TECHNOLOGY OF STRIKING PLATFORM PREPARATION ON LITHIC DEBITAGE FROM WADI AGHAR, SOUTHERN JORDAN, AND ITS RELEVANCE TO THE INITIAL UPPER PALAEOLITHIC TECHNOLOGY IN THE LEVANT

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Introduction

A chrono-cultural term, Initial Upper Palaeolithic (hereafter IUP), has been widely used in archaeological studies of cultural changes from the Middle to Upper Palaeolithic period as well as in paleoanthropological discussions about behavioral changes around 50–40 ka in relation to geographic expansions of *Homo sapiens*. As described by Kuhn and Zwyns [2014], a definition of the term IUP has been broadened and applied to lithic assemblages from various regions, including the Levant, central Europe, the southern Altai, Mongolia, and northwest China, on the basis of apparent similarity in general characteristics of lithic techno-typology, such as Levallois-like blanks, robust pointed blades, and the presence of Upper Palaeolithic tool types (e.g., end scrapers and burins).

At the same time, researchers have been aware of regional and temporal differences among various IUP assemblages in several techno-typological features, such as the presence or absence of characteristic tool types (e.g., Emireh points and chamfered pieces) and core types (e.g., burin-cores), and variations in core reduction methods (e.g., flaking directions, locations of flaking surfaces, and preparation of core striking platforms) [Škrdra 2003; Fox and Coinman 2004; Zwyns *et al*. 2012; Kuhn and Zwyns 2014]. However, our understanding of these similarities and differences in terms of cultural-history, cultural evolution, or paleoanthropological processes are still limited, requiring further accumulation and examination of relevant data.

This paper presents a preliminary examination of technology for striking platform preparation on lithic debitage from Wadi Aghar, one of the IUP sites in southern Jordan (Fig. 1). Although a previous analysis by Coinman and Henry [1995] reported technological attributes of striking platform preparation at Wadi Aghar, this paper presents new data on this aspect of lithic technology 1) by using new lithic samples from a recent re-excavation at the site and 2) by paying attention to a butt type, “the partially faceted butt”, which was recently suggested to characterize the IUP assemblages from Ksar Akil [Ohnuma and Bergman 2013]. Through the analyses, the paper aims to discuss trends in IUP lithic technology in the Levant.

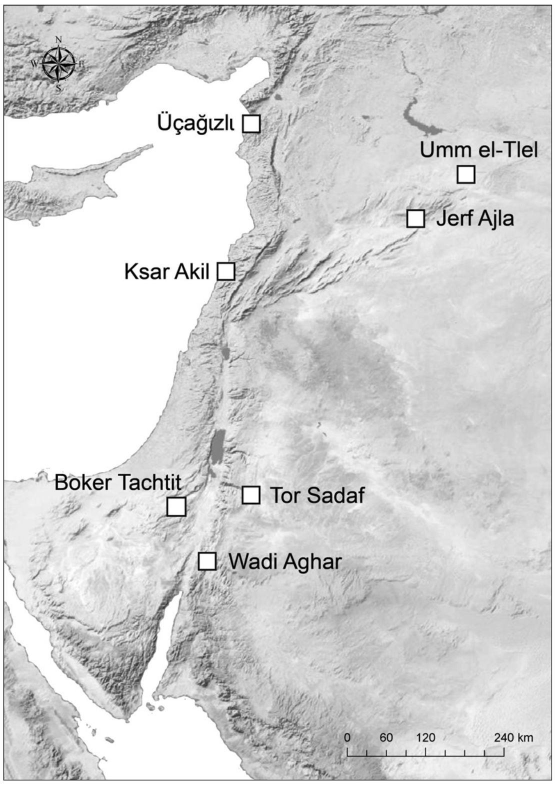

Fig. 1: Map of the Levant, showing the locations of IUP sites.

