).

There was repetitive occupation at the site but the density of the artefacts in the layers remains variable (tab. 1). This could be due to the restricted excavated area but differing occupation strategies must also be considered a factor. However, the assemblages from an individual layer indicate a temporal sample, the duration of which is very difficult if not impossible to calculate. The time interval between the deposition of first and last item

layer	6a	6b	6c	7a	7c
excavated surface (m2)	10	14	2	14	18
density (item per m3)	247	2170	161	22	66
fauna (artefacts ≥ 2cm)	6	51	6	13	29
lithics (artefacts ≥ 3cm)	392	2946	190	33	326

Table 1 - Artefact density in Hummalian layers.

in the lithic assemblages are seldom precise and rarely defines a single phases of occupation. While the results from preliminary micromorphological and geological studies, the on-site field-work observations, and the artefact's category and technological features can help to construct a initial and incomplete picture of on-site versus off-site production strategies, the pending results of the more detailed micromorphological and geological studies will allow a fuller and hopefully clearer picture of the differing site strategies in the future. The high density of artefacts in layer 6b and 6a could be due to a long term occupation or several single but successive occupation episodes or due to palimpset. The density of artefacts in layers 7 and 6c is lower and can correspond to the short-term occupation where blanks were produced and maintained on-site. The stratigraphy from bottom to top is subdivided as follows (fig. 1):

Layer 7: This is a complex series of clay mineral deposits and erosions of variable thickness which reaches a maximum of 40 cm. This layer was established in swampy environment of a hot climate and is intersected throughout with red sand (layer 7b), which sometimes forms accumulations up to 20 cm thick. layer 7 is divided into three sub-levels (a,b,c).

Layer 7c is black clay containing organic levels and developed due to a change in the deposition conditions. The occurrence of a calcified horizon composed of calcified and silicified roots, the fragments of carnivore coprolites, a lot of bones, some of which are burnt and lithic artefacts indicate soil formation without water coverage but the presence of algae spores and gastropod shells testify the existence of water in close proximity. A change to Sebkha conditions interrupts the soil formation and the green-black clay started to accumulated and formed level 7a.

For the most part artefacts from layer 7a were gathered in the western area of the excavation, contrary to layer 7c where the lithic artefacts were concentrated in the eastern part. The majority of faunal material from these layers come from western part and is unfortunately highly fragmented and as a result the numbers of identified fragments are low. Among the identified fauna are Camelids which predominate, equids and a few large bovids. The surface preservation and edge sharpness of bones advocate that the burial probably took place relatively rapidly and that post depositional forces were responsible for destruction of the bones. It could be possible that this organic layer over time has become highly compressed owing to sediment over load and hence caused the high degree of bone fragmentation and also the fragmentation of several blades. Sandy layer 7b was sterile.

Layer 6c: A change to damper conditions led to the precipitation of layer 6c. Its compact, carbonate silt, of approximately 30cm thickness, which is partially eroded by the deposition of the layer 6b, is currently limited to one surface on the Eastern profile. The partial erosion of layer 6c happened before the formation of the following layer 6b. The minute remains of layer 6c were perceptible throughout the East profile, but were not identified on the West profile or on any other worked profile comprising Hummalian layers on the Western part of the excavation.

The soil formation is indicated by the presence of mud cracks and calcified root remains. It is subdivided into two sub-levels:

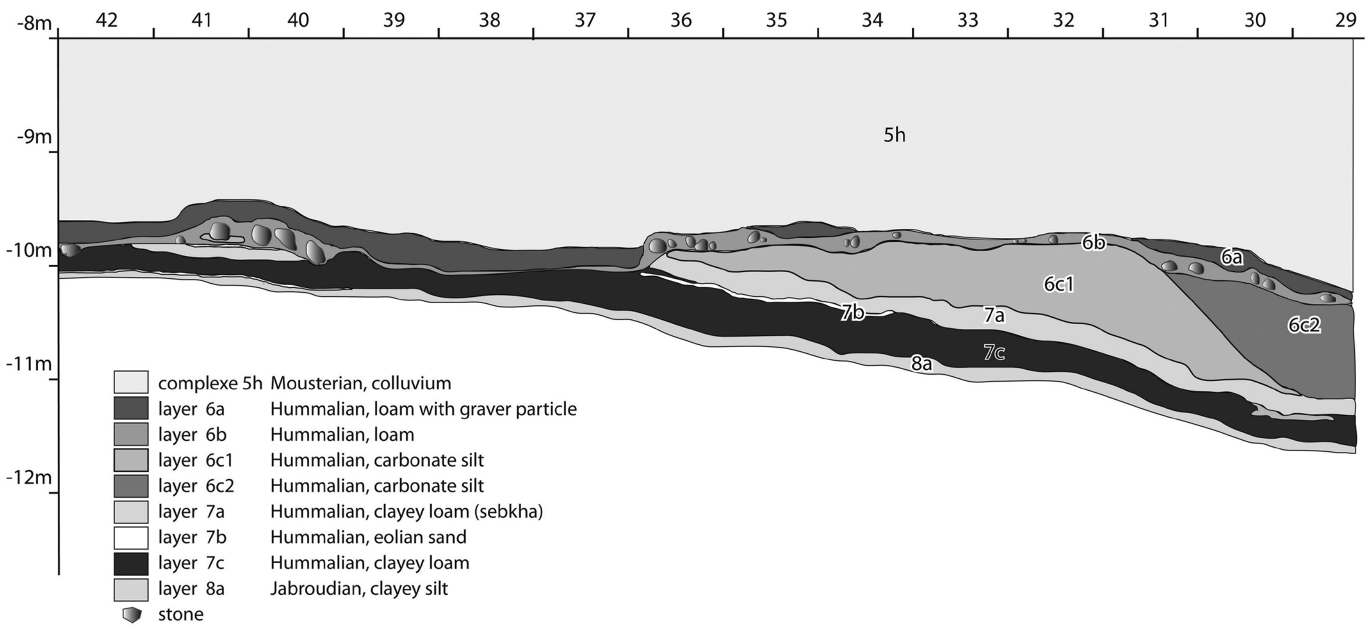

Figure 1 - Profile East, Hummalian sector.

6c-1 which is compact, sterile, white carbonate silt. Layer 6c-2, a brown yellow carbonate silt where the lithic material and small bones including a felid bone, three fragments of ostrich shell and also Equid teeth were collected from two square meters. Nearly all the artefacts were found in a sub-horizontal position which is concordant with the inclination of layer.

Layer 6b: A thin loam deposit with a maximum thickness of 14 cm. The layer seems to have formed during a period of varying water level, so from time to time a relatively dry surface appeared. It emerges to have been formed over long period and the soil formation took place during the dry phases. The surface of the layer during the deposition of the artefacts was relatively dry and seems to be well conserved as confirmed by the presence of small bones fragments and a carnivore coprolite observed in the micromorphological analysis (Rentzel & Ismail-Meyer, no date). It seems that the artefacts in this layer were laid on the surface uncovered for a long time and formed a thick layer of flints without the clear intermediate sub-levels. One small zone approximately 4 m² represents the physical deformation and erosion of layer 7c.

It is difficult to elucidate whether the assemblage from layer 6b is a result of a single or successive human occupations. Although, it does confirm that the lithic material represents a single technological tradition.

6b appears identical in all the sectors excavated and is easy to locate due to the regular presence of pebbles and blocks of limestone and travertine. These blocks although eroded were certainly brought into the site by Hominids as the type (limestone) and size of rock are not found naturally in this location, and forms something of an imitation manuport living floor (fig. 2).

Layer 6a: A detritus loam sediment with an average thickness of 15 cm. It eroded part of layer 6b. It is not always easily distinguishable from the layer 5h. The depositional context of this layer is so far not determined. It could be possible that the archaeological remnants were redeposited within repeated debris flow, but it is just as likely that humans arrived on the site after the accumulation of debris and settled on colluviated material. The concentration of objects larger than 3 cm on three square meters and the presence of small debris on almost all excavated surface could suggest that a sorting of objects according to size occurred.

At the same time nearly all objects were found in a sub-horizintal position in accordance with the layer inclination and the white-grey patination of lithic objects is homogenous. Some animal bones and two fragments of ostrich shell are also found.

Lithic Analyses

The Archaeological Samples and the Lithic Preservation

The excavation surface is located in the Northeast part of site and in 2005 reached an area of 26 m² and produced more than 6000 lithic artefacts (tab. 2) and 105 bone fragments. Unfortunately the excavated area was bisected by the cutting of a drainage channel and thus split the excavated areas into two distinct parts. Two profiles of the east and west faces of the excavated area were recorded.

