Kebara V — A Contribution for the Study of the Middle-Upper Paleolithic Transition in the Levant

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ABSTRACT

The excavations at Kebara Cave (Mt. Carmel, Israel) revealed an important archaeological sequence of late Middle Paleolithic units superimposed by Early Upper Paleolithic ones. This sequence provides important insights concerning our knowledge of the Middle-Upper Paleolithic transition in the Levant. Here we present a detailed description of the lithic assemblage from Unit V, considered as the last Middle Paleolithic occupation on site. This assemblage is dated to 48/49 ky cal BP, thus representing the final stages of the Middle Paleolithic in the region. Although in previous publications the material of Unit V was considered as a Middle/Upper Paleolithic admixture, the results of the current study indicate (at least concerning the assemblage presented here) that the number of Upper Paleolithic items is negligible. We discuss the role of this assemblage for understanding some of the late Middle Paleolithic lithic variability, as well as the appearance of the Upper Paleolithic blade technology in the Levant.

After a detailed synthesis of the archaeological evidence (lithics, stratigraphy and radiometric dating) from Kebara and other sites, we demonstrate that the lithic technology at the end of the local Middle Paleolithic is focused on flake production by using centripetal and bi-directional prepared Levallois cores, while the retouched component of the assemblage is dominated by typical Middle Paleolithic forms. Accordingly, one cannot observe a direct continuity between the Middle Paleolithic and the Upper Paleolithic techno-typologies.

INTRODUCTION

The transition from the Middle Paleolithic (MP) to the Upper Paleolithic (UP) in Eurasia marks a turning point in human history as it marks the dispersal and spread of the only surviving hominin, *Homo sapiens sapiens* replacing endemic populations (e.g., Neandertals, Denisovans) or rarely mingling with them. How this came about is one of the crucial topics in current prehistoric research.

Genetic studies indicate that in the Levant there is a strong possibility of encounters between Neanderthals and Modern Humans taking place at ca. 47,000–65,000 years ago (Sankararaman et al. 2012), slightly before or during the MP-UP transition. The demographic dynamics in the late MP Levant are rather complex as compared to other areas of Eurasia or Africa, probably involving both Neanderthal and Modern Human populations (Hershkovitz et al. 2015). Indeed, the presence of both human groups in this particular region within the same time-frame raises questions about the nature of the local MP-UP transition (e.g., Greenbaum et al. 2019).

There are only a few Levantine sites with a late MP depositional sequence superimposed by an early UP one (Figure 1). Among these sites, Kebara Cave (Mt. Carmel, Israel) is the only one where in-depth radiometric dating studies were undertaken of the whole MP-UP sequence (Bar-Yosef et al. 1996; Brock and Higham 2009; Porat et al. 1994; Rebollo et al. 2011; Schwarcz et al. 1989; Valladas et al. 1987). We would like to present herein a detailed scenario, based on lithic studies, of the Levantine MP-UP transition, providing a solid background for further discourse on this issue.

The TL, ESR, and ^{14}C dates demonstrate that during the time span of ca. 60 ky to ca. 48/49 ky cal BP (Units XII-V), the cave was inhabited by humans who employed MP lith-

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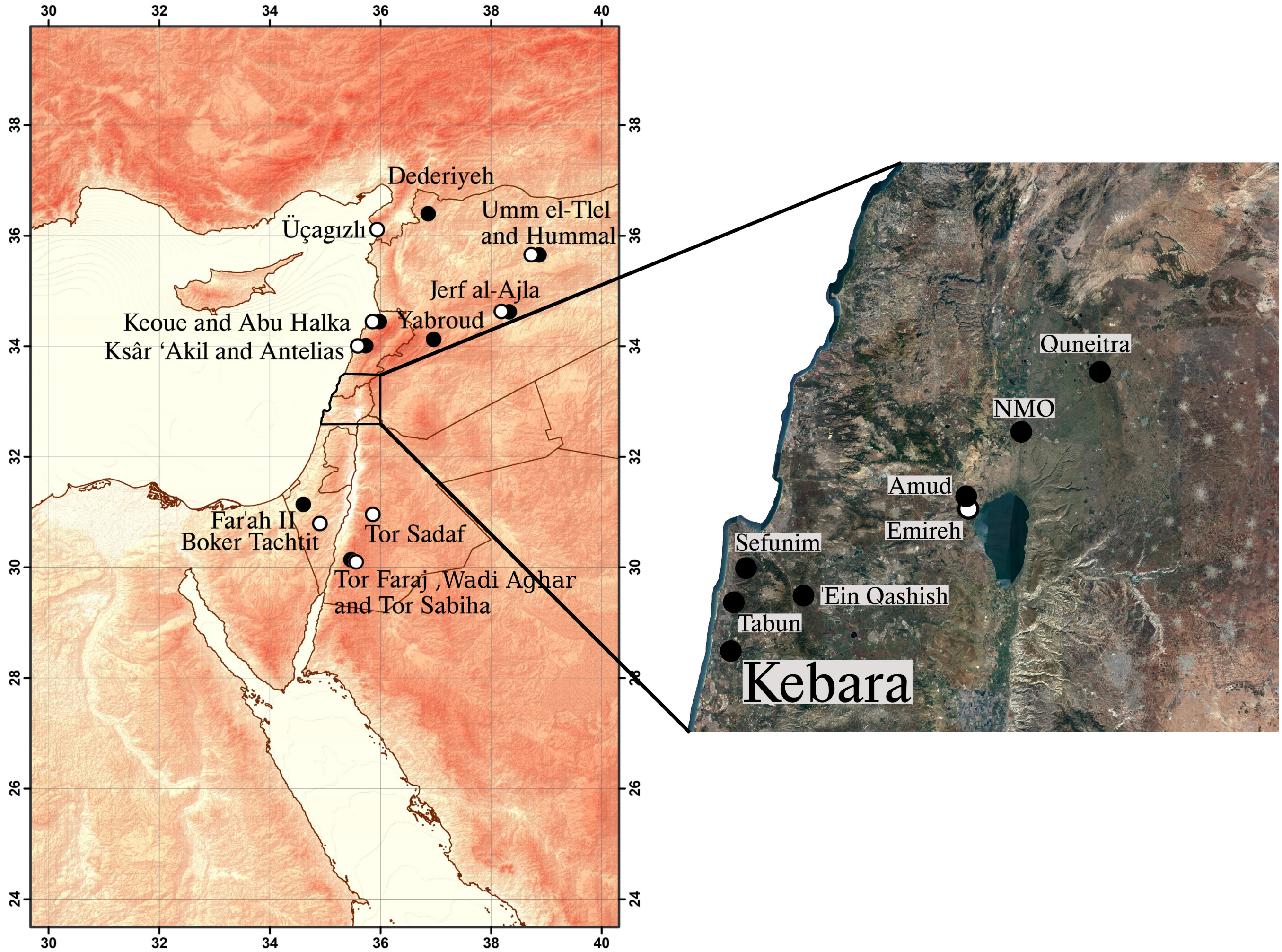

Figure 1. Location of late MP (black) and major IUP (white) sites in the Levant.

ic technologies, i.e., the Levallois techno-complex. This late MP sequence is followed by a short chronological *hiatus* of ca. 2,000 years. Then, at ca. 46/47 ky cal BP, the cave was occupied again, this time by humans who used UP lithic technology (notably striving for narrow and thin blades). The first UP lithic assemblages at the cave are attributed to the Early Ahmarian (Units IV-III), and are superimposed by Levantine Aurignacian ones (Units II-I). Based on the data summarized in the publications mentioned above, it was claimed that the so-called Initial UP (IUP) industries (see detailed description below), missing in the Kebara sequence and associated with the MP-UP transition in the Levant, can be dated to the time interval of the *hiatus* between the MP and the UP deposits in the cave (Bar-Yosef et al. 1996; Rebollo et al. 2011; Table 1).

Some scholars have claimed that the dates of the Early Ahmarian at Kebara are too early, and propose that the Levantine MP-UP transition occurred a few millennia later (e.g., Douka et al. 2013; Stutz et al. 2015; Zilhão 2013). More recently however, charcoal radiocarbon dates from the Early Ahmarian layers at Manot Cave (Galilee, Israel) have provided similar dates to those from Kebara (Alex et al. 2017; Barzilai et al. 2016) (and see further discussion on the MP-UP transition below).

No matter which chronological model for the Levantine MP-UP transition one adopts, there is no doubt that the last part of the late MP sequence in Kebara (Unit V) is dated to post 50 ky BP, and its lithic assemblage is one of the latest Levantine MP assemblages known in the Levant. The study of the techno-typological properties of this assemblage may be crucial for understanding the nature of the very end of the Levantine MP, its relation to the following UP industries and, by proxy, to the MP-UP transition at large.

The material of Unit V, collected from the upper part of the Western profile and the lower part of the Southern profile during the 1982–1990 excavations at Kebara was considered admixed due to the fact that the sediment of Unit V was partly redeposited and some UP artifacts were recovered therein (Goldberg et al. 2009). Thus, the study of the late MP assemblages in the cave had focused on the units with higher ‘integrity’ (Units XII-VII; Bar-Yosef et al. 1992; Bar-Yosef and Meignen 1992; Meignen and Bar-Yosef 1988, 1991, 1992). Also G. Tostevin, in his comparative studies of the latest MP assemblages with the UP ones, chose not to study Unit V because of the uncertainties in differentiating

TABLE 1. TL AND ^{14}C DATES IN THE KEBARA CAVE STRATIGRAPHY.

Unit	TL Mean Age	^{14}C Years Mean Age	Number of Dates	References
III		41.7±3.2 ka	9*	Bar-Yosef et al. 1996; Brock and Higham 2009; Rebollo et al. 2011
IV		42.3±3.3 ka	6*	
V		47.3±6.7 ka	7*	
VI	48.3±3.5 ka		5	Valladas et al. 1987
VII	51.9±3.5 ka		5	
VIII	57.3±4 ka		5	
IX	58.4±4 ka		4	
X	61.6±3.6 ka		7	
XI	60±3.5 ka		5	
XII	59.9±3.5 ka		6	

*excluding dates considered unreliable (low %C or problematic context).

between this unit and the UP ones (Tostevin 2003: 60).

Here we want to briefly clarify some issues pertaining to the nature of this assemblage and why we now consider it 'worthy of study.' Firstly, geoarchaeological exploration has revealed combustion structures in Unit V (see below). The presence of *in situ* hearths demonstrate that people inhabited the cave at the time of this unit sedimentation (pre-Ahmarian). Secondly, after the detailed study of the lithic assemblages of the Early Ahmarian in the cave (Bar-Yosef and Belfer-Cohen 2019), and the information gained from other recently published studies on the Ahmarian technology (see references and a comprehensive discussion below), we felt that the assemblage from Unit V is far from being a mechanical admixture of MP/UP material. Thus, we have endeavored to study a new sample of Unit V that was collected during a short season of excavations in 2006; this field work was conducted in order to obtain ^{14}C samples along the Southern profile, an area in which Unit V was considered to be better preserved (Rebollo et al. 2011). Certainly, in an idyllic situation we would have preferred to study a lithic assemblage embedded in primary anthropogenic sediments. This is not the case here. Nevertheless, this assemblage does provide important information as regards lithic technology and typology of a late MP industry. Indeed, through a methodical examination of this assemblage, keeping in mind the caveats mentioned above (see Sampling and Methodology below), it was possible to describe in detail the characteristics of the lithic assemblage produced by the last MP inhabitants of the cave.

THE SITE-SETTING AND ITS DEPOSITIONAL HISTORY

Kebara cave is located in the southern part of the western flank of Mt. Carmel, ca. 2.5km east to the present Mediterranean Sea shore, on the left bank of the Wadi Kebara mouth. Its arched entrance faces the shore line (westwards) and the estimated size of the main hall of the cave is ca. 26m x 20m. Under the chimney (in the rear of the cave) the ceiling is ca. 18m high.