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IUP assemblages from Wadi Aghar, southern Jordan

This shallow rockshelter site (E 35.33172°, N 29.93678°) is located in the Jebel Qalkha area, southern Jordan, at the mouth of Wadi Aghar that drains into Wadi Qalkha (Fig. 2). The site was initially investigated in the 1983–84 seasons as part of long-term prehistoric investigations in the western Wadi Hisma [Henry 1995]. The excavation of three 1 m × 1 m units revealed cultural deposits of 35 cm thickness, in which three layers were detected (Layer A: a powdery grayish tan sand; Layer B: a light reddish brown sandy silt; Layer C: cemented pinkish sand) [Coinman and Henry 1995]. A rock-lined hearth with burnt sediment and ash was found in Layer B.

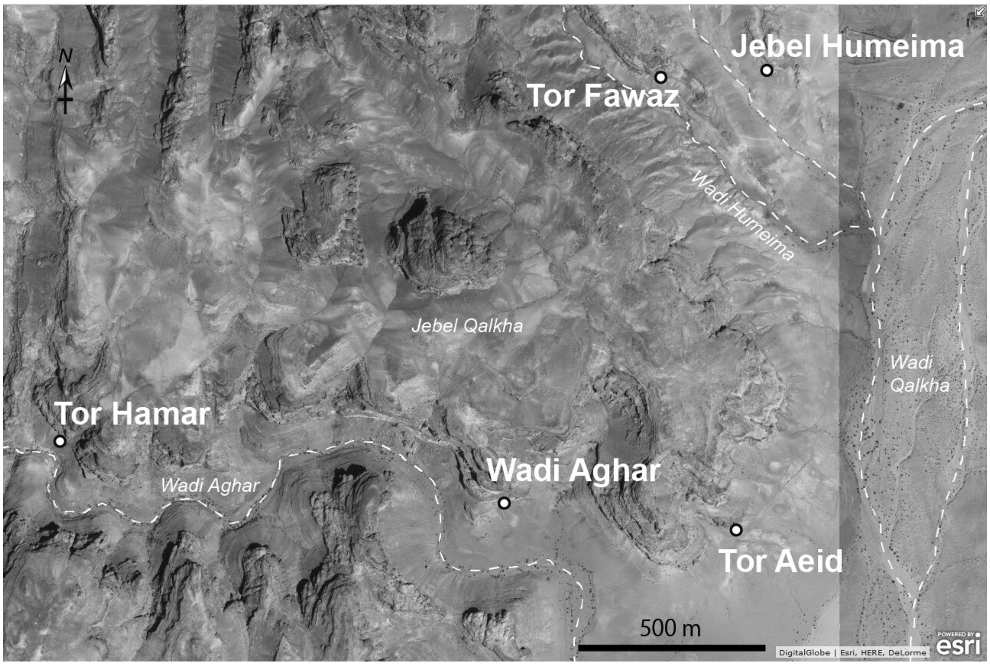

Fig. 2: Satellite image of the Jebel Qalkha area, showing Upper Palaeolithic sites.

The 1983–84 excavations recovered a total of 325 pieces of lithic artifacts, which were interpreted as representing "a technological stage between the local Levantine Mousterian and subsequent Upper Paleolithic assemblages in the south Jordan area" [Coinman and Henry 1995: 191]. Although the Wadi Aghar lithics show some similarities to the assemblages from Boker Tachtit Level 4 and Ksar Akil Levels XXIII–XXI/XX in the presence of UP tool types and robustness of blades, Coinman and Henry [1995] noted important differences in platform features. Namely, single, unfaceted butts (i.e., the plain butt in another terminology: Inizan *et al*. 1999) are more frequent in Wadi Aghar blanks in comparison with Boker Tachtit Level 4 and Ksar Akil Levels XXIII–XXI/XX. On the basis of this observation, they suggested that Wadi Aghar lithics represent a technological phase later than Boker Tachtit Level 4 but before the Early Ahmarian that is characterized by production of thin blades with small plain butts (e.g., linear and punctiform: Inizan *et al*. 1999).

The suggestion by Coinman and Henry [1995] gained support from a subsequent study of stratified assemblages from Tor Sadaf, where the lowermost phase (Tor Sadaf A), resembling Boker Tachtit Level 4, was overlain by an assemblage (Tor Sadaf B) that is characterized by an increase in blades with unfaceted butts [Fox 2003; Fox and Coiman 2003]. The Tor Sadaf B assemblage was overlain by an Early Upper Paleolithic assemblage that is the Early Ahmarian.