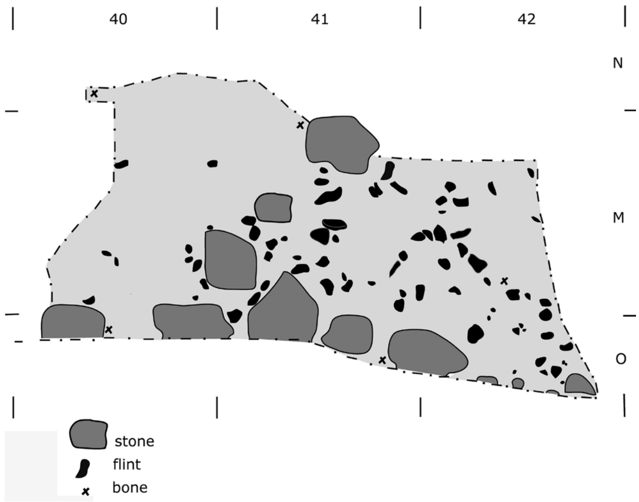

Figure 2 - Layer 6b, Manuport living floor.

Figure 3 - Layer 6b, crushing visible on blade.

The whole lithic assemblage of layer 6b is characterized by the same state of alteration. Its patina is rather strong, homogeneous and of white-grey colour. 65% of blades and 3% of flakes have undergone mechanical breakage. 25% of all artefacts show crushing or a series of pseudo-retouch removal (fig. 3). These three phenomena, erosion, mechanical breakage and crushing, are related to the post-depositional conditions of preservation within the assemblage. The bad preservation of the artefacts could be due to the effect of long-term exposure on surface (erosion and digenesis) whilst also being trampled.

		6a	% out of complete assembalge	% out of debitage and shaped items	ENIT*	% out of complete assembalge	% out of debitage and shaped items	6b	% out of complete assembalge	% out of debitage and shaped items	ENIT*	% out of complete assembalge	% out of debitage and shaped items	6c2	% out of complete assembalge	% out of debitage and shaped items	7a	% out of complete assembalge	% out of debitage and shaped items	7c	% out of complete assembalge	% out of debitage and shaped items
Artefact Categories	blank flakes	50	4%	17%	50	4%	21%	448	9%	13%	448	11%	17%	8	3%	7%	4	2%	15%	35	6%	26%
	blank blades intact	4	0%	1%	103	9%	43%	204	4%	6%	838	20%	32%	30	10%	25%	3	2%	11%	16	3%	12%
	blade fragments≥3cm	133	11%	44%				1415	28%	40%				12	4%	10%	10	5%		24	4%	18%
	bladelets intact	1	0%	0%	9	1%	4%	9	0%	0%	97	2%	4%	2	1%	2%	1	1%	4%	1	0%	1%
	bladelet fragment	21	2%	7%				134	3%	4%				9	3%	8%				9	2%	7%
	shaped tools on blades intact	2	0%	1%	7	1%	3%	112	2%	3%	232	6%	9%	21	7%	18%	1	1%	4%	7	1%	5%
	shaped tools on blade fragment ≥3cm	9	1%	3%				171	3%	5%				1	0%	1%				2	0%	1%
	shaped tools on flakes							68	1%	2%	68	2%	3%	3	1%	3%	1	1%	4%	4	1%	3%
	shaped tools on débris							14	0%	0%	14	0%	1%					0%	0%			
	cortcal elements blades(CEB) intact 50-100%	4			9	1%	4%	7	0%	0%	49	1%	2%				1	1%	4%	2	0%	1%
	CEB fragment≥3cm	10						66	1%	2%												
	cortcal elements flakes 50-100%	44	4%	15%	44	4%	18%	293	6%	8%	293	7%	11%	11	4%	9%	1	1%	4%	13	2%	10%
	core trimming blades (CTB) intact	4	0%	1%	9	1%	4%	103	2%	3%	210	5%	8%	8	3%	7%	1	1%	4%	6	1%	4%
	CTB fragment≥3cm	9	1%	3%				130	3%	4%							2					
	Core trimming flakes	7	1%	2%	7	1%	3%	155	3%	4%	155	4%	6%	9	3%	8%				8	1%	6%
	cores	4	0%	1%	4	0%	2%	176	3%	5%	176	4%	7%	5	2%	4%	2	1%	7%	7	1%	5%
	Total debitage and shaped items	**302**	24%	100%	**242**	20%	100%	**3505**	69%	100%	**2580**	62%	100%	**119**	40%	100%	**27**	15%	100%	**134**	23%	100%
	débris ≥3cm	106	9%		106	9%		342	7%		342	8%		4	1%					84	14%	
	chips≥3cm	17	1%		17	1%		55	1%		55	1%		64	21%		6	3%		108	18%	
	débris<3 cm	816	66%		816	69%		1165	23%		1165	28%		114	38%		149	82%		263	45%	
	Total	**1241**	100%		**1181**	100%		**5067**	100%		**4142**	100%		**301**	100%		**182**	100%		**589**	100%	
	medial fragments<3cm	168						1104						7						76		
dorsal scar pattern %	unidirectional	85%						82%						66%			71%			78%		
	bidirectional	11%						11%						33%			13%			16%		
	centripetal	0%						2%						1%			4%			2%		
	indeterminable	4%						5%									13%			3%		
		No.*	%					No.*	%					No.	%		No.	%		No.	%	
	laminar items	137	57%					1440	56%					83	70%		6	43%		67	50%	
	flake items	101	42%					964	37%					31	26%		6	43%		60	45%	
	cores	4	2%					176	7%					5	4%		2	14%		7	5%	
	total	242	100%					2580	100%					119	100%		14	100%		134	100%	

Table 2 - Inventory of Hummalian assemblages. ENIT; total length of intact tools added to the total length of fragments that are greater than or equal to 3 cm divided by the median length of intact specimens (ENIT). This value should approximate to the number of discarded tools.

Several experiments (Behrensmayer *et al.* 1986; Mcbrearty *et al.* 1998; Thiébaut 2007; Villa & Courtin 1983) showed that trampling can cause severe damage to the artefacts. It can cause breakage, crushing, and pseudo-retouch and vertical and horizontal displacement of artefacts. In the case of the artefacts from layer 6b; breakage, crushing and the pseudo-retouch are evident. Cryoturbation could cause a similar crushing and breakage, but there is no evidence of this phenomenon in any layer. The occurrence of a high degree of fragmentation in the faunal remains also lends weight to the trampling hypothesis (Frosdick 2010).

The presence of the broken blanks observed at the time of the excavation and whose fragments were easily joined also suggests interference by mechanical disturbances to the artefacts. In the same way some connections between the broken elements made on 4 m² of the excavation testify to a displacement of less than 1 m, and thus an in situ breakage probably mechanical in nature. However, lack of time did not allow a systematic refitting of all broken artefacts.

In the case of layer 6a ninety percent of blades are broken and several artefacts show signs of edge damage. It seems that the archaeological material from layer 6a have been subjected to the same taphonomic forces as those of layer 6b. The state of preservation of the artefacts from layers 6a and 6b indicates that the taphonomic modification of these layers was important, and also explains the small number of preserved bones, the majority of which are teeth.

The high fragmentation of artefacts due mainly to the post depositional taphonomy of the collections from layers 6a and 6b make them difficult to quantify. In both cases, blades were the worst affected by fracturing, which seem to break consistently in to two or three parts. Those items which retain the flake platforms, their original dimension can be estimated after Dibble & Pelcin (1995), but for those without their original length remain unknown at the time of fracture.

Here quantification of the different blade groups, whilst bearing in mind that this problem needs to be assessed at a later date, using a formula of estimating the number of intact tools: total length of intact tools added to the total length of fragments that are greater than or equal to 3 cm divided by the median length of intact specimens (ENIT). This value should approximate to the number of discarded tools.

Although all lithic assemblages frequently exhibit a variable rate of fragmentation, the problem of accounting for these fragments seems to be unresolved. This due to the fact that different researchers produce fragment counts, their size and their nature differently. Often, comparison between assemblages is extremely difficult and the use of a standardised methodology would allow for better understanding of differences between sites. As Shott (2000 and the references therein) showed there exists some possibilities to evaluate this quantification problem, "otherwise, differences may owe as much to how we counts as to what…" (Shott 2000:737). The lithic artefacts from layer 7a and 7c are well preserved, nearly all were found in sub-horizontal position with accordance to the inclination of layer. These do not exhibit any edge damage but at the same time a number of blades are fragmented. Several pieces demonstrate an orange patination probably originating from the iron oxide deposits. All artefacts from layer 6c are well preserved with still sharp edges and were probably covered by sediment soon after deposition. In layers 7a, 7c and 6c all intact and each fragmented item bigger than 3 cm were counted as an individual specimen, whilst refitting was continually undertaken in these assemblages

The Hummalian layers contained about 200 potentially burnt flints. The majority of these were found in layer 6b, where the overheated flints were found in three main concentrations around which the other burnt flints were distributed. Some archaeological and experimental evidence (Sergent *et al.* 2006) shows that severely overheated flints are the best marker of non-structured surface hearths. In addition, the micromorphological analysis shows the presence of charcoal in layers 6a and 6b (Rentzel & Ismail-Meyer n.d.). This could suggest the potential existence of hearths, which could also have been easily destroyed by intensive trampling.