The cave is located in an ecotone zone rich in biomass, at the border between the limestone hills of Mt. Carmel and the sand and *kurkar* ridge of the coastal plain. The former is dominated by Mediterranean *maquis* and the latter by a more open environment characterized by shrub and grasses (Zohary 1980). Paleobotanical remains from Kebara indicate that even during MIS 3 the cave surroundings were dominated by a rich Mediterranean *maquis* (Albert et al. 2007; Baruch et al. 1992; Lev et al. 2005). The coastal plain was several kilometers wider in the late MP (and in the UP) than it is today, due to low sea levels in MIS 4-2 (Siddall et al. 2003; Waelbroeck et al. 2002).

The cave's depositional history was described in detail elsewhere (Goldberg et al. 2007; Goldberg and Laville 1991; Laville and Goldberg 1989). Here we present a summary of the main points.

The initial occupation of the cave is seen in Unit XIII. This sedimentary unit bears evidence of human presence (including hearths). However, lithic and fauna remains are very rare, which indicates an ephemeral occupation.

A drastic change in the cave occupation is seen in the following units (Units XII-VII). The sediments of these units are mainly ash-derived minerals from wood burning (Albert et al. 2007; Schiegl et al. 1994, 1996), and there is a high concentration of superimposed combustion structures. Based on the density and characteristics of the finds (lithics and fauna), it was proposed that when Units XI-VIII were deposited, the cave served as a base camp (Meignen et al. 2006, 2017 and references therein).

After the deposition of Unit VII, a drastic change occurred. Increased precipitation in the cave vicinity caused the reopening of the sinkhole in the rear part of the cave, which led to a major subsidence event that caused a strong dip to the southeast (Goldberg at al. 2007; Laville and Goldberg 1989). As a result of these changes, low-energy water flows from the cave entrance deposited silty clay (*terra rossa*, from the outside) and reworked ashy deposits characteristic of Units VI-V. However, despite the change in the physical conditions of the cave, *in situ* combustion structures in these units demonstrate that humans continued to use the cave, although ephemerally (Goldberg at al. 2007; Meignen et al. 2017).

SAMPLING AND METHODOLOGY

The lithic assemblage from Unit V presented here was collected during a field season in 2006 while pushing back the Southern profile created by previous excavations (1982–1990) in order to collect samples for ^{14}C dating. Its provenience is therefore close to the previous sample that is presented briefly elsewhere (Meignen 2019; Meignen et al. 2017). It derives from Squares R15-R19 and contains the material from the deposits that were directly dated by radiocarbon to 48/49,000 years cal BP (Rebollo et al. 2011). The thickness of the deposit reached ca. 80cm in some places (Sq. R17) corresponding to 550–630 below datum, but in most cases the studied deposit is ca. 30cm thick (the variation of deposit thickness in this unit is due to erosion and layer tilting as was mentioned earlier).

The assemblage was divided into cores and knapping products. Each category was measured and analyzed according to technological and stylistic attributes. This approach enables the examination of the different gestures, methods, and modes of production throughout all the reduction sequences identified in the assemblage, as well as recognizing and allocating the flaked items according to their place and role in the dynamic process of knapping. The list of the observed attributes is based on previous studies of Levantine MP assemblages (Ekshtain 2006; Goren-Inbar 1990; Hovers 1997, 2009). Some minor changes were made for a better fit with attributes that are more common in the UP lithic assemblages (e.g., platform abrasion). This was essential for the evaluation of the supposedly UP intrusion into this late MP assemblage and to distinguish between the results of human manipulations and those stemming from taphonomic processes (Bleed 2001).

In the present study, core trimming elements (CTE) include only diagnostic items that are grouped by Hovers (2009) under the term 'core management pieces.'

RESULTS

Flint is the only raw material in the assemblage, which comprises 2083 items. Half of the assemblage is composed of debris, mostly chips. Artifacts (>2cm) and cores account for 1007 items. The general breakdown of the assemblage is presented in Table 2.

Half of the flaked items in the assemblage are broken (Table 3). This is not exceptional for Levantine MP cave assemblages (Alperson-Afil and Hovers 2005: Table 9; Hovers 2009: Figure 6.6). Less than 1% of the artifacts are abraded. Patinated and double patinated artifacts comprise ca. 2%. In general, it can be said that the state of preservation of the assemblage is good.

As mentioned above, the integrity of the assemblage had to be validated, due to the possibility of mechanical admixture with UP material from Unit IV. The most general trait of the Ahmarian is its blade orientation. In addition, new gestures and techniques were introduced to the processes of knapping, such as platform abrasion and the use of a softer hammer (Belfer-Cohen and Goring-Morris 2007; Kuhn 2004; Monigal 2002). It can be expected that if the assemblage is 'contaminated' with a significant amount of UP material, we will find technological and typological UP elements in the assemblage.

Blades and bladelets are present in the assemblage in low frequencies (ca. 6%) and the blade index (Ilam) is 10.7. This value is within the range known from Levantine late MP assemblages (Hovers 1998; Shea 2006). Platform abrasion is rather rare (ca. 2.1%). Punctiform (0.8%) and lipped platforms (7.5%) are also rare. There are a few clearly UP bladelets, but such intrusive items are rather rare in the assemblage discussed here. No diagnostic Ahmarian tools are present (e.g., el-Wad points) and retouched blades and bladelets are extremely rare.

Core frequencies in the assemblage are low and preclude a detailed and informative examination (ca. 1% of the assemblage excluding debris). The cores are small and heavily exploited. Nevertheless, the dominant core types are Levallois cores (for flakes) and cores on flakes (Goren-Inbar 1988; Hovers 2007) made on cortical flakes (see Figure 4 below). Still, though limited, the information obtained indicates the presence of two different reduction sequences. The first is a Levallois one and the second is a more expedient one.

Cortical flakes are well represented. Flakes with 51–100% cortex cover comprise 11.1% of the debitage, which indicates on-site knapping (Geneste 1985). On average, flakes with a cortex cover of 1–50% are longer (ca. 4cm) than flakes without cortex or heavily cortical (51–100%) (both are ca. 3cm long; Figure 2). The abundance of cortical items suggests that the low frequency of cores may be biased by the small area sampled.

The Levallois products (i.e.. Levallois end-products not including atypical Levallois or indeterminate items, see Table 2) account for 80 items, including retouched items; Levallois Index is 8.4. These are mostly flakes (83.8%) with some blades (10%) and points (6.3%). Note that the definition of Levallois point in this study follows Meignen's 'Levallois point *sensu stricto*' (e.g., broad-based points, Meignen 2019; Meignen and Bar-Yosef 1991: 56). Almost all the Levallois items have prepared striking platforms (ca. 92.2 %; Table 4). Elaborate *chapeau de gendarme* platforms are present in small numbers (9.1%).

The most common dorsal scar patterns on the Levallois blanks are the centripetal and bidirectional patterns (each comprising 31%; see Table 4). The convergent pattern is also well represented (25.4%); the unidirectional (parallel and along axis) scar pattern is the least common (12.7%). Among Levallois blanks, the most common dorsal scar patterns on the flakes (excluding the blades and points), are the centripetal (36.2%), the bidirectional (29.3%) and the unidirectional parallel (13.8%) ones (see Table 4). The con-

TABLE 2. GENERAL BREAKDOWN OF THE ASSEMBLAGE.

		N	Total (%*)
Levallois (excluding retouched items)	Levallois flakes	51	
	Levallois blades	8	
	Levallois points	5	**64** (6.4)
	Atypical Levallois flake	30	
	Indeterminate ('maybe' Levallois) blades	9	**39** (3.9)
Retouched items (excluding 3 retouched CTEs)	Levallois	16	
	Non Levallois	24	
	Bladelets	1	
	Unknown (too broken)	9	**50** (5)
Waste >2cm (including 3 retouched CTEs)	Non Levallois flakes	577	
	Flakes unknown (too broken)	130	
	Non Levallois blades (excluding CTEs)	41	
	Blades unknown (too broken)	2	
	Bladelets	12	
	Burin spalls	5	
	Core Trimming Elements	77	**844** (84.7)
Cores	Levallois core	4	
	Core on flake (Nahr Ibrahim technique)	2	
	Bladelet core	1	
	Core fragments	3	**10**
Debris	Chips	844	
	Chunks	187	**1031**
Total			**997***

*excluding cores and debris.

vergent pattern is most common among the points (80%).

In contrast to the Levallois items, among the non-Levallois ones, unprepared striking platforms are the most common (55.7%) and more than half of the dorsal scar patterns are unidirectional (53.1% among all complete items; see Table 4). This is probably related to the fact that most of the items derive from the core preparation stage (Van Peer 1992).

A rough division of all identified Levallois blank forms according to basic morpho-types, revealed that 'rectangles' (rectangular and sub-rectangular) and 'triangles' (triangular, sub- triangular and leaf-shaped) are equally represented (42%) while rounded forms are rarer (16%). A detailed examination shows that the most common morpho-type is the 'sub-rectangular' (28%) (Figure 3 and Table 5).

There is no significant difference in the average length of Levallois blanks according to their morpho-types and/or scar pattern (ca. 4–5cm for the complete unretouched Levallois items; Figure 4 and Table 6). Perhaps an exception are the circular Levallois flakes that are ca. 3cm, but their small numbers (n=2), prevents a statistical test. Additionally, typical products of the centripetal core **method of initialization** and unidirectional or bidirectional **methods of exploitation** (e.g., *Levallois enlèvement II* blank with sub-radial dorsal scar pattern and long scar parallel to the flaking axis: Boëda 1995; Boëda et al. 1990) practically do not exist in the assemblage. These two observations suggest that the Levallois scar pattern variability is not related to different stages in the core reduction (e.g., Dibble 1995).

The technology diagnostic CTE items are mostly *eclats outrepassants* and *eclats débordants* with centripetal and bidirectional scar patterns (Figure 5). The characteristic waste of Levallois point production by the *unipolaire convergente* method (i.e., *eclats débordants corticaux* that are intentionally overshot and slightly twisted; see Demidenko and Usik 2003; Meignen 1995) is absent here. Most of the 'naturally

TABLE 3. THE ASSEMBLAGE BREAKAGE FREQUENCIES.

	Com.	Dis.	Prox.	Lat.	Dis. and Prox.	Dis. and Lat.	Prox. and Lat.	Fragment (no edges)	Total (%)
Levallois (excluding 16 retouched items)	40 (62.5)	13 (20.3)	2 (3.1)	1 (1.6)	2 (3.1)	1 (1.6)	2 (3.1)	3 (4.7)	**64 (6.4)**
Retouched Items (excluding 3 retouched CTEs)	23 (46)	10 (20)	5 (10)	3 (6)	-	2 (4)	3 (6)	4 (8)	**50 (5)**
Waste >2cm.	442 (50.1)	88 (10)	117 (13.3)	36 (4.1)	18 (2)	35 (4)	34 (3.9)	113 (12.8)	**883 (88.6)**
Total	**505 (50.7)**	**111 (11.1)**	**124 (12.4)**	**40 (4)**	**20 (2)**	**38 (3.8)**	**39 (3.9)**	**120 (12)**	**997**

Com.=complete; Dis.=distally broken; Prox.=proximally broken; Lat.=laterally broken

backed knives' in the assemblage are atypical and do not seem to be reconfiguration elements of the debitage surface after the removal of Levallois blanks (Meignen 1995). A few CTE items are clearly derived from cores on flakes. The original ventral face of the blank, which was used as a core, can be detected (see Figure 5:4). This, together with 14 Janus flakes and the cores on flakes, reveal the presence of the core-on-flake reduction sequence, as in all of the Kebara MP sequence, especially in the lower units (Bar-Yosef et al. 1992; Meignen 2019).

Due to the small number of cores, it is quite hard to evaluate if the methods used usually in the assemblage are preferential or recurrent. However, at least some of the Levallois flakes that have a centripetal scar pattern (and the lack of *enlèvement II* blank with a sub-radial dorsal scar pattern) seem to originate from a preferential core reduction (Figures 6 and 7).