A new excavation at Wadi Aghar was conducted in 2016 in order to obtain chronological and paleoenvironmental data associated with the IUP lithic technology. Six 50 cm × 50 cm units (Units A–F) were excavated beside the previous excavation areas (Fig. 3). We opened Units A and B besides the 1983–84 season units. Units C and D were placed besides Unit 27 of the 1993 season, while Units E and F were opened next to Unit 26. Each of these units was excavated by natural stratigraphy as well as by arbitrary 10 cm levels in order to record vertical distributions of cultural remains and samples. All sediments were sieved through a mesh of 2 mm.

Among the new units, Units A and B exposed 70–90 cm-thick deposits above cemented rubble (Fig. 4). The top 30 cm of the deposits fits the description of Layer B, which is underlain by Layer C, a very compact deposit of 15 cm thickness. The bottom level of the 1983–84 units (and the descriptions in Coinman and Henry 1995: 143–144) indicates that the previous excavation stopped in Layer C. However, our excavation of Units A and B found that Layer C is underlain by less compact orange sandy deposits of 20–35 cm thickness (Layer D). The density of lithic artifacts was found to be high in the lower part of Layer C and the upper Layer D (Fig. 4).

The excavation of Units C and D exposed very compact sandy deposits of 20 cm thickness. Although this may correspond to Layer C, the excavation was halted by large rocks at the bottom of the units. In Units E and F, compact sandy sediments were also found, but excavation was stopped due to time constraints.

Among the new excavation units, Units A–B yielded the largest number of lithic artifacts (n = 201). The following analyses focus on these

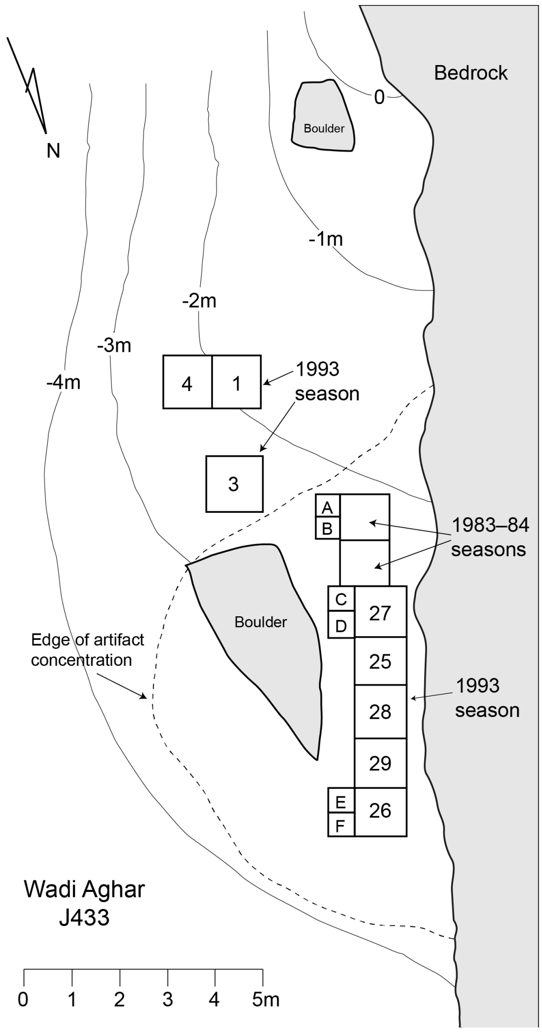

Fig. 3: Topographic map at Wadi Aghar, showing the locations of excavation units (based on an original map drawn by Donald O. Henry). Units A–F were excavated in the 2016 season.