The Procurement of the Raw Material

The raw material used in Hummalian layers is approximately 99% local Lower Eocene flint from the El Kowm area (Diethelm 1996). This is a very fine grained flint of excellent quality for knapping. Its colour varies from black to dark brown with a white cortex. The nodule size fluctuates from a few centimetres up to tens of centimetres, and are very heterogeneous, forming both nodules and plates. This flint is very abundant and easily accessible in a radius of about fifteen kilometres around the site. The rest of the raw material is made out of cretaceous flint and travertine, of which the former is probably obtained from the formations at Jabal Mqabra and Jabel Minshar a distance of about fifteen km from the site, the latter is possibly of local origin. The occurrence of lithic items which bear a weathered cortex or neocortex give evidence of using the flint gathered in secondary context. However, the small numbers of such specimens in all Hummlian assemblages demonstrates that the use of such a strategy seems to be rarely practiced.

An additional source of raw material was the flint found on the site, which is visible by the reuse of exhausted Levallois cores, the broken blanks and debris for bladelet production. The tendency to recycle the raw material is visible by, among other things, the large occurrence of cores on flake. The substantial flakes were struck on their dorsal, or occasionally on ventral surface following the different reduction strategies, Laminar, Levallois or Nahr Ibrahim technique. Their final stage of reduction shows that the aim was to obtain as many blades or bladelets as possible.

The recycling of blanks for shaping new tools, which is perceptible by double patinated items, occurred sporadically in layer 6a and 6c, but is not noteworthy in assemblages from layer 7. In layer 6b recycle material makes up 4% of retouched tools. Occasionally the exhausted cores were retouched for tool use. Two examples of cores made on Yabrudian scrapers coming from layer 7c and 6c show that the procuring of lithic material from older occupations took place as well.

Layer	Ilam	Ratio blank to CTE and cortical elements
6a	57.6	2.4
6b	59.9	1.8
6c	72.8	3.1
7a	75.0	4.0
7c	52.8	3.4

Table 3 - Ratio blank to Core Trimmig Element and cortical elements; ILam in Hummalian layers.

Blank Production

The influence of the raw material on debitage is inevitable, but it is difficult to appreciate its importance without the refitting. A high-quality raw material can increase the tool efficiency by the ease of flaking, facility for maintaining and recycling (Edmonds 1987). Experiments carried out in El-Kowm on Eocene flint show that even an inexperienced flintknapper starting with an elongated and convex nodule, is able to strike some blades but will not succeed in producing a regular series and will even make the same knapping errors as those observed from the Hummalian material. Conversely, because the flint is so easily knapped the smallest error such as an imprecise, badly controlled, too forceful or too weak blows will cause a mistake. Generally an overshot or fracturing of the proximal part is produced, which often requires repair to continue the flaking. The systematic debitage of a great number of elongated supports required experience, but it is also facilitated by the quality of flint. Laminar debitage noted here can appear in fact rather opportunistic due to the use of the natural shape of the block, the lack of or summary core shaping, but is also effective.

There were no blocks of raw material found on the site. In layer 6b the marked presence of flakes bearing from 50 to 100% of cortex on their surface, several of which are entames which present the initial stage of the raw material aquitisation (Tixier 1963:33), core trimming elements and cores shows that the debitage was at least partly carried out on site. This assumption can be reinforced by the fact that the cortical butts and single scars are observed on a large majority of cortical blades. The ratio of core trimming elements (CTE) and cortical elements to blanks is high (tab. 3), whilst the length and volume of CTE and blanks are equivalent.

In other layers the first, cortical removals from a natural platform (entames) were not recorded and the cortical elements are under represented in layer 7c, 7a and 6c. Nevertheless CTE that belong to the stage of reshaping the core, when the convexities have been lost or the core surface does not allow further flaking which required a mend, were existent alongside those with cores in variable quantities .The size of CTE is related to blank size.

It can be supposed that in case of layer 6c and 7c already prepared decocorticated nodules were transported to the site where they were shaped and blanks produced. Additionally in the level 7c a small debitage workshop was also discovered. A partial refitting shows that the debitage is produced from a small convex nodule of a few centimetres in length, which displays traces of cortex removal. A few items were removed from nodule and two of them which were elongated and broken left with the waste.

The high degree of the small debris in layer 6a is probably related to the post-depositional disturbances. In the case of layer 6c the small debris may possibly come mainly from tools production as the percentage of retouched items is high and a minority from core shaping. In the case of layer 7 it is just as likely that the small fragments were present due to post-depositional disturbances as to tool resharpening. Besides this in all levels the relatively frequent use of removal of overhang from blanks could also be liable for small debris production.

The lithic assemblages show no major differences between layers. The aim of production was the elongated, converging or parallel blanks (tab. 3). At the same time achieving the particular blades size was not an aim as the blades are extremely variable in their length, width and thickness within assemblage (tab. 4) as well as between the assemblages coming from different layers. The common flaking technique is direct percussion with a hard hammer as attested by a circular and well testified impact point, bowed bulb and numerous radial defaults (Pelegrin 2000). All assemblages fall under a particularly coherent technical unit. The technological studies confirm the existence of a Laminar system of debitage (Meignen 1998), and a particular core volume management. This process is very different from

		length (L)			width (W)			thickness (T)			WT platform			median		
Blades category	**n**	min	median	max	min	median	max	min	median	max	min	median	max	LW	WT	LT
Cortical (cx 50-100%)	**10**	6.2	7.9	10.6	1.4	3.0	5.0	0.8	1.4	2.4	2.0	2.1	2.3	2.6	2.1	5.6
CTB	**103**	3.1	6.8	14.0	1.2	2.5	6.6	0.3	1.2	2.5	0.9	2.0	4.5	2.7	2.1	5.7
Bladelets	**10**	2.0	3.8	4.6	0.7	1.4	1.4	0.3	0.7	1.2	2.3	2.4	2.5	2.7	2.0	5.4
Blank Levallois	**20**	5.7	6.8	8.5	1.9	2.8	3.8	0.5	0.7	1.1	2.2	4.1	12.0	2.4	4.0	9.7
Blank Laminair	**186**	4.0	7.3	16.0	1.3	2.9	6.5	0.4	1.0	2.6	0.8	2.3	4.7	2.5	2.9	7.3
Shaped	**112**	4.2	7.7	14.0	1.2	2.8	5.5	0.3	1.0	2.6	0.8	2.5	6.3	2.8	2.8	7.7

Table 4 - Layer 6b, metrical data of blades.

Levallois system of debitage which shows working on successive surfaces. However, the practice of Levallois debitage is also observed at the same time, with the presence of cores, and typical Lavallois products, lames débordantes, and predetermined flakes. It seems that there are two coexistent reduction strategies. Indeed, it could also be possible that a system of Levallois and Laminar debitage were carried out successively on the same block giving the opportunity for a more efficient use of the entire block by passing from one reduction strategy to another and might be related to the decreasing size of the core. The close connection between the two flaking system can be seen by the existence of laminar cores made on big edge flakes or on the large fragments stem from Levallois cores. This suggests that Laminar and Levallois production could take place within the same reduction sequence. A comparable situation has been identified in a Middle Palaeolithic blade industry from Etoutteville (France), where the Levallois production started on large, flint nodules. These frequently split at the beginning of the reduction process, these large broken fragments from this early stage of debitage were regularly recycled for blade cores manufacturing using the particular core volume management similar to Laminar system, whilst the original block was flaked following the Levallois scheme (Delagne & Kuntzmann 1996).

Alongside these two main core reduction strategies the Nahr Ibrahim (Schroeder 1969; Solecki & Solecki 1979) technique and the regular debitage of bladelets on thick flakes or nucleiforme debris were also documented at the site (tab. 5).

All presented flaking systems were involved in blade manufacture, but the laminar strategy is more universal. The majority of cores are exhausted and few broken at the end of the debitage (generally marked by hinges), the dorsal scar pattern shows the choice of laminar debitage; however, some cores also show the flake negative whilst others demonstrate both at the same time.

The existence of these different reduction strategies could indicate the different use of the products especially if they treated differently. This appears to be the case of the Hummalian industry, where the thick, laminar blades are often retouched and the majority of the elongated Levallois products were not modified, as their broad and thin nature was naturally appropriate for the intended use.

The technological analysis presented here will focus on layer 6b which is the richest assemblage and gives the opportunity to define the Hummalian industry. The metrical analyses were carried out on complete pieces. Although, information could be taken from the majority of broken or crushed artefacts that could be used for other technological studies.

cores types	7c	7a	6c	6b	6a
Semi-rotating	2			74	
Facial	1		2	17	1
Frontal				5	
Levallois	3		1	37	
Nucleiforme burin		2	2	28	1
Nahr Ibrahim	1			14	2
Irregular				1	
Total	7	2	5	176	4

Table 5 - Core categories in Hummalian layers.