Indeterminate ('maybe' Levallois) blades (Copeland 1983) are not common (n=9) (see Figure 7: 6). and no diagnostic CTE of non- Levallois blade production (such as ridge blades, core tablets, and plunging blades from prismatic cores: Inizian et al. 1999) were recovered.

The retouched items comprise 5.3% of all the artifacts bigger than 2cm (n=53) and 41.5% of them are made on Levallois blanks (see Table 2; Table 7). The mean length of the complete retouched items (n=25) is 5.5cm. Separating the retouched items into Levallois and non-Levallois blanks, the mean length of retouched Levallois blanks is 6cm (n=11) and that of non-Levallois ones is 5.3cm (n=14). In fact, the Levallois retouched items are on average the largest artifacts in the assemblage. It seems that blank selection for modification was based on length dimensions.

A detailed typological list is presented in Table 7. The most common tool type is the side-scrapers (45.4%). More than half of them (62.5%) are made on Levallois flakes. One of the double side-scrapers has a truncated-faceted proxi-

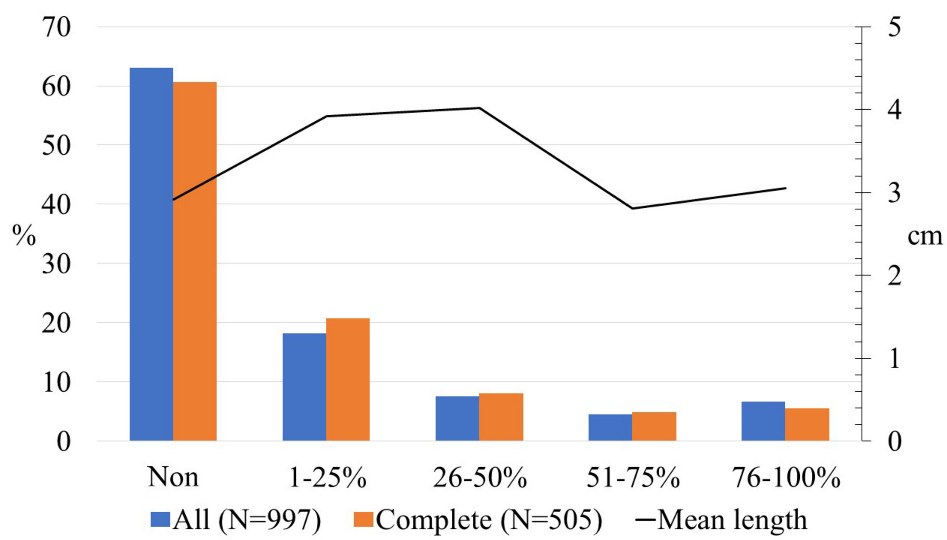

Figure 2. Cortex covering and mean length.

TABLE 4. FREQUENCIES OF STRIKING PLATFORMS AND SCAR PATTERNS ACCORDING TO TECHNOLOGICAL CATEGORIES.

		Striking platform					Scar pattern				
		Plain*	Dih.*	Faceted		Indet. and others**	Uni.*	Con.*	Bid.*	Cen.*	Indet. and others**
	N			simple	Chg.*						
Levallois (all)	**80**	**6 (7.8)**	**3 (3.9)**	**61 (79.2)**	**7 (9.1)**	**3 (3.3)**	**9 (12.7)**	**18 (25.4)**	**22 (31)**	**22 (31)**	**9 (11.3)**
Flakes	67	5 (7.7)	2 (3.1)	55 (84.6)	3 (4.6)	2 (3)	8 (13.8)	12 (20.7)	17 (29.3)	21 (36.2)	9 (13.4)
Blades	8	1 (14.3)	1 (14.3)	5 (71.4)		1 (12.5)	1 (12.5)	2 (25)	5 (62.5)	-	-
Points	5	-	-	1 (20)	4 (80)	-	-	4 (80)	-	1 (20)	-
Atypical and maybe Levallois	28	3 (10.7)	4 (14.3)	20 (71.4)	1 (3.6)	-	9 (33.3)	8 (29.6)	4 (14.8)	6 (22.2)	1 (3.6)
Non Levallois	427	183 (43.2)	73 (17.2)	115 (27.1)	-	56 (13.1)	204 (53.1)	44 (11.5)	49 (12.8)	87 (22.7)	43 (10.1)

*Percentage does not include Indet.
**Percentage of total.
Dih.=Dihedral; Chg.=*Chapeau de gendarme*; Indet.=Indeterminate; Uni.=Uniderectional; Con.=Convergent; Bid.=Bidirectional; Cen.=Centripetal

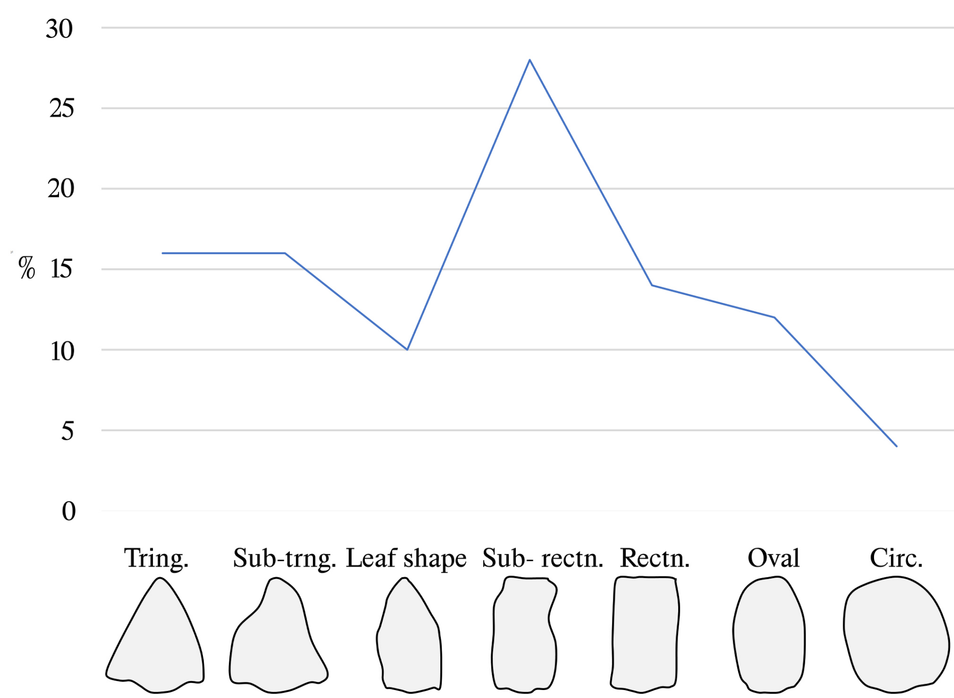

Figure 3. Frequency of identified Levallois end-products morphology (n=50) (Tring.=Triangular; Rectn.=Rectangular; Circ.=Circular).

TABLE 5. FREQUENCIES OF LEVALLOIS END-PRODUCTS MORPHOLOGY.

Blank shape (all Levallois end-products)	N (%*)	Scar pattern: Uni.	Con.	Bid.	Cen.	Indet.
Triangular	8 (16)	-	5	-	3	-
Sub- triangular	8 (16)	1	2	3	2	-
Leaf-shaped	5 (10)	-	3	1	1	-
Sub- rectangular	14 (28)	4	2	5	3	-
Rectangular	7 (14)	-	1	3	3	-
Oval	6 (12)	-	1	3	2	-
Circular	2 (4)	-	-	-	2	-
Indet.	30	4	4	7	6	9

*Percentage not including Indet.
Uni.=Unidirectional; Con.=Convergent; Bid.=Bidirectional; Cen.=Centripetal; Indet.=Indeterminate.

mal base (Figure 8: 7). It is important to note that this item is by no means an Emireh point (see Volkman and Kaufman 1983). No side-scrapers with ventral retouch, characteristic of the early MP units at Kebara (Meignen 2019; Meignen and Bar-Yosef 1991; Schick and Stekelis 1977), are present in the Unit V assemblage.

Apart from side-scrapers, no other formal tool type is common in the assemblage. Only two items are identified as Mousterian points (although one may consider some of the 'double scrapers' as 'points')[1] and 'UP tools' are rare. Burins are absent and only one (atypical) end-scraper is present. Denticulates are rare as well (5.7%), made exclusively on non-Levallois flakes. The 'retouched flakes' (after Goren-Inbar 1990) (30.2%) are the second most common tool type and 36.7% of them are made on Levallois flakes.

UP intrusive tools are restricted to one twisted bladelet with ventral retouch and perhaps one broken tip of a point, made on a thin blank with a flat retouch, not characteristic of the assemblage (Figure 9: 7–8). Emireh points or chamfered pieces are absent.

DISCUSSION

THE ASSEMBLAGE CHARACTERISTICS

It appears that at least two different Levallois core initialization and exploitation processes are present. One is characterized by a centripetal initialization and the second by bidirectional and unidirectional flaking for core initialization and exploitation. Some specific CTE items, such as *eclats outrepassants* and *eclats débordants* with centripetal and bidirectional scar patterns support this argument. Both reduction methods focused on producing flakes, ranging from sub-triangular to oval (usually in the sub-rectangular form). The Levallois points in the assemblage probably derived from convergent core reduction, that differs from the Levallois core reduction for the flakes. Their numbers, though, are overall negligible and characteristic waste of Levallois point production by the *unipolaire convergente* method is absent.

Only a few non-Levallois blades have been recorded. It is possible that these items are the remains of a poorly preserved ephemeral IUP occupation in the cave (Barzilai and Gubenko 2018). On the other hand, non-Levallois reduction sequences for blades are well documented in some other late MP assemblages (Hovers 1998; Pagli 2013; Sharon and Oron 2014), demonstrating the flexibility of the MP knapper, who was not confined just to the production of the Levallois core morphology (Bar-Yosef and Van Peer 2009). In any case, the numbers of these items in the assemblage are negligible. It is also of interest to note that pointed blades with platform abrasion (and thick butts), well documented in some Levantine late MP assemblages (Sharon 2018; Sharon and Oron 2014), are absent here.

Big flakes (Levallois and non-Levallois) were chosen for shaping into tools, mostly side-scrapers. As the current study did not analyzed procurement and transport of raw