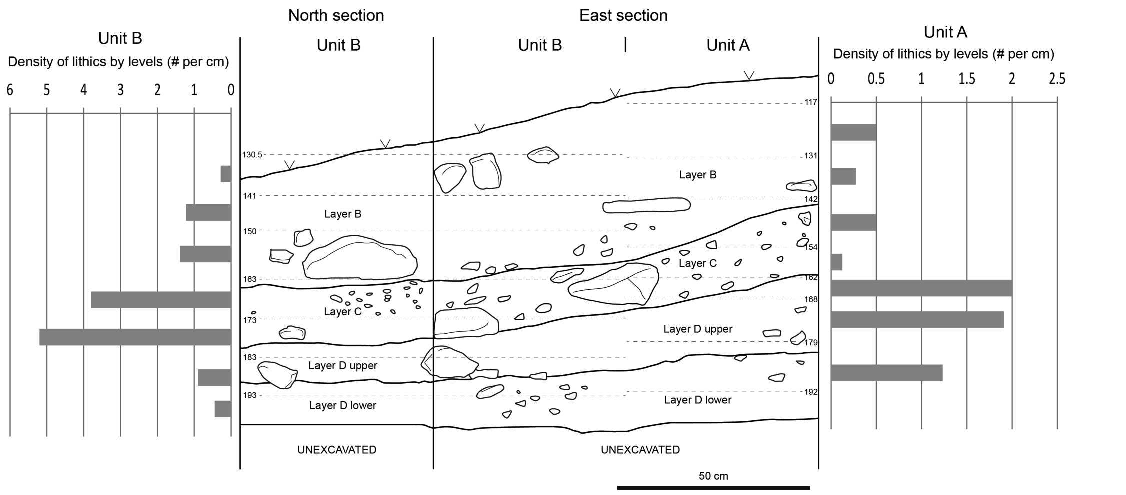

Fig. 4: Stratigraphic sections of Units A and B, showing the density of lithic artifacts by excavation levels (dotted lines) that are projected onto the sections.

units to ensure a chrono-cultural integrity of the lithic samples. The lithic collections from other units will be reported in another paper. Samples for radiometric dating and paleoenvironmental analyses are under study.

Lithic assemblage from Units A and B

Techno-typological characteristics

A new assemblage consists of 201 pieces of flaked flint artifacts (Table 1). Because the site is located in the area with widespread exposure of sandstone, flint must have been transported from limited or far sources. There is a small outcrop of limestone with flint nodules near Jebel Humeima, 2.6 km to the northeast of Wadi Aghar [Henry 1995: 116]. At this outcrop, flint is exposed as nodules with limestone cortex, and the siliceous part is light grey to greyish brown in color. Although this is known to be the most immediate flint source around the Jebel Qalkha area, flaked flint from Wadi Aghar shows greater variations in color, texture, and cortex, indicating the transportation from various sources.

The presence of cortical blanks and cores indicate knapping activities on site. Although only two cores were found from Units A and B, the small number is due to a limited sample size. In fact, the previous excavations in the 1983–84 seasons recovered a greater number of cores from nearby units [Coinman and Henry 1995].

Debitage is dominated by flake blanks, but core reduction technology is characterized by blades and bladelets. The recovered blades are about twice as many as bladelets. A distribution of their width show two peaks in 10–12 mm and 16–18 mm (Fig. 5), indicating that their productions are not continuous but consist of two separate methods. In fact, one of the cores from Unit B is a burin-core, which must have produced only small bladelets. On the other hand, the assemblage from the 1983–84 seasons includes blade cores that are not reduced to the size for bladelets [Coinman and Henry 1995: 184]. Core trimming elements include two crested blades and one plunging blade.

Retouched tools (n = 7) consist of Levallois-like points and end scrapers (Fig. 6). The two Levallois-like points are retouched. One of them

Table 1: Inventory of flaked stone artifacts from Units A and B at Wadi Aghar

		A and B
Retouched pieces	Retouched Levallois-like point	2
	End scraper	5
	(total)	7
Debitage	Cortex flake	16
	Partially cortex flake	29
	Flake	105
	Partially cortex blade	5
	Blade	19
	Bladelet (< 12 mm in width)	9
	Burin spall	2
	Chunk	2
	(total)	187
Core trimming element	Crested blade	2
	Core edge flake	2
	Plunging flake	1
	(total)	5
Core	Burin-core	1
	Core fragment	1
	(total)	2
Total		201