The assemblages from layers 6a, 6c2 and 7 are less productive but present all technological features observed in layer 6b and therefore confirm that they are of the same technological tradition.

The Levallois Method

The use of Levallois method was visible in all layers either by the presence of cores or typical Levallois products. The majority of Levallois cores were made on block and a few on flake. They are rectangular or triangular to round in shape, the majority are elongated and flat, few are convex in cross section. The debitage method is mainly recurrent unidirectional (fig. 4:1), bidirectional or centripetal, and in marginal lineal (fig. 4:2). Only a few cores show the negatives of convergent unidirectional debitage but in the same time the scar pattern visible on Levallois blanks shows that this method was frequently employed.

The Levallois cores, as defined by E. Boëda (1986), are composed of two opposed surfaces, of which one is conceived as the preparation of the Levallois surface and the other, often cortical, as a surface of the striking platform. In the case of layer 6b, cortex occurs on 27 cores (68% of Levallois cores), on the ventral face in 20 (49%) and in eight (20%) on dorsal face (on proximal, medial and distal parts). In the first group the cortex coverage is important, and accounts for 25 to 50% and in the latter groups for less than 25%. The cores with non cortical coverage are the smallest with a median volume of 29.5 cm^3. The cores with cortex less than 25% are bigger with median volume of 36.7 cm^3. The cores with cortex coverage from 25 to 75% are the biggest in the series with a median volume of 49.8 cm^3. Such a cortex distribution indicates that the scarcity of cortex on the core is a function of the core size which suggests that the systematic cortex removal took place on site following the volume reduction.

The convexity of the distal and lateral portions of the cores exhibiting the recurrent method of debitage is guaranteed by the regular removal of edge flake. This removal recreates the hinges or guides and follows the exploitation of the Lavallois surface (Boëda 1988). The éclats débordants will aid the continued flaking by systematically reducing the plane of intersection and will allow a better use of the block volume (Boëda 1995). The distal convexity is also assured by small removals from the latero-distal part of the core. The large platform is established on the proximal or proximal and distal (bidirectional) part of the core. They are in the main faceted, and occasionally plain. The blanks were struck from one or two parallel platforms.

The lateral and distal convexities are achieved in the centripetal Levallois method by the removal of éclats débordants, which are often overshot (fig. 4:3) and maintains the rest of Levallois preparation. Alternatively the extraction of the small flakes around the periphery of the exploitation surface could be used to the same affect. The striking platform is organized around

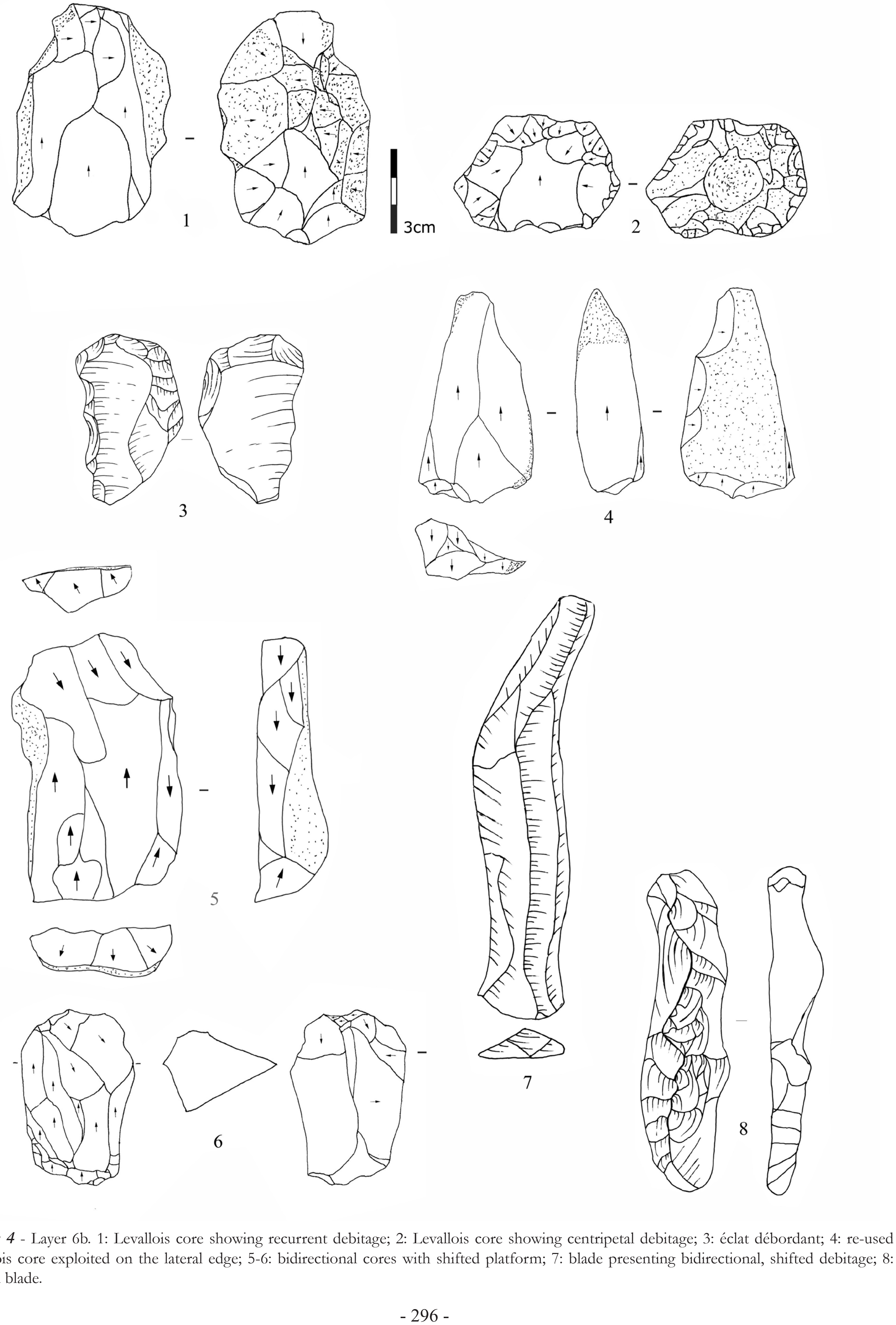

Figure 4 - Layer 6b. 1: Levallois core showing recurrent debitage; 2: Levallois core showing centripetal debitage; 3: éclat débordant; 4: re-used Levallois core exploited on the lateral edge; 5-6: bidirectional cores with shifted platform; 7: blade presenting bidirectional, shifted debitage; 8: crested blade.

the whole core periphery. Four cores show the negative of preferential flake, covering the main part of the exploitation surface. The presence of only a few blanks from this flaking method and the small volume of these cores (median volume = 21.3 cm³ compared to a median of Levallois cores = 41.8 cm³) and size (median length =3.6 cm, median length of Levallois cores=5.2 cm) suggests that the preferential flake method was not used regularly, maybe only at the end of the core reduction. This can be further evidenced by the fact that the median length of blanks (median length of all blanks = 6.2 cm, median length of blanks-flakes = 5 cm) surpass the length of these type of core.

The Levallois cores resulted in mainly large blades, and thin and flakes of varying sizes. The dorsal scar patterning on 69% of the cores shows evidence of laminar debitage and in 31% of flakes. Five cores were reused for blade/bladelet production. These were exploited on the sides (fig. 4:4). Nevertheless, the flint knapper succeeded in obtaining just two or three blades or bladelets on this narrow side because the new striking platform was not re-orientated with the new knapping surface. Occasionally, the nucleus was split in two pieces, which were then struck again if the partition created an apt angle. This cannot of course be regarded as the force behind the changing from Levallois to Laminar debitage but at the same time shows the flexibility of the "Hummalian" flint knappers whose main goal was to strike the elongated blanks regardless of their size and the reduction strategy.

The Laminar Method

The presence of the thick, elongated blanks with triangular or trapezoidal cross section and laminar cores confirm use of the Laminar method in all Hummalian layers. The majority of laminar cores were made on block but many were also made on flake (tab. 6). A consistent morphology is visible in many of the laminar cores in spite of a large variation in size; from three to twelve centimetres. Blank production was usually carried out until exhaustion of the core which produces a narrow or large, often thick blank, of differing size including small blades.