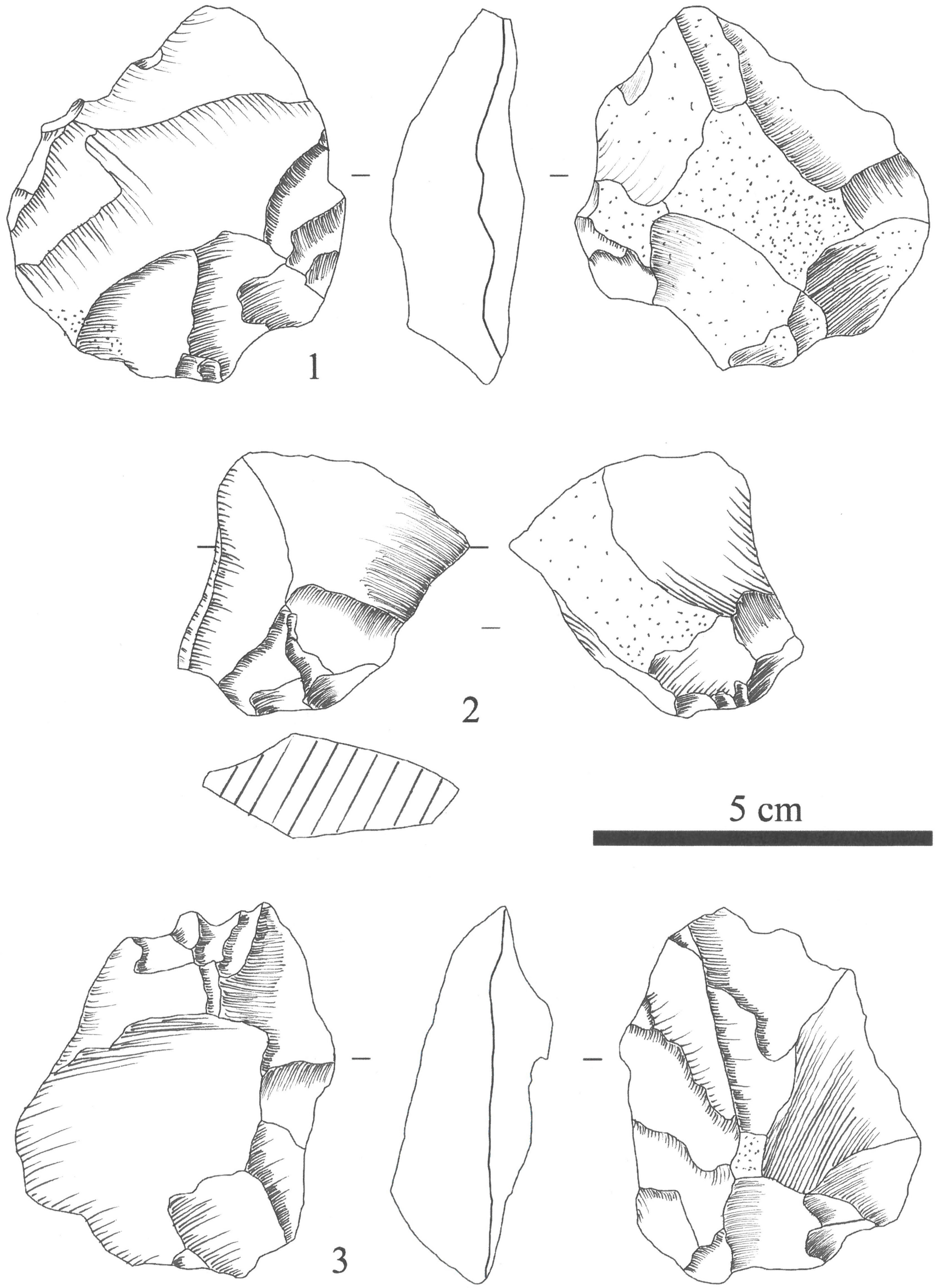

Figure 4. Selected artifacts from Kebara Unit V. 1,3) Levallois cores; 2) core on flake.

material (e.g., Ekshtain et al. 2014, 2017) we lack solid data for testing whether some of the big Levallois retouched items could have been 'personal gear' that was brought to the site (Binford 1979; Kuhn 1995).

Some intrusive UP debitage and tools are present, but are rather rare.

In summary, the described assemblage is without doubt a MP one, in both technological and typological aspects.

THE KEBARA SEQUENCE

The lithic assemblages of the Kebara sequence are published in detail elsewhere (Meignen 2019; Meignen and Bar-Yosef 1991). Here we summarize the relevant points.

TABLE 6. MEAN LENGTH AND *P*-VALUE OF *T*-TEST EXAMINING THE DIFFERENCES IN LENGTH BETWEEN COMPLETE UNRETOUCHED LEVALLOIS BLANKS ACCORDING TO SCAR PATTERN AND MORPHOLOGY GROUPS.

Mean length (cm) of complete unretouched Levallois blanks	Uni.		Con.	Bid.	Cen.	
	5.2±2.5 (mean±SD, n=3)		5.5±11.9 (mean±SD, n=12)	5.2±10.8 (mean±SD, n=12)	4.6±13 (mean±SD, n=13)	
	Tring.	**Sub- tring.**	**Leaf.**	**Sub- rectn.**	**Rectn.**	**Oval**
	49.6±12 (mean±SD, n=6)	58.2±16.8 (mean±SD, n=8)	52.3±4.7 (mean±SD, n=3)	52.3±4.7 (mean±SD, n=10)	42.5±8.7 (mean±SD, n=5)	55.1±9.6 (mean±SD, n=6)

p-value of *t*-test examining the differences in length between groups (only complete unretouched Levallois blanks)

Scar Pattern	Uni.	Con.	Bid.	Cen.
Uni.		0.45	0.64	0.18
Con.			0.79	0.11
Bid.				0.15
Cen.				

Morphology	Tring.	Sub-tring.	Leaf.	Sub-rectn.	Rectn.	Oval
Tring.		0.29	0.28	0.62	0.29	0.40
Sub- tring.			1.00	0.36	0.05	0.67
Leaf-shap.				0.38	0.07	0.66
Sub- rectn.					1.00	0.52
Rectn.						0.05
Oval						

Based on lithic production, the local MP sequence can be divided into two parts, the Lower Units (XII-IX) and the Upper Units (VIII-VI). The Lower Units are characterized by the *Levallois unipolaire convergente* method, yet some technological variability is observed—in Units XII-XI Levallois elongated products are more common and in Unit XII a true bi-directional core reduction strategy was recorded alongside the *unipolaire convergente* one. Units X-IX, however, are characterized by intensive use of a specific *chaînes opératoire* for the production of Levallois points.

In the Upper MP units, Levallois points and blades are less common as these units are characterized by sub-triangular and quadrangular Levallois flakes. The *unipolaire convergente* method is less intensively used and the number of Levallois flakes with a radial dorsal scar pattern is higher.

As for typology, Bordes' Mousterian tool group (II) is the most dominant in all Kebara MP units. However, tools of the UP group (III) (mostly burins) are more common in the Lower units, especially in Unit XI (Meignen 2019; Meignen and Bar-Yosef 1991).

When examining the lithics of Unit V against this background, it appears that no major difference in lithic technology is observed between Unit V and the other Upper MP units of the cave (Table 8). As in Units VIII-VI, the num-

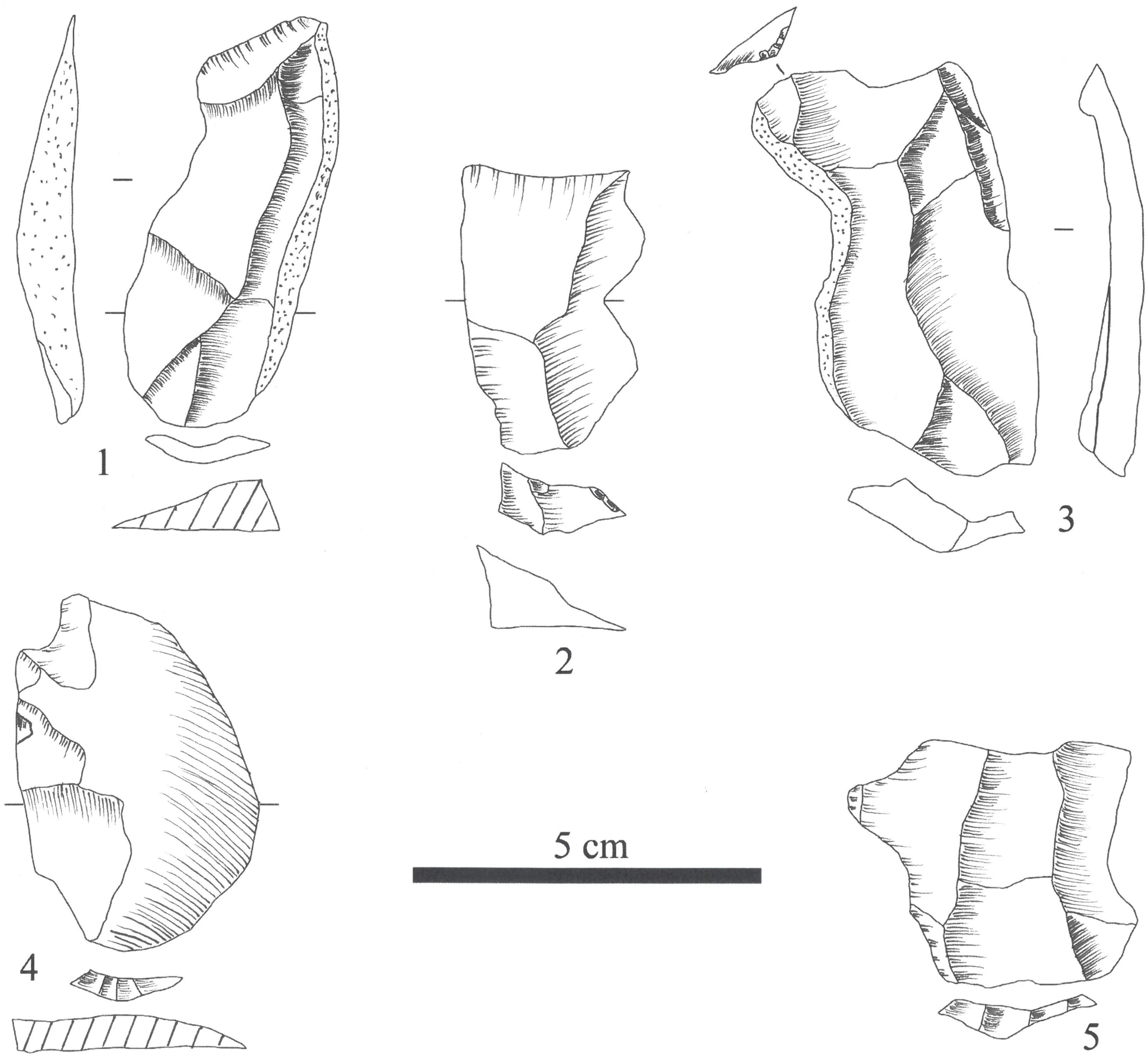

Figure 5. Selected artifacts from Kebara Unit V. 1) eclats débordants corticaux-'naturally backed knives'; 2, 4) eclats débordants; *3, 5)* eclats outrepassants**.**

ber of Levallois points in Unit V is low and that of Levallois flakes with centripetal scar pattern is quite high (see Table 8). The lower ratio of Levallois blades in Unit V (compared to Units XII-VI) is possibly related to the fact that in the present study the 'indeterminate' blades were separated from the Levallois blanks.

However, what does this chronological trend in the Kebara sequence mean? Do we witness only a change in the technological organization related to the site role in the mobility pattern of a particular group? Or does this change in the lithic technology reflect a chronological trend on a regional level?

Multidisciplinary syntheses (Meignen et al. 2017 and references therein) have demonstrated that some change in lithic technology observed in the MP Kebara sequence is broadly contemporary with a change in the site role in the mobility pattern of the relevant human group. The time when the site was inhabited most intensively (Units X-IX) is also the time of rigorous production of convergent Levallois pieces. In general, during the time of the Upper Units deposition, the cave was less intensively occupied and the emphasis had shifted from Levallois convergent products to more flake production.