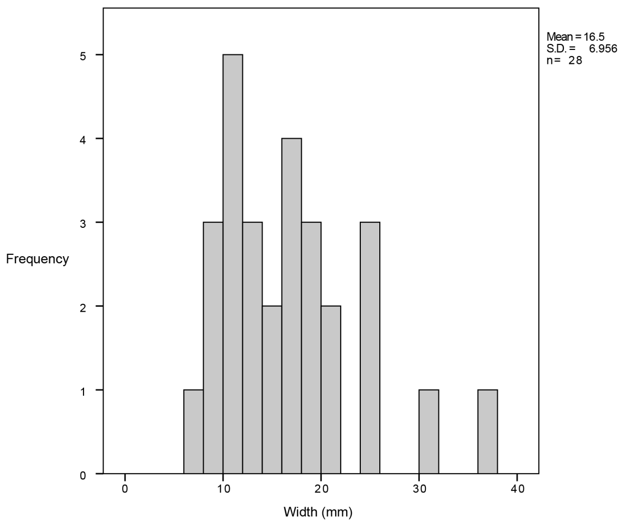

Fig. 5: Distribution of the maximum width measurements of blades and bladelets from Units A and B at Wadi Aghar.

shows dorsal retouch on the left side near the distal end (Fig. 6: 1), while the other has continuous ventral retouch along the both sides (Fig. 6: 2). The former shows a Y-shaped ridge created by unidirectional convergent flaking and has a convex multi-faceted butt (close to the *chapeau de gendarme* form), while the other shows a more irregular ridge pattern (partly due to “pot lid” fractures) with bi-directional flaking scars and a plain butt. The end scrapers are made on robust blades (mean width = 32 mm), and two of them have cortex (Fig. 6: 3 and 5). One of them retains a proximal end of the blank, which shows a partially faceted butt, which will be explained later (Fig. 6: 3).

Frequencies of dorsal scar patterns were observed for blade/bladelet blanks and retouched pieces