The blades were struck out from either one platform or two opposite, offset platforms. The laminar concept is characterised by frequent use of the natural shape of the block, often

layers	on block n	on plaquet n	on flake n	on debris n	total
7c	5		2		7
7a			1	1	2
6c	2		5		7
6b	83	16	64	13	176
6a			3	1	4
	90	16	75	15	196

Table 6 - Cores in Hummalian layers.

with minimal cortex removal and no or summary core shaping. The management of the laminar flaking surface was usually performed by the removal of a naturally backed flake, along a natural ridge without any preparation, using the natural form of block or flake. An alternative to this was to produce the flakes with cortical, often vertically backed, or by secondary crested blades retaining on one side the negatives perpendicular to the vertical axis of the core. Only six blades in layer 6b and two in layer 6c testify to the initialization of flaking using crested blades (fig. 4:8) and it seems that in most cases the first blade was struck directly from a single striking platform with respect to the natural shape of block.

If the flaking surface showed too many hinge marks, lost its convexity or became too bowed, the flint knapper often removed a flake. Most of the struck "cleaning flakes" to maintain the flaking surface corrects the middle part, whilst a few occur at the distal part, occasionally these are also plunging. The majority are non cortical, few show 1 to 25% cortex of their dorsal face. These are rather weighty with median thickness of 1.3 cm and four to ten centimetres in length. This indicates that this practice was used throughout the core reduction.

It is entirely possible that the laminar system is related to a rotating system of debitage. This means that the tool-maker began with a frontal debitage along the narrowest face of the core and subsequently repositioned to the one of the adjacent faces, as a consequence of this changed to semi-rotating debitage. The core volume management is organised into three main categories (fig. 5 top).

Semi-Rotating Debitage

This is well represented and perceptible on 42% of cores in layer 6b. The majority are complete on block and there are several on flakes. The flaking surface covers part of the nucleus and its sides and opposes a plane or cortical surface (posterior). However, if produced on flake it opposes the ventral face. More than half of the semi-rotating cores have a single striking platform. The remainder exhibit two opposing striking platforms, the greater proportions of which are offset (fig.4:5-6) with a few parallel platforms. These can be classified according to their cross-section and demonstrate a development of the flaking surface which can be expanded on to the side during flaking (fig. 5 bottom).

The debitage is generally organized according to the vertical axis (length) of the block. Certain cores had initially, two converses and offset striking platforms, one of which was lost at the end of the debitage, by a plunging flake. The cores are rectangular to triangular in shape, elongated and as a rule convex in cross-section. The platforms of the majority of cores are minimally prepared by two or three weighty blows on the smooth lateral sides, although these occasionally occur on cortical sides. These removals from the core sides have a role of refreshing the intersection between the platform and the flaking surface and allow the exploitation of the lateral sides of the core. It seems to be frequently utilised. No more than six pieces exhibit the removal of the rejuvenation core flake. The cores with two opposed faintly offset platforms demonstrate that the flaking

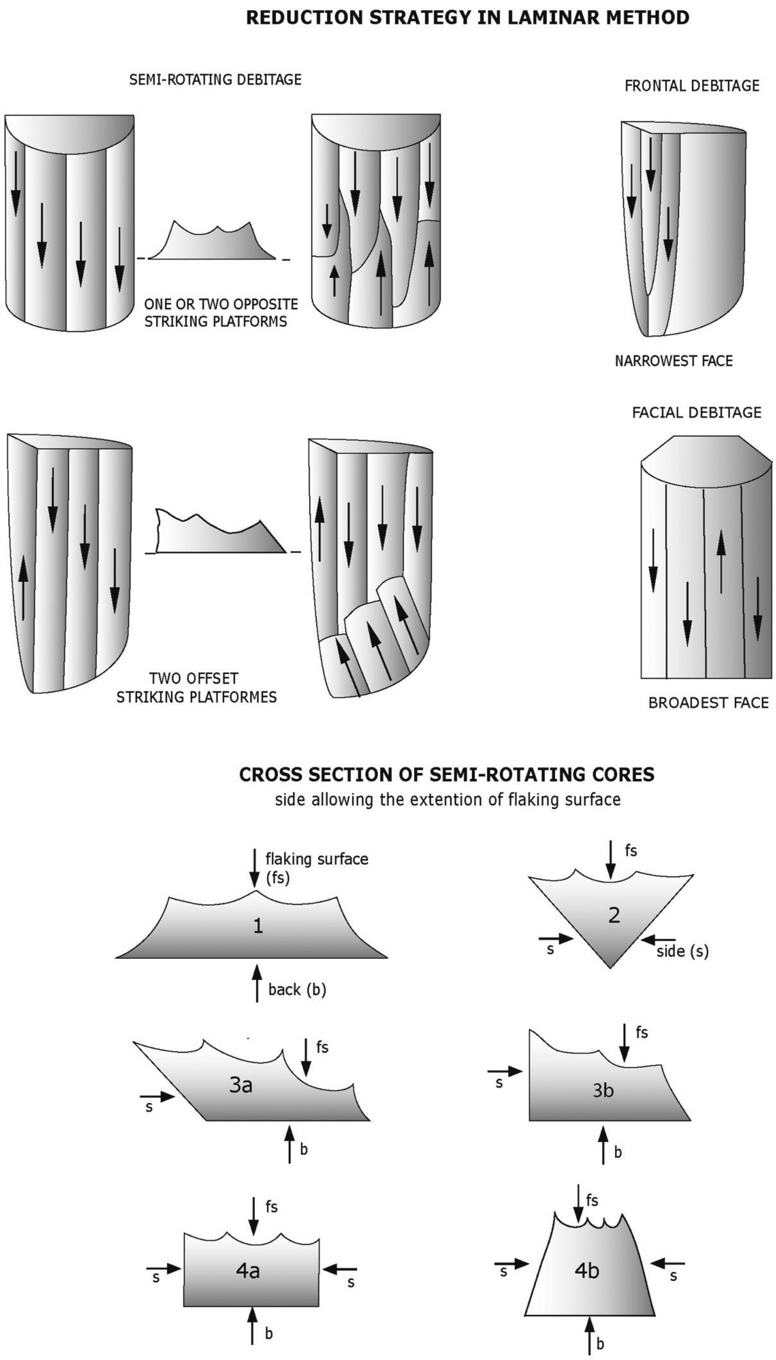

Figure 5 - Top: reduction strategy in Laminar method; bottom: cross section of semi-rotating cores.

was occurring independently on both the narrow and broadest face of the core. The intersection between these two surfaces created the required convexity of flaking surface for continuation of the debitage.

Three semi-rotating cores were made on the big éclats débordants, still having the traces of Levallois preparation, evidently from Levallois cores. All cores provided blades and several bladelets.

Facial Débitage

This is recognized in 10% of cores, half made on block and half on flake. The debitage is carried out on the broadest surface of the core from its convex or flat dorsal face. They can be either bidirectional (two opposite parallel platforms) or unidirectional. The majority of platforms are prepared as with the semi-rotating cores, by two or three blows from the lateral sides or plane. They are rectangular or triangular to round in shape and not elongated. At the end of exploitation they produce mostly blades (41%), flakes (35%) or both (24%). In three cases when the ventral face was exhausted, the core was rotated and exploited on its ventral face. The flint knapper normally managed to remove one or two more flakes before discarding the core. Despite the fact that several cores at the end of exploitation give the notion of being similar to Levallois, the management and the maintenance of the surface convexities separate them from the latter completely.

Frontal Debitage

This is recognisable on 3% of cores, four complete on block (fig. 6:1) and one on flake. They have one striking platform and the flaking concerns the narrowest face of the core. The platform is prepared by one or two blows and debitage starts on the natural edge of the block, in the case of core on flake the edge of flake serves as a guide-ridge. The cores are rectangular or triangular in shape, elongated and convex in cross-section. They provide three or four blades at the end of their exploitation.

The Nahr IbrahimTtechnique (NI)

This was recognized in 8% of cores in layer 6b. These are normally made on large non cortical flakes or those showing only small patches of cortex covering less than 25% of their distal face (fig. 6:2). They are rectangular to triangular in shape and mainly convex in cross section. The dorsal surface shows between two and five elongated negatives. Four are complete on Levallois flake while still retaining the rest of Levallois preparation. They can be bidirectional or unidirectional. The flake was truncated on either its proximal or distal ends, with some exhibiting truncation at both ends, in all cases these were also facetted, subsequently the detachment of rather thin blanks occurred. In the lithic assemblage, the blanks struck from NI cores are not abundant but are observed.

The Bladelet Production

The bladelet production was perceptible in all Hummalian layers, in the case of layer 6b it represents 16% of all cores. The small blades were systematically struck from nucleiforme burin-like pieces made on broken, thick blade, flake or on nucleiform debris (fig. 6:3-5). Similar to the frontal debitage the flint knapper used the natural shape of block and started to detach the blanks from natural edge of the core. The platform is mostly unprepared/plain or corrected by truncation, periodically they are prepared by one or two blows. The unidirectional flaking started on the narrowest face of the core and frequently expanded on to the broad face. They result in two to five bladelets, of two to four centimetres in length. Additionally, small blades were also produced from different volumetric cores at the end of their reduction or on the side of exhausted Levallois cores.