However, it is important to note that the decrease in convergent products and the diversification in the ways of production of Levallois items (e.g., radial flaking in Unit VIII) takes place before the cave occupation became ephemeral (Units VI-V). So, it seems that the shift from intensive production of convergent Levallois products to more flake production in the Kebara MP Upper Units cannot be relat-

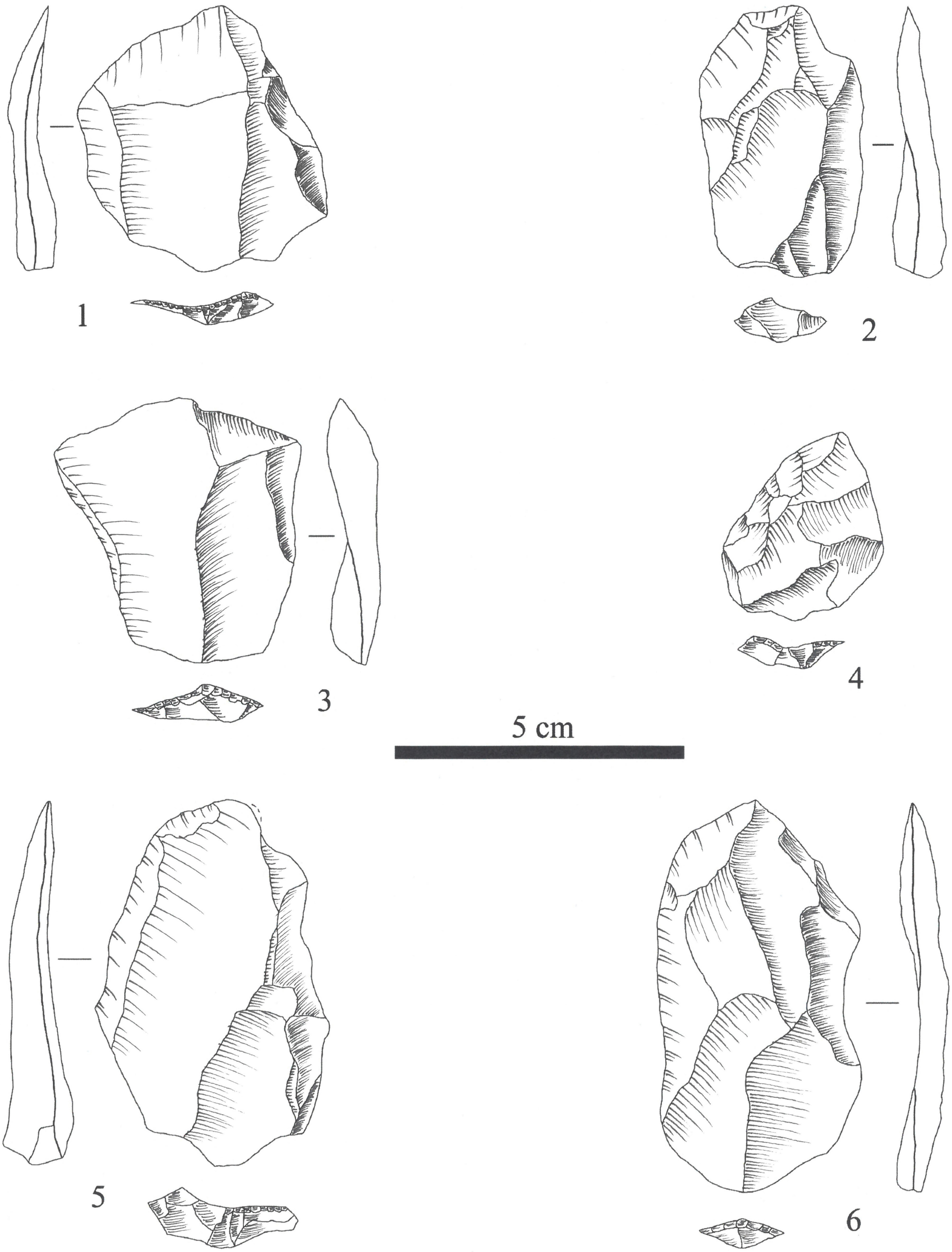

Figure 6. Selected artifacts from Kebara Unit V. 1–6) Levallois flakes with centripetal scar pattern.

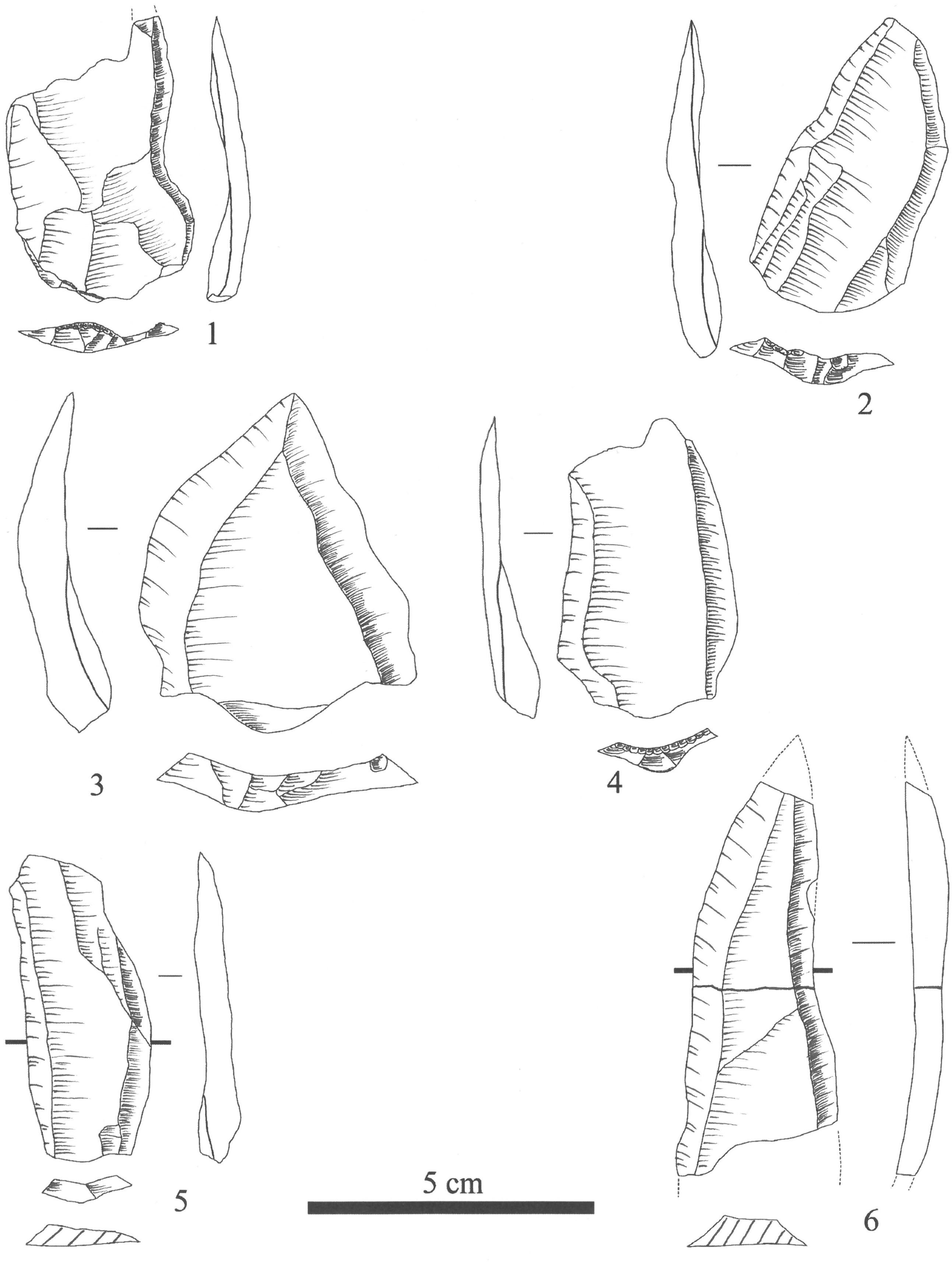

Figure 7. Selected artifacts from Kebara Unit V. 1, 2) Levallois flakes with bidirectional scar pattern; 3) Levallois point; 4) Levallois flake with a unidirectional scar pattern; 5) Levallois blade; 6) indeterminate ('maybe- Levallois') blade.

TABLE 7. TYPOLOGICAL CLASSIFICATION OF THE RETOUCHED ITEMS (following Goren-Inbar 1990).

Bordes Type	Tool Type		N	%	Levallois Blanks
6	Mousterian point		2	3.8	1
9	Side-scraper	single	7	28.3	1
10			7		4
11			1		6
12		double	1	5.7	-
15			2		2
18		convergent	2	3.8	-
21		déjeté	2	3.8	1
	Side-scrapers total		***24***	***45.4***	***15***
31	End-scraper (atypical)		1	1.9	-
42	Notch		1	1.9	1
43	Denticulate		3	5.7	-
45	Retouched on ventral face		2	3.8	-
62	Miscellaneous		4	7.5	-
	Retouched flake		16	30.2	6
	Retouched blade		1	1.9	-
	Retouched bladelet		1	1.9	-
	Total		**53**	**100**	**17 (32.1%)**

ed only to a change in the site role in the mobility pattern. We will discuss this issue further below by examining lithic technology diachronic trends in the regional sequence. The radiometric dates from Kebara MP sequence (see Table 1) suggest that the shift from intensive production of convergent products to more emphasis on flake production occurred after 60 ky, most probably around 55 ky.

THE REGIONAL SEQUENCE

Well dated southern Levantine late MP assemblages are rare. In fact, the assemblages from Kebara, Amud, and Quneitra are the only ones that are well dated, their chronology confirmed through two or more radiometric methods (Figure 10 and references therein). Some dates from late MP layers elsewhere are rather problematic, either being preliminary or portraying a major disagreement between different samples and dating methods (see Figure 10). However, based on technological similarities (with emphasis on the *Levallois convergente* reduction sequence) and correlation between well dated sites (Kebara Lower Units and Amud) it seems reasonable to assume that the assemblages from Dederiyeh 1–15 (Nishiaki et al. 2012), Tor Faraj (Henry 2003a), Tor Sabiha (Henry 1992, 1995), Umm el-Tlel V (Pagli 2013, 2015) Hummal HM-A (Hauck 2011, 2013) Yabroud I 2–6 (Pagli 2013, 2015) Ksâr 'Akil XVIII-XVIIB (Meignen and Bar-Yosef 1992 *contra* Marks and Volkman 1986 and see Pagli 2013, 2015 for recent examination), and most probably also the assemblages from Keoue Cave (Northern Lebanon: Nishiaki and Copeland 1992) predate the Upper Units of Kebara.

A technologic signature similar to that of the MP Upper Units at Kebara—centripetal and bidirectional Levallois core reduction alongside a unidirectional one, and the emphasis on flake blanks—can be observed in the assemblages of Ksâr 'Akil XVIIA-XVIA (Pagli 2013, 2015) and Quneitra (Goren-Inbar 1990). Bar-Yosef (1998, 2000), who first noted this similarity, notes also the similarities with the Sefunim Cave MP assemblage, though comparison with the assemblage from the latter site is difficult considering the available data (Ronen 1984). It is worth mentioning that, as in Kebara and Ksâr 'Akil, also at Yabroud II, Layers 10–9, with a dominance of the convergent Levallois flaking, are overlaid by Layers 8–6, portraying an increase of centripetal and some bidirectional flaking (Pastoors et al. 2008).