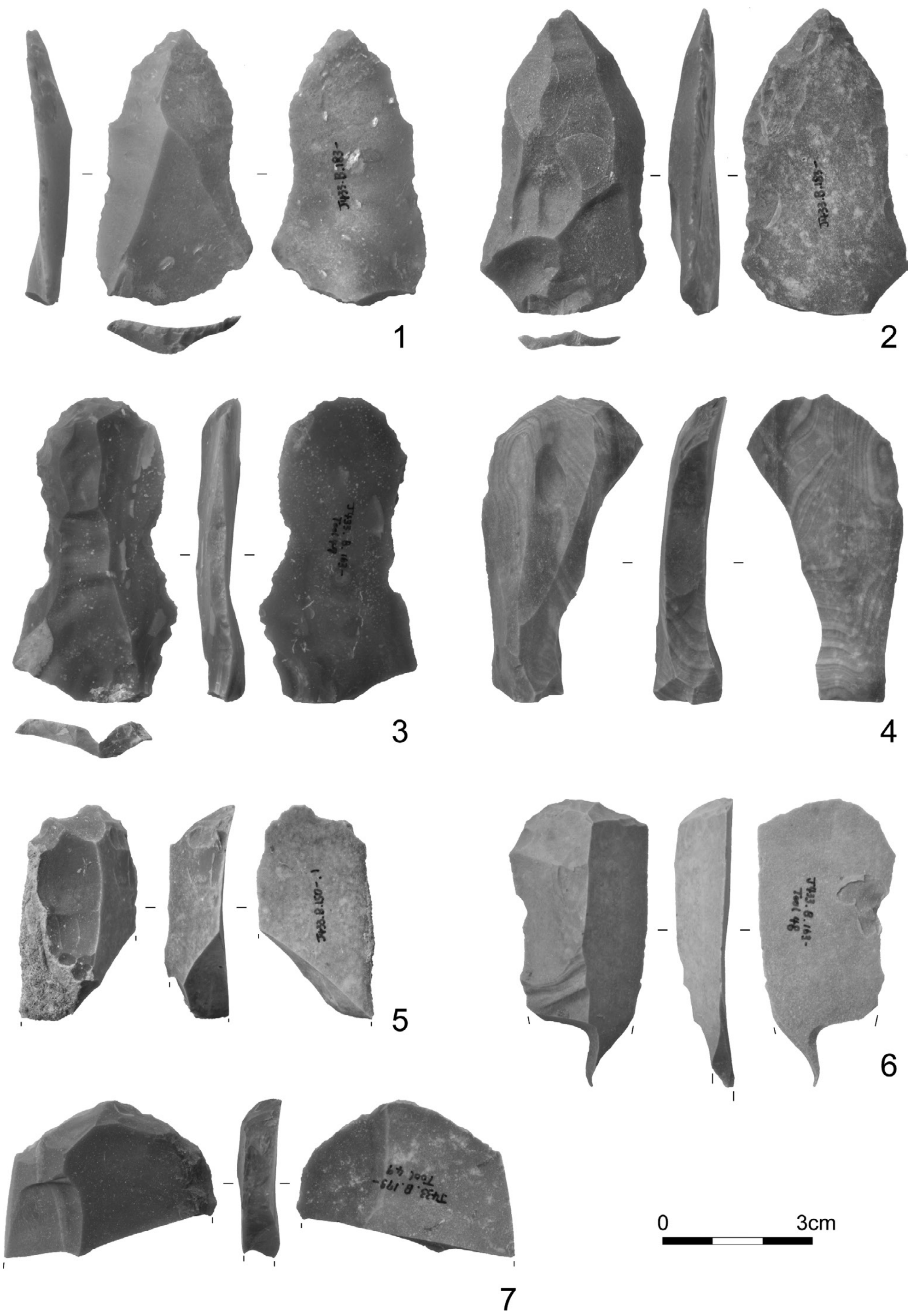

Fig. 6: Retouched pieces from Units A and B at Wadi Aghar. 1 and 2: Levallois-like points, 3–7: End scrapers.

(n = 20, including only complete and almost complete pieces). Unidirectional patterns are dominant with the unidirectional parallel pattern accounting for 50% and the unidirectional convergent for 30%, while the bidirectional pattern is 20%.

Technology of striking platform preparation

Here we present data regarding the technology of striking platform preparation. The data comprise 1) the frequencies of the butt types and 2) the occurrences of the overhang removal. The former types include cortical, plain, dihedral faceted, partially faceted, multi-faceted, and shattered. While most of these types are standard categories in lithic technological studies [e.g., Inizan *et al*. 1999], the partially faceted type has been uniquely recognized in the study of IUP and Early Ahmarian assemblages from Ksar Akil, Lebanon [Ohnuma 1988; Ohnuma and Bergman 2013]. According to the definition by Ohnuma and Bergman 2013, the type is defined by small faceting, directed from the dorsal surface onto the butt area, which aims "to remove the overhang at the core striking platform edge left by previous flake removals" [Ohnuma and Bergman 2013: 11]. The partially faceted butt shows multiple facets, but it is distinguished from the multi-faceted type by the location (sometimes concentration) of small facets at spots, where dorsal ridges meet the butt.

In the Ksar Akil sequence, the frequency of the partially faceted butt was high in Levels XXIII–XX, immediately preceding, with some overlap, the increase in overhang removals by percussion (in Levels XXI–XVIII) and abrasion (in Levels XIX–XVI). Because the latter techniques characterize the production of thin, slender blades/bladelets of the Early Ahmarian, the occurrence of the partially faceted butts in the IUP was suggested to represent "an intermediate form between the Middle Palaeolithic faceting to arrange the *angle de chasse* and the Upper Palaeolithic overhang removal" [Ohnuma and Bergman 2013: 7]. Because of this potential importance as a chrono-cultural marker, we incorporated this category in the classification of butt types for Wadi Aghar lithics.