It was decided that the specimens which present just one coup de burin negative will be categorize as burin not as core for bladelets production. Nevertheless the question how they should be classified remains open. The microwear analyses could help to shed more light on this problem. Unfortunately such studies on the lithic material from Hummal have not so far been undertaken.

categories of CTE	blades	%	flakes	%	blades +flakes
crested	4	2%	1	1%	5
semi-crested	10	4%			10
with prepared back	20	9%	15	10%	35
with natural back	81	35%	28	18%	109
with cortical back	46	20%	28	18%	74
éclat débordant	6	3%	15	10%	21
cleaning	37	16%	26	17%	63
plunging	20	9%	11	7%	31
hinged	9	4%	28	18%	37
resharpening			4	3%	4
Total	233	100%	156	100%	389

Table 7 - Layer 6b, Core Trimming Element categories.

The Blades

The blades represent more than half of the debitage, excluding small debris, in almost all layers (the exception being layer 7a assemblage) and which consists of blanks, and core trimming, primary blades, bladelets, shaped tools.

The Cortical Blades

The cortical blades bearing more than 50% of cortex on their dorsal surface seem to correspond to the initial core shaping stage and differ significantly from the blanks. The cortex is perceptible on the proximal and medial parts in 64% and remainder on the medial-distal part. In most cases the striking platform is broken, cortical, and sometimes plain. The majority of these present a unidirectional scar pattern and the rest bidirectional. It indicates that the decortication of the nodule was carried out on a single, usually cortical or non-prepared platform. They are generally parallel or convergent and occasionally divergent. Single scars are observed on a large majority of cortical blades. Their median index length to thickness is the smallest in the blades group. This means that the cortical blades are thicker and smaller and relatively more substantial than other groups. This is also observed in the median volume and the median index of width/thickness (tab. 4).

The Core Trimming Blades (tab. 7)

The core trimming blades are composed of 60% backed blades with natural, cortical, or prepared back. Typical "lames débordantes", the cleaning blades, the crested and semi-crested blades, the plunging and hinged blades are considered representative of this group. The naturally backed blades are the most frequent, followed by the cortical backs and those with a prepared back. The majority are unidirectional, with the remainder being bidirectional. Alongside which most are convergent or parallel although several are divergent. Their scar pattern is significantly more variable than in the cortical blades and quite similar to those from blanks. A single scar is visible on 21% of pieces, but the greater part has two or more converging or parallel scars. 37% show from 1 to 50% of cortex on the dorsal surface which appear either on the distal or medial part although less frequently on the proximal part. The majority of striking platforms, excluding the broken pieces, are lightly facetted, punctiform, plain or cortical, some are damaged by crushing and there are rare cases of dihedral platforms. 50% have a curved profile, with just a few being twisted. They are usually quite thick, either triangular or trapezoidal in cross section, very few are flat. Similarly to the laminar blanks the maximal width occurs in the medial portion in 54%, 26% in distal and 20% in proximal.

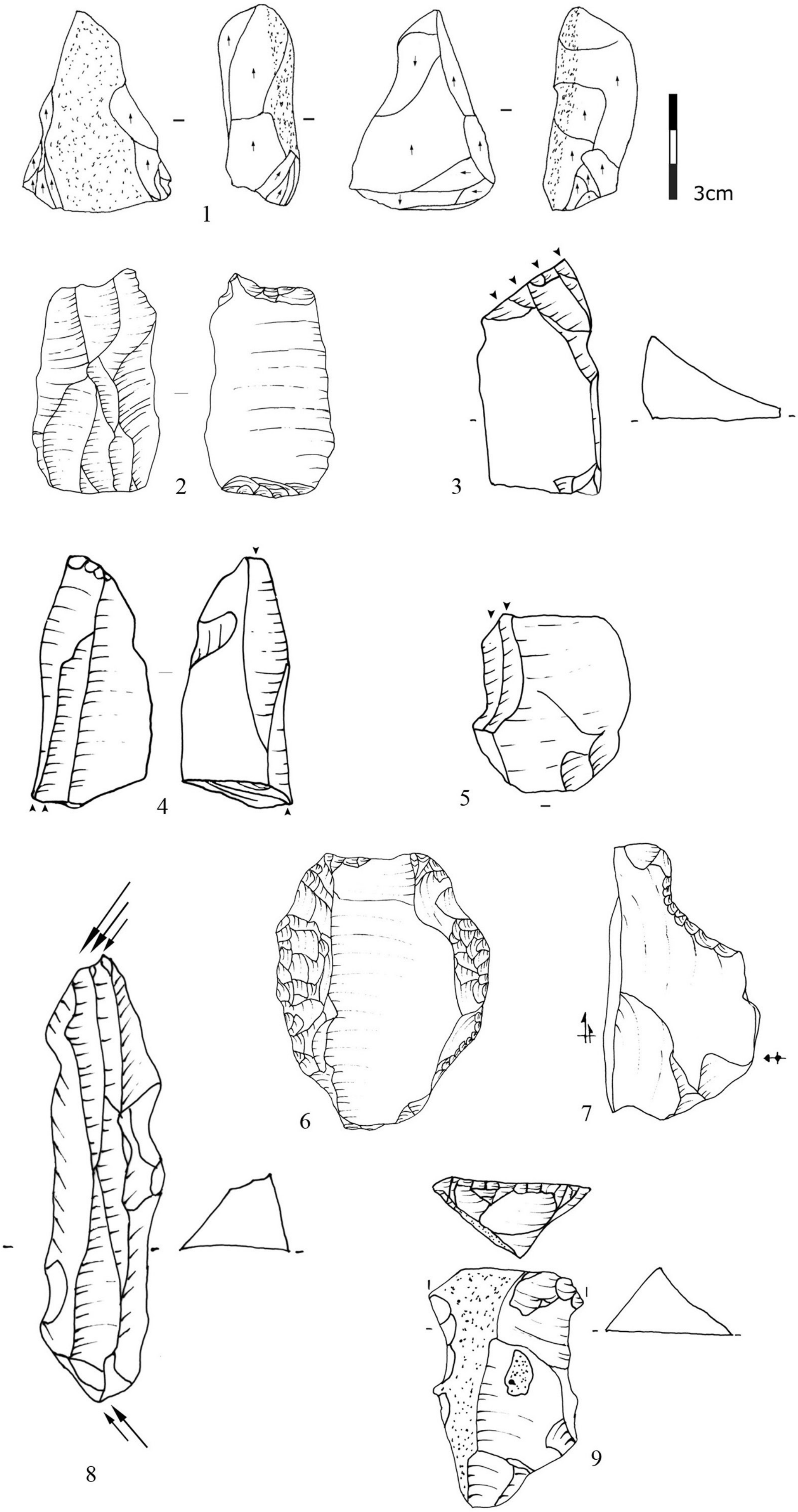

Figure 6 - Layer 6b. 1: unidirectional cores with frontal debitage on lateral edges; 2: Nahr Ibrahim core; 3-4: nucleiforme burin on debris; 5: blade fragment used for bladelet production; 6: double scraper made on Levallois flake; 7: notch made on broken flake; 8: double burin made on blade extremities; 9: end-scraper.

The blanks-blades

The volumetric cores produce the narrow and large thick blades, with triangular or trapezoidal cross sections with plain or lightly prepared butts. The Levallois recurrent method results in a series of rather wide blanks with faceted or plain platform, although occasionally narrow, and thin elongated blanks are recorded.

In the Hummalian assemblage from layer 6b the blanks showing either of these characteristics were easily separated, but between both these groups exists a number of blanks which are somewhat problematic due to their ambiguous morphology with respect to their metrical attributes. The state of preservation also adds to the difficulties in deciding about their inclusion. Most have lost their proximal part either through breakage or at the moment of failure. They are short and thin and could possibly be struck from either Levallois cores or from Laminar cores as their volume reduces and as they become flatter. Certainly this could be the case of the facial cores. For this reason it was decided to separate them from clearly Levallois and prismatic blades.

The metrical analyses made on the Levallois and Laminar sets demonstrate that the thickness and length seem to be the most distinctive attribute between these blanks. The t-test of ratio length/thickness ($t=-9.742$; $p=0.00$) and the width/thickness ($t=19.835$; $p=0.00$) confirm the total dissimilarity opposite between these two groups. Quantifying, this shows that 76% are laminar blades, 9% Levallois blades and 15% are those blades of indeterminate morphology.