The ESR and TL dates of ca. 54 ky from Quneitra (Valladas in Oron and Goren-Inbar 2014; Ziaei et al. 1990), correspond well with the Kebara MP Upper Units. However, it is clear that the U-series and radiocarbon dates from the late MP layers at Ksâr 'Akil are problematic (Douka et al. 2013; van der Plicht and Bartstra 1989). This said, the technologi-

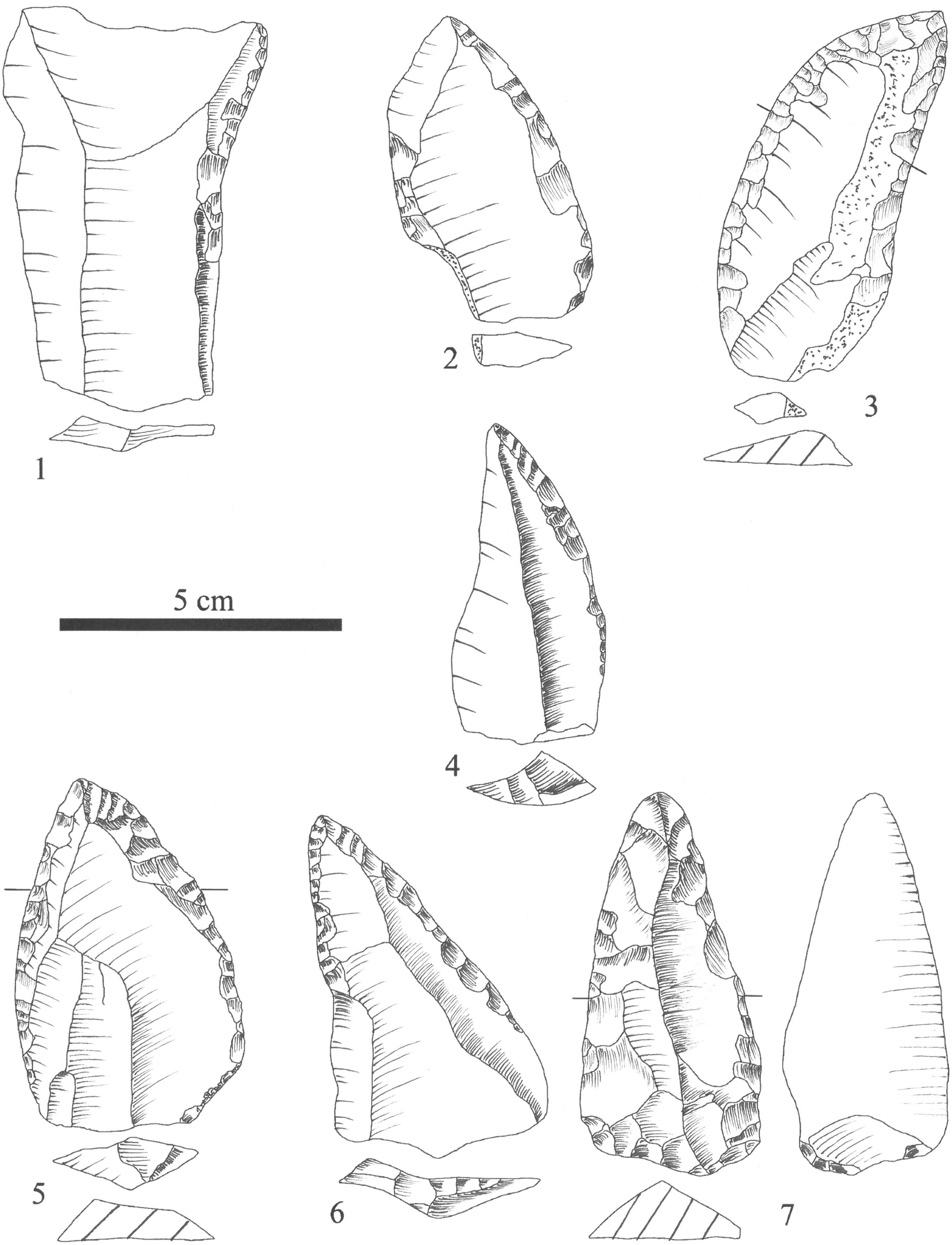

Figure 8. Selected artifacts from Kebara Unit V. 1–4, 6, 7) side-scrapers; 5) convergent scraper/Mousterian point.

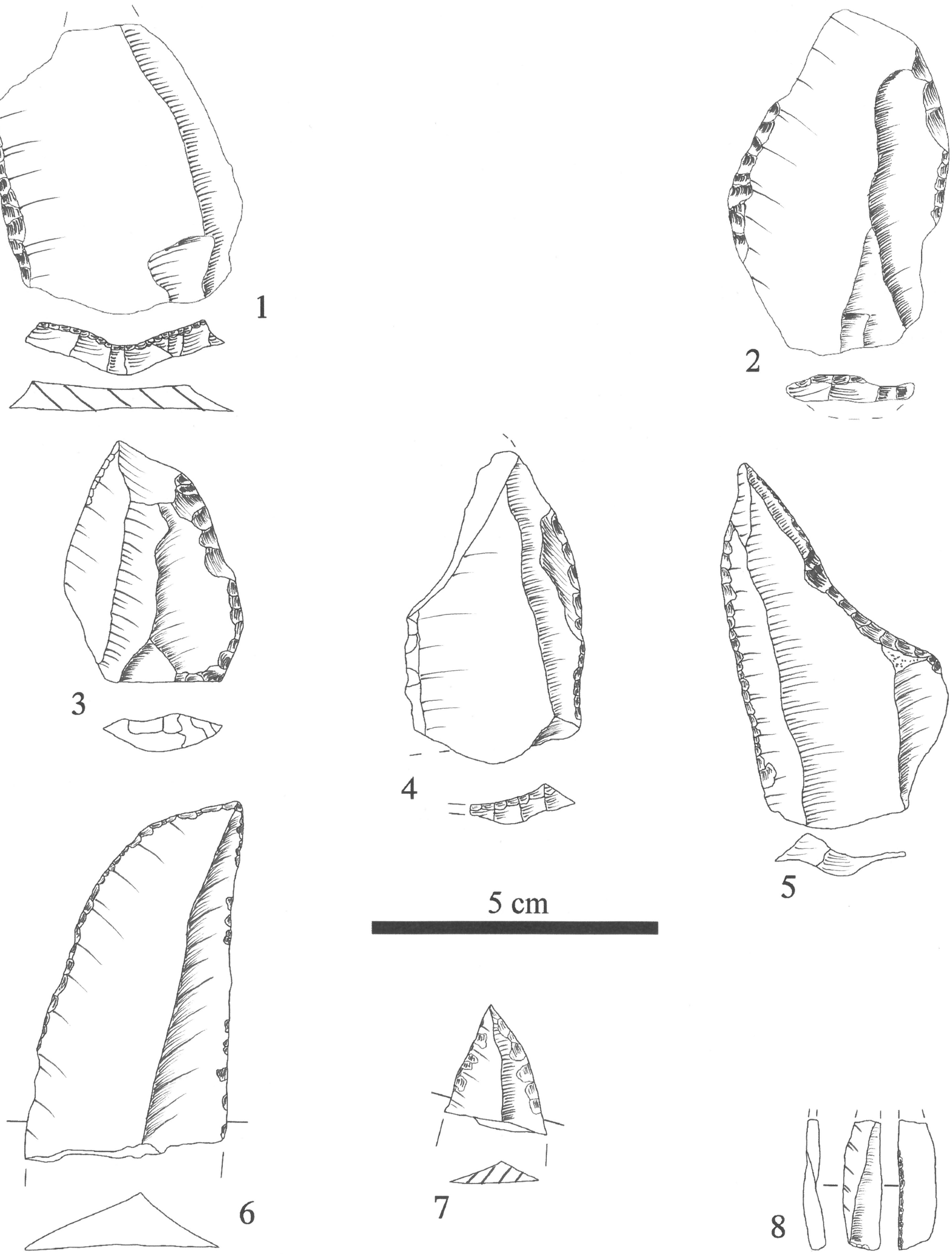

Figure 9. Selected artifacts from Kebara Unit V. 1–5) side-scrapers; 6) retouched flake; 7) broken tip of a point; 8) twisted bladelet with ventral retouch* (*Intrusive UP items).*

TABLE 8. SELECTED TECHNOLOGICAL ATTRIBUTES OF LEVALLOIS END-PRODUCTS IN THE KEBARA CAVE SEQUENCE.

	Blank type %			Dorsal scar pattern %			
Unit (N)	**Points**	**Blades**	**Flakes**	**Uni.***	**Con.**	**Bid.**	**Cen.**
V (80)	6.3	10	83.8	12.7	25.4	31	31
VI (340)	4.1	20.9	75.0	24.7	34.6	12.1	28.6
VII (493)	8.1	17.4	74.5	11.5	45.2	12.3	31
VIII (219)	7.3	19.6	72.8	13.2	49.1	9	28.8
IX (554)	18.7	21.7	59.6	10.7	56.2	12	21.2
X (534)	28.5	22.7	48.9	8.1	53.9	13.2	24.8
XI (487)	13.3	32.8	53.8	15.5	46.5	18.9	19.1
XII (175)	14.2	32.6	53.2	9.1	56.6	20.6	13.7

*excluding convergent. Uni.=Unidirectional; Con.=Convergent; Bid.=Bidirectional; Cen.=Centripetal.

Units XII-VI after Meignen 2019.

cal trend in the Ksâr ‘Akil MP sequence is broadly similar to the one identified in Kebara. The emphasis on the *Levallois convergente* reduction sequence to produce triangular flakes and points is shifting to flake reduction, many of them with a centripetal scar pattern (Pagli 2013, 2015). Indeed, judging by the quantitative data and drawings available (Pagli 2013, 2015) it seems that Ksâr ‘Akil layers XXVIIA-XXVIA mostly resemble the Kebara MP Upper Units. However, broad-base Levallois points are not as common in the lowest MP layers of Ksâr ‘Akil, as in the case of the Kebara MP Lower Units (XI-IX). In fact, most of the points and triangular Levallois flakes therein are of the ‘leaf shaped’ type (Pagli 2013). It may suggest that Ksâr ‘Akil XXVIII-XXVIIB are comparable to the upper layers at Amud and Dederiyeh where this type of Levallois pointed blank is rather common (Hovers 1998, 2004; Meignen 1995; Nishiaki et al. 2012; but see Krakovsky 2017), but at this stage, it is a working hypothesis. However, if this is the case, it indicates that the technological differences between the Kebara MP Upper Units and Amud B1 reflect chronological trends, in spite the contemporaneous TL and ESR dates. Given the limitation of these dating methods, such a hypothesis is reasonable.

The stratigraphic evidence (from Kebara and Ksâr ‘Akil) demonstrates that during MIS 3 in the Levant, the emphasis on the *Levallois convergente* reduction sequence to produce triangular flakes and points is shifting to flake production with an increase in centripetal and bi-directional prepared Levallois cores.

A technological difference is clearly observed between the cave sites and the small late MP open-air sites of NMO and Far’ah II, in both of which there is emphasis on non-Levallois core reduction (Gilead 1988, 1995; Gilead and Fabian 1990; Sharon 2018; Sharon and Oron 2014). This difference probably relates to the sites’ function (ephemeral hunting sites). It was suggested that in sites of this type, the Levallois blanks could be carried out of the site as personal gear (Hovers 2009: 208). It will be interesting to see how the assemblages from the new excavation at the open-air site of ‘Ein Qashish will correlate with other late MP assemblages, as on-site Levallois core reduction is present (N. Mitki, personal communication). For now, it is possible to mention that in the earlier initial excavation at the site, the assemblage was not dominated by a *Levallois convergente* method (Malinsky-Buller et al. 2014).

As is the case for the Levantine MP in general, the variability and dynamics of the Levantine late MP are far from being clear. As more information arrives from the arid regions, it becomes evident that in the periphery there are technological traditions that are poorly represented or absent in the Mediterranean region (Goder-Goldberger et al. 2016; Pagli 2013).

THE MIDDLE-UPPER PALEOLITHIC TRANSITION IN THE LEVANT

From the lithic perspective, the MP-UP transition is marked as a technological change from the Levallois concept for producing flakes, points, and blades to the production of elongated points and blades under a different, volumetric concept, which does not fit Boëda’s definition of the Levallois concept (Boëda 1995). According to the UP volumetric concept, the geometry of the debitage surface of the cores is much more convex, enabling production of blades and elongated points (see Van Peer 1992; Van Peer et al. 2010: 41–54, for a discussion on the limitation of the Levallois concept to produce blades due to the core geometry). Typologically, a change is also observed in the toolkit. The most distinctive tool of the MP, the side-scraper, is less common and is replaced by typical UP forms, such as end-scrapers and burins.