Table 2 shows the frequencies of the butt types for blade blanks (including blades, bladelets,

Table 2: Frequencies of the butt types for blade and flake blanks from Units A and B, Wadi Aghar

	Blade (n = 16)	Flake (n = 51)	Total (n = 67)
Cortex	0%	4%	3%
Plain	31%	61%	54%
Dihedral faceted	6%	6%	6%
Partially faceted	44%	10%	18%
Multiple faceted	6%	12%	10%
Shattered	13%	8%	9%
Total	100%	100%	100%

Table 3: Correlation between the butt types and the occurrences of the overhang removal

		Overhang removal				
		No	Percussion	Abrasion	Unknown	Total
Butt types	Cortex	1	1	0	0	2
	Plain	19	16	1	0	36
	Dihedral faceted	3	1	0	0	4
	Partially faceted	6	6	0	0	12
	Multiple faceted	5	2	0	0	7
	Shattered	0	1	0	5	6
	Total	34	27	1	5	67

and partly cortical blades) and flake blanks (including flakes and partly cortical flakes). The partially faceted type is the most frequent on blade blanks, immediately followed by the plain type, while the plain type is dominant on flake blanks. Some of the partially faceted butts identified in Wadi Aghar lithics are shown in Fig. 7.

Table 3 shows the correlation between the butt types and the occurrence of the overhang removal. The overhang removal by abrasion is very rare. About a half of the samples lack the overhang removal, and 40% of the samples show the removal by percussion. It is noteworthy that the overhang