The laminar blades are longer and thicker than Levallois, but there is a similarity in width measurements. The laminar blades are often curved in profile. They tend to be trapezoidal or triangular with a thick or slightly flattened section. 15% bear cortex, in most cases on the distal part, however cortex is found on the proximal and medial parts. This can indicate the partial preparation of the nucleus and that the end opposed to the striking platform did not matter. Only 6% of Levallois blades show a small amount of cortex on the dorsal surface, which occurs equally on the distal, proximal and the medial sections of the artefact. They are in the main straight in profile with a flattened or sometimes concave trapezoidal cross-section. The butts of laminar blades, excluding those which are broken, are mostly plain prepared. In the case of Levallois, they are faceted or plain. Interestingly, in the latter group fewer butts are broken. Both groups occasionally show cortical, dihedral and punctiform striking platforms. The slightly faceted platform visible on Laminar blanks appears to be applied to reduce overhang and amend the flaking angle. They are more or less rectangular in shape; the point of percussion is placed well back. Those produced by the Levallois method are rather thin in relation to the blank thickness. The contrast between the platform sizes in Levallois and Laminar blades is also confirmed using the t-test ($t=-3.170$; $p=0.02$).

The removal of overhang was used relatively often in both groups. Only the primary blades are derived of this kind of edge preparation. The dorsal scar pattern shows that unidirectional debitage dominates in both groups, but bipolar flaking is more often used in Levallois than in Laminar debitage. The flint knappers often used the ridges left by anterior removals as a guide to steer the force through the piece. This occurred either behind or to the side of a central ridge or between two central ridges. The majority of the blades are convergent with parallel blades following and the remainder being divergent. The scar patterning visible on Laminar blanks shows that two or more convergent negatives are best represented, followed by a single negative, and two or more parallel negatives. The scar organisation visible on Levallois blanks is slightly different. Two or more parallel scars; followed by two or more converging scars are the most frequent and the single scar seldom appears. The Levallois blanks with converging dorsal scar pattern are most likely related to the Levallois point production, though the typical Levallois points are seldom in all collections. It seems that in both cases the goal from the outset was to produce the converging or parallel blanks using the unidirectional and less frequently bidirectional flaking method.

As the blank production was regularly carried out until exhaustion of the core the assemblage includes blades with a size scale ranging from lengthened blades to minute blades (tab. 4). The non-Levallois blades exhibit a wide dimensional variability while the Levallois blades give an impression of being more uniform. 55% of the prismatic blades attain their maximal breadth in the middle part, 28% in proximal and 18% in distal part. The Levallois blanks are the widest at their proximal (44%) or medial (42%) part, the rest on their distal part.

The production of small blades/bladelets (length < 5cm, width ≤ 1.4cm) accounts for 4% of the debitage excluding debris. It confirms that the point of interest was manufacturing the elongated blanks throughout the whole reduction strategy regardless of their dimension, although the Levallois blades are more standardised in their size.

It emerges that the presence of blanks which length and width noticeably surpass the size of all cores and trimming elements is most likely related to the extended exploitation of cores rather than the indication of off site production (Binford 1979).

The Flakes (tab. 8)

The flakes account for approximately 40% of the debitage, excluding debris, in almost all layers excepting layer 6c where the percentage is the lowest, and consists of primary flakes, modified flakes, the core trimming elements, and flake blanks.

The cortical flakes

The flakes bearing more than 50% of cortex are most likely produced from the initial phase of core shaping as the cortex appears mostly on the proximal-medial or medial-distal part. 80% measure from 3 to 4cm in length; they are thin, convex in profile and irregular in shape. 43% of cortical flakes show from 76 to 100% cortex on their dorsal surface. The flakes measuring more than 4cm in breadth or length are substantial with the biggest volume, thick and usually broader than they are long. They are mainly unidirectional although occasionally bidirectional.

		length (L)			width (W)			thickness (T)			WT platform			median		
Flakes category	**n**	min	median	max	min	median	max	min	median	max	min	median	max	LW	WT	LT
Cortical (cx 50-100%)	**268**	1.3	4.0	8.5	2.3	4.7	8.9	0.6	1.3	2.2	2.4	2.8	6.3	0.9	3.6	3.1
Core Trimming	**123**	2.6	5.0	9.3	1.7	3.5	6.5	0.4	1.0	3.2	1.1	2.6	8.0	1.4	3.5	5.0
Shaped	**73**	2.8	4.8	9.3	2.1	3.8	7.3	0.5	1.1	3.0	1.0	3.0	6.3	1.3	3.5	4.4
Blanks Levallois	**93**	2.6	5.0	9.4	1.8	3.8	7.2	0.5	0.7	1.7	1.9	4.3	14.3	1.3	5.4	7.1
Blanks non-Levallois	**95**	2.1	4.9	11.4	1.1	3.5	9.9	0.4	1.0	2.3	1.0	2.4	5.0	1.4	3.5	4.9

Table 8 - Layer 6b, metrical data of flakes.

Their striking platforms are often fractured or cortical with a few examples of plain and lightly prepared.

The core trimming flakes

The assemblage of core trimming flakes comprises of backed flakes, cleaning flakes, plunging flakes, hinged flakes, and re-sharpening elements (tab. 7). 48% show from 1 to 50% cortex on their dorsal face, distal, medial and proximal parts. The butts are facetted or plain, sometimes punctiforme, cortical and infrequently dihedral and often fractured at the moment of failure. 80% are unidirectional, 18% bidirectional, 1% centripetal and rest are indeterminate. The core trimming flakes are not very abundant, but are longer and slightly thicker than blanks, their platforms are also relatively more massive than those from latter group.

The flake blanks

The blanks are not elongated and nearly half present the Levallois morphology which is thin, rather wide and not very long. They also display variability in size from 2 to 9 cm in length. Their butts are thin, mostly faceted but can be plain or cortical. They are mainly unidirectional; although artefacts with bidirectional dorsal scar pattern are also well represented (20% of Levallois flake-blanks) and a small number are centripedal. 35% bear a small amount of cortex on their dorsal face, in most cases, on the distal part though occasionally also on the proximal and medial parts. This indicates that the flaking surface and proximal end usually lacked cortex.

The rest of the flakes are larger and thicker than Levallois examples. The platforms are rather broad, and are either plain or faceted. The dorsal scar shows unidirectional flaking in most of cases, with the presence of a small proportion of bidirectional flaking. The majority (65%) are covered by small quantities of cortex on their dorsal or proximal parts, and to a lesser extent also on the medial portion. It suggests that the cortex was not removed from the flaking surface, especially on the proximal and distal ends.

The Retouched Tools (tab. 9)

The percentage of retouched artefacts varies between the assemblages, from a high of 20% of debitage, excluding small debris, in case of layer 6c to 3%, lowest of in layer 6a. They were shaped mostly on the thick blades struck for the most part from

type of tool	**7c**	**7a**	**6c**	**6b**	**6a**
retouched point			8	94	2
pointed blade	2		6	29	6
blade retouched on one bord	5	1	5	80	2
blade retouched on two bords	3			38	
partially retouched blade				20	
transversal scraper				1	
face plane				2	
notch/denticulate	1			31	
perçoir			1	5	
truncation				7	
end-scraper				14	
atypical end-scraper				6	
burin			1	16	
with Nahr Ibrahim preparation			1	7	
diverse	2	1	3	15	1
total	**13**	**2**	**25**	**365**	**11**

Table 9 - Category of retouched tools in Hummalian layers.

Laminar cores, and less often on flakes or debris. The retouched blades are longer and broader than the unmodified blades (tab. 10). This indicates a choice of longer and broader supports for shaping these tools especially if it is to be believed that the original size of many of them has been reduced throughout repeated use and retouching. The retouched tool assortment consists of a high percentage of elongated end-point products fashioned by intense retouching, these are typologically considered points and convergent scrapers and parallel blades retouched continuously on one or both sides, typologically classified as single or double scrapers on blade (fig. 7:1-6). The retouched pointed blades are symmetrical or asymmetrical ("pointes incurvées" after Neuville 1951), with the semi-abrupt retouch mostly covering both sides and abrupt retouch concerning the distal parts ("Hummalian point" after Copeland 1985). The retouch applied on the blank is continuous, usually invading, and occasionally

		length (L) median		width (W) median		thickness (T) median		LW	
Layer	n	blank	shaped	blank	shaped	blank	shaped	blank	shaped
7c	10	6.3	9.0	2.6	3.1	0.7	1.1	2.4	2.9
6c	20	7.6	8.5	2.3	2.9	0.7	0.8	3.3	2.9
6b	112	7.1	7.7	2.9	2.8	0.9	1.0	2.4	2.8
6a	2								

Table 10 - Metrical data of blank-blades, retouched blades in Hummalian layers.