The first appearance of the UP in the Levant is marked by industries that combine “archaic” technological features common in the MP (e.g., faceted core platforms and direct, hard hammer, percussion), with core exploitation and

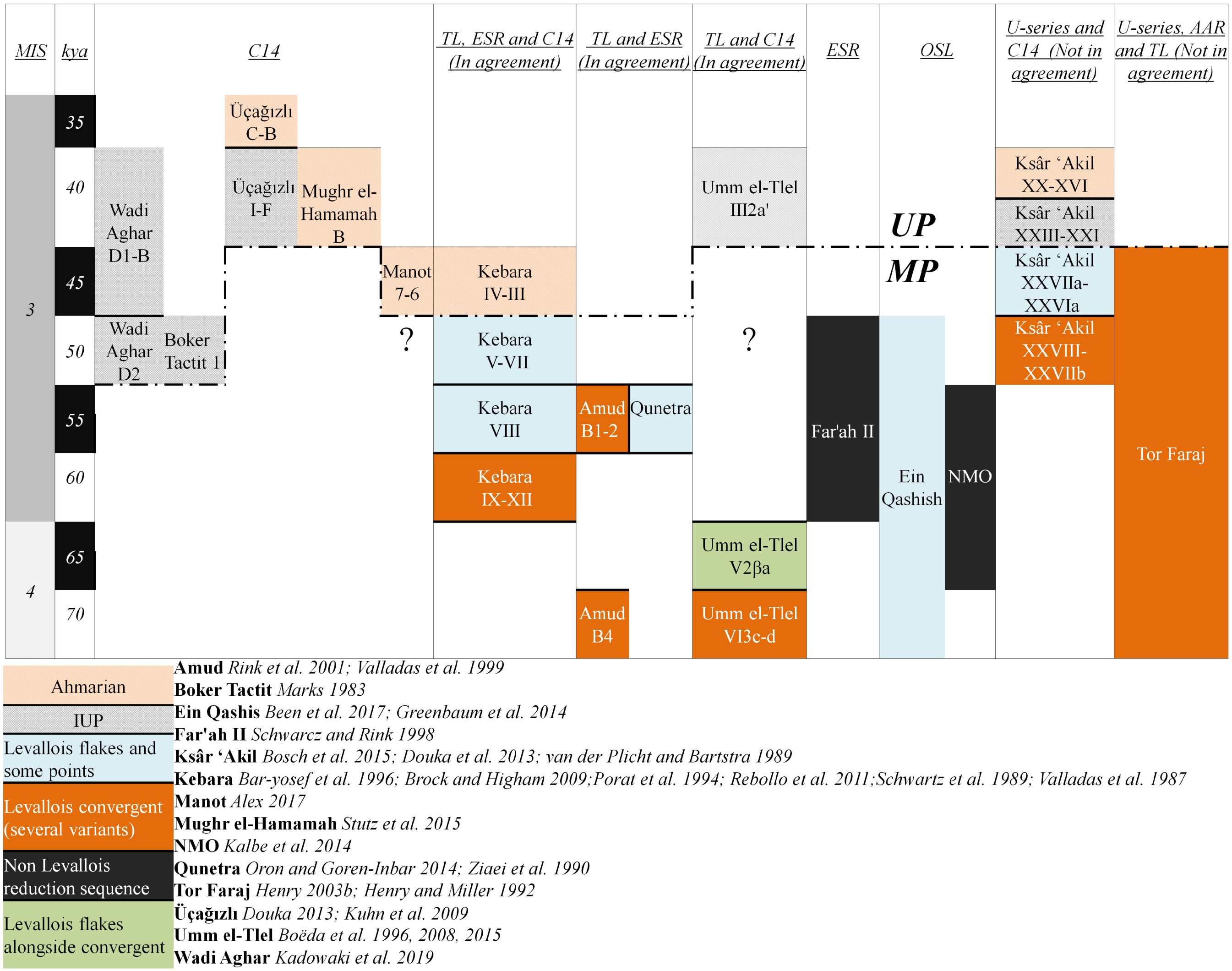

Figure 10. The Levantine late MP, IUP, and EUP dated assemblages and schematic presentation of the lithic variability.

maintenance typical of that of the UP (e.g., exploitation of the core from the narrower side, ridge blades, and core tablets; Belfer-Cohen and Goring-Morris 2009; Meignen 2012).

These industries have been defined as IUP, a term originally used for the latest phase of Boker Tachtit stratigraphy (Level 4) (Marks and Ferring 1988; and see discussion on Boker Tachtit below). Currently, this term alternates with the more traditional one, the "transitional industries," as a more neutral definition (Kuhn 2019; Kuhn et al. 1999; Kuhn and Zwyns 2014).

Following the IUP in the Levant, a new techno-complex appears, the Ahmarian (Gilead 1981, 1991; Marks 1981; and see Goring-Morris and Belfer-Cohen 2018 for a recent synthesis), proclaiming yet another technological change. The prismatic cores for points and blades are replaced by narrow-fronted cores producing narrow blades and bladelets (see Goring-Morris and Davidzon 2009; Monigal 2003 for detailed descriptions of the Ahmarian *chaîne opératoire* based on refitting studies). Faceting of the striking platforms disappears while abrasion of the margin of the striking platform becomes the common practice (Belfer-Cohen and Goring-Morris 2007; Kuhn 2004; Monigal 2002). As a result, the blades in the Ahmarian are much finer and thinner compared to those of the previous periods/industries and punctiform platforms became common.

Recently it was proposed that some lithic assemblages reflect an Early UP (EUP) industry that combines Ahmarian (*sensu lato*) and IUP techno-typological characteristics. This model suggests a slow and gradual IUP-EUP transition in some parts of the Levant (Leder 2014; Stutz et al. 2015; Stutz and Nilsson Stutz 2017). A detailed discussion on this subject is beyond the scope of the present paper. However, this "evolutionary stage" (the so called *Ksar Akilian*, Leder 2014: 212–213) is not yet well documented and further work needs to be done to refute the possibility of a palimpsest layer that comprises both EUP and some IUP (or MP) artifacts and thus to ensure the credibility of such a phase. Perhaps the assemblage from the newly excavated Trans-Jordanian site Mughr el-Hamamah, (dated to 45–39ky cal BP), claimed to be an *in situ*, unmixed EUP assemblage with Levallois technology (Shea et al. 2019), can clarify some of this issue in the near future.

Nevertheless, and as an aside at this point, it can be said that it is in the Ahmarian that the "full-fledged" UP blade technology finally appeared. It is considered as a local entity, which evolved from the Levantine IUP (Bar-Yosef 2000; Gilead 1991; Goring-Morris and Belfer-Cohen 2018; Marks 1993, 2003; but see Douka et al. 2013; Kadowaki et al. 2015).

There are several facies of the Levantine IUP, but their chronology and interrelationships are still not well understood. The best documented (in terms of lithic studies) is the one discovered at Boker Tachtit in the Central Negev, with a stratigraphic sequence of four well-preserved, short-term occupation levels (Marks 1983a). The high refitting rate of the assemblages from the different layers demonstrates in detail the chronological change that occurred in the lithic technology (Marks and Volkman 1983, 1987; Volkman 1983). Simply put, the initial occupation of the site (Level 1) is characterized by the use of specific bi-directional cores for the production of Levallois-like points. The use of ridge blades for core shaping is well documented. In the most recent occupation (Level 4), the lithic technology is characterized by the use of uni-directional pyramidal cores for the production of points and core-tablets for core maintenance are common. The Emireh point, the so-called *fossile directeur* of the MP-UP transition (Garrod 1955), was recovered throughout Levels 1-3. In Level 4, this point had disappeared, replaced by unretouched points. As regards tool typology, all the levels are characterized by UP tool types (burins and end-scrapers) (Marks and Kaufman 1983). The excavators claim a gradual change from a Levallois core reduction to pyramidal blade cores which occurred throughout the local occupation sequence (Marks and Volkman 1983, 1987).

It seems that in the adjacent site complex of Boker, the small flint assemblage of the lowest level in Area D, the oldest in the stratigraphic sequence therein, is similar to that of Boker Tachtit Level 4 (Goldberg 1983; Jones et al. 1983). This assemblage can be used for connecting the stratigraphy of Boker Tachtit (and the Emiran industry) with the Ahmarian levels in the Boker site complex (best represented in Areas A and CE).

Other assemblages that resemble Boker Tachtit Level 4 were reported from two rock shelters in Jordan. The first is from Tor Sadaf in Wadi el-Hasa (west-central Jordan), underlying an Ahmarian occupation (Fox 2003) and the second from Wadi Aghar (Coinman and Henry 1995; Kadowaki et al. 2019) in Jebel Qalkha (southern Jordan).

Some radiocarbon dates from the Boker Tachtit sequence are available (Marks 1983b). Level 1 is dated by two radiocarbon dates to ca. 47,000 ^{14}C years BP (47,284±9,048; 46,930±2420). There are two more dates from this level: >45,570 and >34,950. Level 4 is dated by one radiocarbon date to 35,0554,100 ^{14}C years BP. All dates from Boker Tachtit have a significant standard deviation. The date of Level 4 overlaps with the dates of later UP industries and apparently is younger than the real age of this level (see below). Recently the site was re-excavated in order to obtain more reliable dates (Barzilai and Boaretto 2016). However, the new dates have not yet been published.

The taxonomic definition of the different assemblages of Boker Tachtit changed over time. The differences stem from how one defines Levallois. If the bi-directional point cores recovered in Boker Tachtit are perceived as Levallois cores, then Level 1 can be referred to as Terminal MP and only Level 4 can be considered as UP. The levels in-between will then be referred to as transitional (Marks 1983c; Marks and Volkman 1983). Adhering to Boëda's (1995) definition of Levallois, one could claim that the Levallois concept is absent in all the levels of Boker Tachtit and the core reduction concept observed therein needs to be referred to as an UP one (Meignen 1996, 2012). Nevertheless, Marks's definition of Levels 1–3 as Emiran and of Level 4 as yet another, unnamed, IUP industry (e.g., Marks 2003; Rose and Marks 2014) is quite reasonable (regardless of whether true Levallois cores are present in the Emiran), based on the difference in core reduction techniques and the absence/presence of the Emireh points.

Unfortunately, the assemblages from the type site of the Emiran, the Emireh Cave, (Garrod 1955) are not from clean contexts, comprising an admixture of MP, Emiran, and UP artifacts (Barzilai and Gubenko 2018). Thus, it seems that the site of Boker Tachtit is almost an "isolated island" in the Levantine record. Still, some Emireh points were recovered in old excavations and from surface collections in the Galilee and on the Lebanese coast (Copeland 2000; Volkman and Kaufman 1983), indicating that the Emiran also was present elsewhere in the Mediterranean region.

In the Northern Levant, another facies of the IUP is best known from Ksâr 'Akil levels XXV-XXI. This important site has the longest and most complete UP sequence in the Levant, on top of a long MP sequence. Unfortunately, the geopolitical problems of the Middle East stopped the excavation of J. Tixier in the 1970's before he reached the Early UP units. Therefore, the only IUP assemblage studied from this site derives from the Boston College excavations in the 1930's and the 1940's. The stratigraphy and the curation procedures of those excavations are problematic (Braidwood et al. 1951; Ewing 1947; see Williams and Bergman 2010 for an attempt to synchronize between the sections of the different excavations). Nevertheless, this site provides important information on the IUP and the cultural sequence of the Levantine UP.

The UP sequence of Ksâr 'Akil was divided into phases, and the IUP levels of XXV-XXI were referred to as Phase A (or Phase 1) (Azoury 1986; Copeland 1975; Ohnuma 1988; Ohnuma and Bergman 1990). The industry of this phase is represented by numerous points and blades detached from pyramidal or semi-prismatic cores and bi-directional parallel side ones. It seems that the latter are more common in the lower levels of this phase (XXV-XXIV). Core platform faceting and points with relatively thick striking platforms are common (Ohnuma 1988). The presence of Levallois core reduction in Ksâr 'Akil (as in Boker Tachtit) is again a matter of definitions. For I. Azoury (1986), the points in Phase A were produced with a specialized Levallois technique. Copeland argued that the cores in Phase A are very similar to the Levallois cores in the MP level below (XXVI) and that the "unretouched debitage is strongly Levallois" (Copeland 1975: 337). Others, however, consider the technology of Ksâr 'Akil Phase A as non-Levallois (Marks 1983c; Meignen 2012; Ohnuma 1988; Ohnuma and Bergman 1990). Despite the presence of some Levalloisian features in Ksâr 'Akil Phase A (e.g., platform faceting and direct hard hammer percussion; see Kuhn 2004 *contra* Ohnuma and Bergman 1990), according to Boëda's definitions, the core reduction in this phase is not Levalloisian.