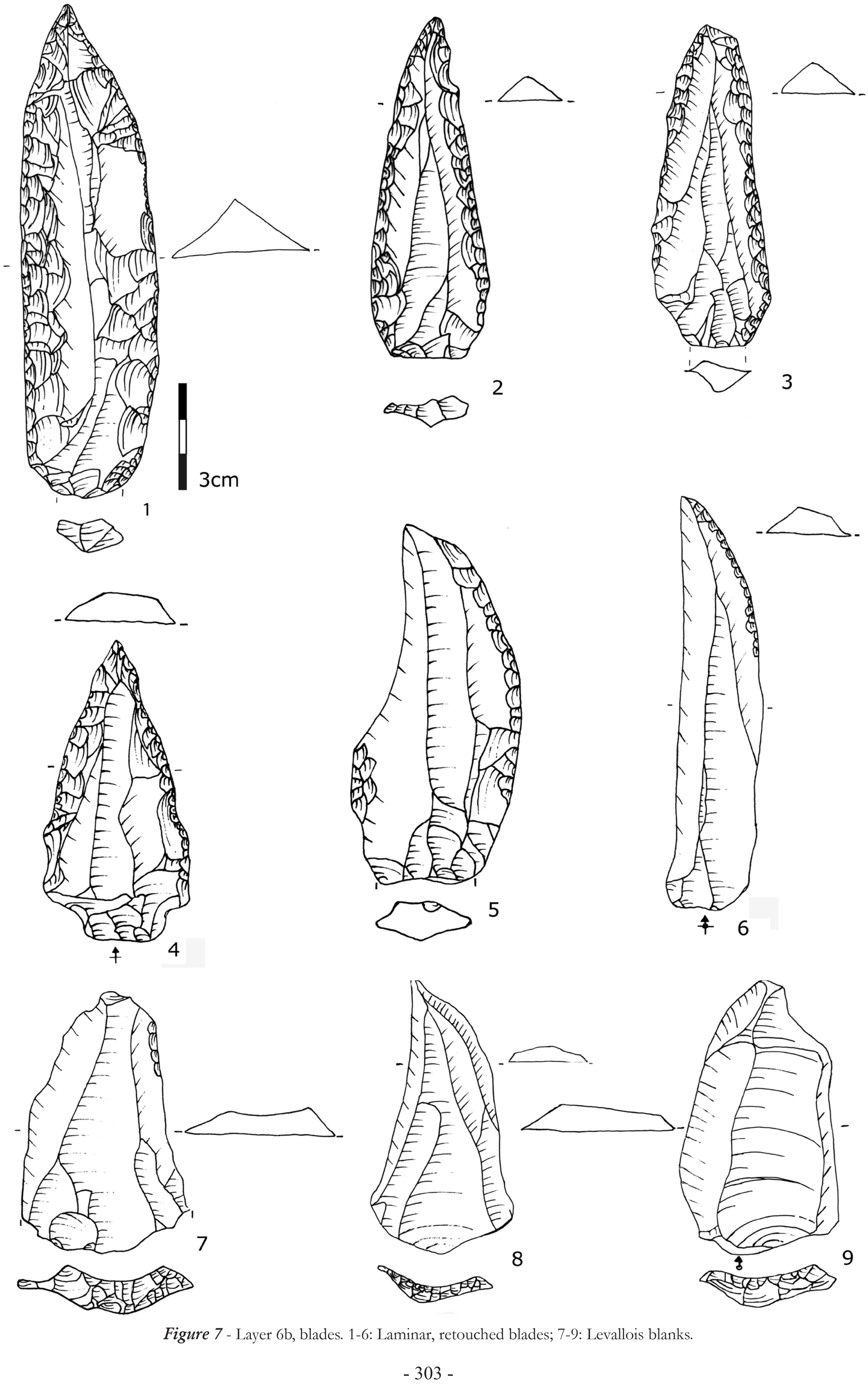

Figure 7 - Layer 6b, blades. 1-6: Laminar, retouched blades; 7-9: Levallois blanks.

invasive, covering almost the whole of the dorsal surface. The majority of blades are covered by invading semi-abrupt retouch from their proximal to distal part. Abrupt retouching is also well represented and involves essentially the distal part of blank.

Following the idea of "Frison effect" (Jelinek 1976) and the suggestion of scraper transformation through resharpening and reduction concluded by Dibble (1987), the simple lateral scrapers exhibit the least reduction whereas the converging scrapers, the most. The heavily retouched specimens could be considering in the maintained tool category indicating numerous resharpening events and thus a longer use-life.

The collections from the layer 7c, 6c and 6b present quite a large amount of retouched tools especially the assemblage from level 6c. The assemblages presenting great variability in their composition and the high rate of heavily retouched specimens relative to the total number of artefacts may possibly indicate restrained use of the lithic resources, perhaps a more intense occupation and thus less mobility (Shott 1989).

The majority of the elongated Levallois products were not retouched (fig. 7:9). Nevertheless the Mousterian tool types such as scrapers fashioned on flake, denticulate/notches, the Upper Palaeolithic tool style-like burin and end-scrapers are very significant traits of the Hummalian industry, as well (fig. 6:6-9).

Conclusions

After presenting the Hummalian blade assemblages particularly the one from layer 6b it is important reinforce the most significant features of the Hummalian industry:
• Hummalian is clearly intercalated between the Yabrudian and Mousterian levels.
• Laminar and Levallois reduction strategies are used, with the former concept dominating. Most probably both take place through the same reduction sequence.
• The unidirectional flaking system dominates, but bidirectional is also represented.
• The existence of bidirectional cores with two opposite platforms slightly offset seems to be an important and characteristic trait.
• The Laminar cores were usually not decorticated and shaped. The flinknapper use the natural shape of the block for beginning debitage. Crested blades were rarely used to initialise the flaking. The management of the laminar flaking surface was achieved either by the removal of a flake edge along a natural ridge or by flakes with cortical and often a vertical back (again due to natural form of the block) or by secondary crested blades. The maintenance of flaking surface was assured by the regular removal of "cleaning flake" throughout the reduction.
• The Levallois recurrent method is the most prevalent, but the linear method is also observed. The maintenance of flaking surface was accomplished by systematic use of éclat débordant.
• The aim of production was the converging or parallel elongated blanks of different sizes, struck mostly from Laminar cores, but also from Levallois cores which are associated with short blanks as well.
• As blank production was carried out until exhaustion of the core, the assemblage includes blanks with a size scale ranging from elongated blades to small bladelets but there is also a separate production of bladelets manufactured on debris or thick flakes recorded.
• Importance of recycling: numerous cores on flake, the reuse of patinated blanks for shaping new tools, production of the bladelets on broken blanks and debris, recycling the Yabrudian scrapers as a core and shaping exhausted core for tool use.
• The tool kit comprises of elongated points and heavily retouched blades, the Mousterian tool type scrapers and notches/denticulate also Upper Palaeolithic type burins and end scrapers. Maintenance of tools.
• Technique of percussion: hard hammer.

The laminar phenomenon is very distinct within the Near East, it appears in the late Lower Palaeolithic (Rust 1950; Garrod 1956, 1970; Jelinek 1975; Barkai *et al.* 2003, 2005), immediately preceding Acheulo-Yabroudian contexts (Préaurignacian and Amoudian) and then is seen systematically in the early Middle Palaeolithic (Hayonim Layer F and E, Abou Sif, Tabun D, Tabun unit IX, Rosh Ein Mor, Ain Difla) and later in a heart of the Middle Palaeolithic (Nahal Aqev, Douara IV (Akazawa 1979), Jerf Ajla Unit E (Schroeder 1969)).The former group shows non-Levallois debitage. The second consists of assemblages showing the use of the Laminar and Levallois reduction strategy simultaneously and containing a high percentage of blades. All these industries differ in the use of both reduction strategies, by the production of various tools, site type and site use and also in chronology (between 260 to 160 ka). The assemblages from Tabun D (Jelinek 1981; Mercier & Valladas 1994; Mercier *et al.* 1995), Rosh Ein Mor (Marks & Crew 1972; Crew 1976; Marks & Monigal 1995) and Ain Difla (Lindly & Clark 1987) appear to be dominated by the Levallois method, including a significant percentage of Upper Palaeolithic tools and a small number of elongated usually lightly retouched points. These are clearly distinguished from the lithic industries from Hayonim Layer F and E (Meignen 1998, 2000) and Abou Sif Layer C and B (Neuville 1951, and personal studies on the part of collection at IPH, Paris) which at the moment seem to show greater similarities with the Hummalian industry. Unfortunately a detailed evaluation between the assemblages is at the moment not possible as the lithic assemblages from Hayonim are still under study and the statistical data are not available. The Abou Sif assemblages from the old excavation are described only typologically (Neuville 1951; Skinner 1965; Perrot 1968), although are considered as Mousterian with elongated retouched points. These assemblages concurrent with the Hummalian appear to present both Laminar and Levallois reduction strategies, with the former dominating. The goal was to produce the elongated blanks. The tool-kit is not only characterised by presence of the important heavily retouched points and blades, but also by the Mousterian and Upper Palaeolithic tools types. Previous TL age estimation places the Hummalian industry from layer 6b at 170-250 ka (Richter 2006). However, new results throw these dates into doubt as the variation in dating is too broad (Richter *et al.* 2011). A potential age for the Hummalian industry from sand αh of 200 ka is proposed, which places the Hummalian industry alongside the assemblages from Hayonim Layer lower E and F (160-230 ka in Mercier *et al.* 2007).

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