Typologically, the assemblages of Ksâr 'Akil Phase A are UP in character (many end-scrapers and burins), yet the most distinctive tool of this phase are the chamfered pieces (*chanfreins*) (Azoury 1986). These burin-like tools are blades or flakes with a distal transverse blow usually made on a lateral preparation.

Assemblages similar to those of Ksâr 'Akil Phase A, with chamfered pieces, are found in the Northern Levant on the Lebanese coast in Antelias Cave (VII-V) and Abu Halka (IV f-e) (Azoury 1986; Copeland 1975). It is of interest to note that at Abu Halka, there are also Emireh points (Copeland 2000). An additional important site excavated more recently that can be attributed to the later part of Ksâr 'Akil Phase A (XXII-XXI), is Üçağızlı Cave in Hatay, Turkey (Kuhn et al. 2009). Eight chamfered pieces were published from the lowest layers in the cave (I-H). Also, the overlying layers F-G are attributed to Ksâr 'Akil Phase A, based mostly on technological attributes. These layers are overlain by UP layers equivalent to those of Ksâr 'Akil Phase B (in particular, Levels XVII–XVI) (Kuhn et al. 2009). This latter stage can be considered as a Northern variant of the Early Ahmarian.

In the Southern Levant, chamfered pieces were found only in one locality, S'de Zin 7, a surface scatter. There was a difference though between this assemblage and the northern ones as no platform faceting was observed (Goring-Morris and Rosen 1989).

In contrast to the Emiran of Boker Tachtit there are many more radiocarbon dates for the Northern IUP facies with the chamfered pieces, though the dates are not that straightforward. Douka et al. (2013) dated marine shells from Ksâr 'Akil XXIII-XXI, providing a range of 37,430 to 30,890 ^{14}C years BP (clustering around 35,000 ^{14}C years BP). The Bayesian models applied by Douka et al. (2013) suggest that the IUP in Ksâr 'Akil is to be dated to 42,850–41,550 years cal BP. On the other hand, Bosch et al. (2015a) dated one marine shell from Ksâr 'Akil XXII that provided an earlier date of 44,400–43,100 years cal BP. The Bayesian models applied by Bosch et al. (2015a) suggest 45,900 years cal BP as the minimum age for the beginning of the IUP in Ksâr 'Akil (Level XXV) (see Bosch et al. 2015b; Douka et al. 2015, for more detailed discussion on the chronology for Ksâr 'Akil).

At Üçağızlı Cave, charcoal radiocarbon dates from Layers F-I can be clustered into two groups. The younger falls between 34,000 to 36,000 years BP, whereas the older falls between 39,000 to 41,400 years BP. As the excavators of the site comment, it is difficult to convert the ^{14}C years dates to calendric years, because the outcome will be between 39,000 to 46,000, depending on which group of dates and calibration models are used (Kuhn et al. 2009). The IUP layers at Üçağızlı were also radiocarbon dated using shells. Those dated the IUP layers at the site as 40,800–37,800 years cal BP (Douka 2013).

Indeed, the radiocarbon dates of the IUP at Ksâr 'Akil and Üçağızlı (in particular those offered by Douka 2013 and Douka et al. 2013) are later than the dates of Boker Tachtit. As in the case of Boker Tachtit Level 4, the dates overlap with the Early Ahmarian at Kebara and Manot caves (Alex et al. 2017; Bar-Yosef et al. 1996; Rebollo et al. 2011; but see Zilhão 2013).

Another facies of the Levantine IUP is known from the Northeastern province, in the el-Kowm and Palmira regions, Syria. This facies is often called *Paléolithique intermédiaire* (Boëda and Bonilauri 2006; Boëda et al. 2015). It is best known from the site of Umm el-Tlel, layers III2b'-II base'. This industry is interstratified between late MP levels and UP ones. The *Paléolithique intermédiaire* can be divided into four sub-facies, all sharing the common characteristic of end-scrapers and burins being the dominant tool types. These tools are manufactured on blade blanks which are the primary predetermined product. Another characteristic of the *Paléolithique intermédiaire* is "the presence of narrow-based, elongated Levallois points, which are **not systematically produced through Levallois reduction strategies"** (Boëda and Bonilauri 2006: 77, our emphasis). In many cases, a thinned base for these specimens is achieved by shallow removals, carefully performed, just prior to the detachment of the point from the core. These narrow-based, elongated points with the dorsal thinned base are called Umm el-Tlel points (Boëda and Muhesen 1993). In some of the *Paléolithique intermédiaire* assemblages, a specific reduction sequence for bladelets is present (Boëda and Bonilauri 2006).

A similar industry with Umm el-Tlel points was found in Jerf al-Ajla Cave Layer C (equivalent to Coon's Layer Brown 1) (Richter et al. 2001; Schroeder 1969). Apart from these points, there was also a distinctive core type, the 'Jerf al-Ajla' core (Richter et al. 2001; Schroeder 1969). These cores-for-points have a broad faceted striking platform and a triangular shape modified by lateral preparations. Their scar pattern is somewhat similar to Nubian Type 2 cores, but it is clear that some of them do not have the geometry of a Levallois core (Richter et al. 2001, Figure 4).

The *Paléolithique intermédiaire* of Umm el-Tlel is radiocarbon dated (n=4), ranging from 33,730±200 to 36,000±1,100 ^{14}C years BP and by TL to ca. 36 ky (mean age of three dates). All dates derive from Layer III2a' (Boëda et al. 1996, 2015). Jerf al-Ajla C is dated by TL to ca. 33.3 ky (mean age of eight dates) (Richter et al. 2001).

To sum up, several assemblages from diverse geographic settings in the Levant portray an admixture of MP and UP characteristics. The stratigraphic evidence, when available, assigns these assemblages an inter-stratified position between the late MP and the UP (e.g., Ksâr 'Akil and Umm el-Tlel). The absolute dates of these assemblages are controversial. Nevertheless, they all fall within the time span of 50,000–40,000 years cal BP. However, if the late dates from Umm el-Tlel and Jerf al-Ajla for the *Paléolithique intermédiaire* (ca. 40,000 years cal BP) are considered reliable, then this IUP facies, known from the Palmira and el-Kowm regions, cannot be the 'ancestor' of the Early Ahmarian.

In light of the regional lithic (techno-typological) variability and the radiocarbon dating constraints, it is difficult to offer a pan-Levantine chronological development for the different IUP facies. If one advocates a more ecological approach to explain lithic variability, the diverse ecological niches of the IUP sites may be another explanatory factor (Olszewski 2017). Although some see a South-North dichotomy (Emireh point vs. chamfered pieces) the presence of many Emireh points in the Lebanese coast sites (Copeland 2000) indicates a more complex picture. Still, the rareness of the chamfered pieces in the Southern Levant must be taken into account. Based on technological similarities, Marks (1983c, 2003; Marks and Rose 2014) proposed that the later part of Ksâr 'Akil Phase A and Üçağızlı can be correlated with the upper part of the Boker Tachtit sequence. For him, Boker Tachtit Level 1 is older than the IUP of the Northern Levant.

When examining the IUP against the background of the late MP assemblage of Kebara V, it seems that in terms of lithic technology and typology, one can observe discontinuity (this claim is in agreement with a previous study, of Unit VI; see Tostevin 2003, 2013). All the characteristics of the IUP are literally absent in Kebara V (i.e., there is no production of pointed elongated blanks and UP tools are extremely rare). In fact, in terms of technology and typology, Unit V is more a 'classic MP assemblage' than the unretouched pointed assemblages that preceded it (the so called 'Tabun B' type assemblages). The *Levallois unipolaire convergente* method with the oblique core lateral margins (which in some sense resembles the technology seen in Ksâr 'Akil Phase A and the *Paléolithique intermédiaire*) is a negligible component in this assemblage, and the technology is focused on the production of flakes, most of them struck off centripetal and bi-directional prepared Levallois cores. In the tool-kit, unretouched points are rare and it is dominated by side-scrapers. We emphasize that the bi-directional Levallois blanks identified in this assemblage are not related by any means to the bi-directional Emiran blade-point technology.

The data in the present study accords with a previous proposal which concludes that "If a technological transition to the early UP took place locally, it will be difficult to argue that it emerged from the centripetal core preparation produced by the latest Mousterian in the Levant" (Bar-Yosef 1998: 48). This claim is well-founded in the Mediterranean region, where the archaeological record is well documented, relatively well dated, and is supported by stratigraphic evidence from several sites. Still, it is possible that the IUP stems from contacts among local populations in the arid and adjacent regions. Unfortunately, the archeological record of the late MP in Levantine peripheries is too fragmentary to evaluate the dynamics between the local population and those of the neighboring regions, and their impact on the appearance of the IUP. In the Northeastern province, at Hummal, the top of the MP sequence is eroded (Hauck 2011; Le Tensorer et al. 2011) and thus it is impossible to speculate whether the local MP evolved into the local *Paléolithique intermédiaire*. At the nearby site of Umm el-Tlel, the data on the latest MP layers (Complex IV) is not yet published.

Recently, Rose and Marks (2014) proposed that the IUP point technology stems from a contact between the Levantine population and that of the Arabian Peninsula. This can explain the similarity between the Emiran and the Levallois Nubian technology that is documented mainly in North East Africa and Arabia but more recently also in the Negev Desert and South Jordan (Goder-Goldberger et al. 2016, 2017 and references therein).

Indeed, the similarity between the Emiran and the Levallois Nubian technology was noted several times before as a possible indication of the MP background of the Emiran (Belfer-Cohen and Goring-Morris 2007, 2009, 2014). However, there is a need for additional well-dated assemblages to support this hypothesis. In fact, the only dated Nubian assemblages in Arabia are ca. 106 ky by OSL (Rose et al. 2011), preceding the Levantine MP-UP by ca. 50 ky. Furthermore, the chronological affiliation of the Negev and the Jordanian MP sites is poorly understood, which places them in a chronological 'limbo.' The southern Levantine sites which Rose and Marks consider as contributors to the Emiran need to be first well dated, and only then, considered as related to the Emiran 'ancestors'.

In addition, the tentative proposal of an African origin for the Emiran (e.g., Bar-Yosef 2000) was recently linked to the Nile Valley blade industry named the Taramsan, which is dated by OSL to ca. 60 ky and is associated with modern humans (Van Peer 2004; Van Peer and Vermeersch 2007; Van Peer et al. 2010; Wurz and Van Peer 2012). Even though broad technological similarities can be drawn between the Taramsan and the Emiran (bi-directional blade industries stemming from a Levallois background), there are also some crucial dissimilarities which need to be taken into account. The first is the different methods and modes of core modification and exploitation. In the Emiran, as opposed to the Taramsan, ridge blades are very common. The second is the objective of the core reduction. In the Taramsan, blades are the main end products (produced in recurrent methods; Van Peer et al. 2010), while in the Emiran, the core reduction is targeted to the production of Levallois-like points (produced in preferential methods; Volkman 1983).

Indeed, the connection between the Levantine periphery and the neighboring regions requires further investigation.

CONCLUSIONS

We have presented Kebara Unit V as a case study to examine the lithic technology and typology of the very end of the Levantine late MP. After a detailed description of the assemblage, comparing it to other late MP and IUP assemblages and considering the stratigraphic evidence and the current radiometric dates, we can conclude as follows.

The lithic production technology at the end of the Levantine MP is flake oriented. The assemblages, dominated by several variants of the *Levallois convergente* reduction sequence, are replaced by assemblages that are dominated by a Levallois reduction sequence for flakes.

No direct local contribution to the emergence of the IUP point and blade technology can be detected. This indicates that the emergence of the UP technology is probably related to an arrival of a new population to the region. However, the origin of this group is still elusive.

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ENDNOTES

[1]Interestingly, in the larger sample from Unit V (1982–1990 excavations), numerous convergent retouched pieces were identified (ca. 31% of the retouched tools, Meignen 2019). Such discrepancies are not totally surprising but they must draw attention to the phenomenon of specific spatial patterning frequently encountered in Paleolithic sites.

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