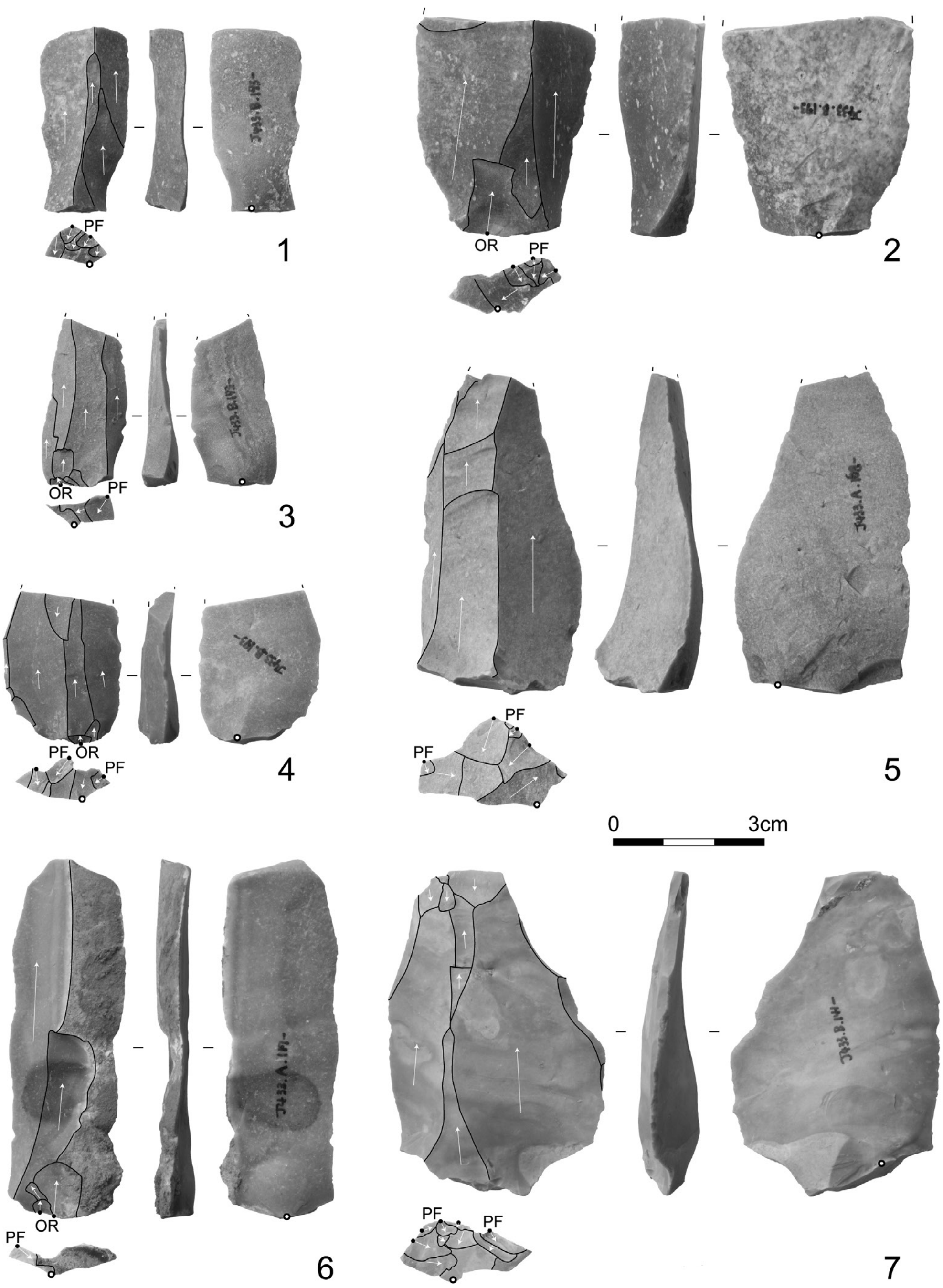

Fig. 7: Blade and flake blanks showing partial faceting on their butts. Arrows on flaking scars (outlined) show flaking directions, and black dots associated with some arrows mean the presence of negative bulbs. The partial faceting on the butts are indicated by “PF”, and the overhang removal by percussion is indicated by “OR”. Open circles indicate the locations of impact points.

removal by percussion occurs frequently with the partially faceted butt. A half of the partially faceted butts are associated with the overhang removal by percussion. The co-occurrences of these two techniques on the same blank are shown in Fig. 7: 2–4 and 6. In addition, blade blanks are more strongly associated with the overhang removal than flake blanks (Table 4).

Table 4: Frequencies of the overhang removal on blade and flake blanks

	Blade (n = 15)	Flake (n = 47)
No	47%	57%
Percussion	53%	40%
Abrasion	0%	2%
Total	100%	100%

Discussion

A new assemblage from Units A–B shows techno-typological characteristics that are generally similar to the lithic collection from the 1983–84 seasons [Coinman and Henry 1995]. For example, the both assemblages are similarly characterized by the production of robust blades (with some bladelets), which are retouched into Upper Palaeolithic tool types (i.e., end scrapers). Another common feature is the dominance of unidirectional flaking for the production of blade blanks. Given these similarities and the spatial proximity between Units A–B and the 1983–84 units, their chrono-cultural positions should be very close to each other.

However, there are some differences between Units A–B and the 1983–84 units. For examples, the former assemblage includes two retouched Levallois-like points, which are not reported in the 1983–84 assemblage. Another difference is the relative frequency of the plain butt type for blades. Assuming that this type corresponds to the single, unfaceted type in Coinman and Henry [1995: 183], it accounts for 71% of the blades in the 1983–84 collection. On the other hand, it is observed only for 31% of the blade blanks from Units A–B.

In discussing these differences, we must first keep in mind the small sample size of the both assemblages (n = 325 for the 1983–84 seasons and n = 201 for the 2016 season). Therefore, the presence or absence of Levallois-like points and the proportional difference in the plain butt type might only represent stochastic variations. Another possibility for the Levallois-like points is their derivation from older deposits given their occurrence in a level (183–193 cm below datum) that is lower than the peak of lithic concentration in Unit B (Fig. 4). As for the frequently of the plain butt, the difference might have resulted from inter-observer variability, particularly because the new type “the partially faceted butt” is employed in this study. Although the partially faceted butt is primarily a sub-category of the multi-facetted butt, the partial facets are sometimes so flat and limited in size and extent (e.g., Fig 7: 2 and 6) that the overall appearance of the butt can be categorized as the plain butt depending on observers. Thus, the recognition of the partial faceting in this study might have reduced the proportion of the plain butt.

Another possibility is a chronological precedence of the Units A–B assemblage to the 1983–84 samples. This is not inconsistent with the occurrence of Levallois-like points and a lower proportion of the plain butt. At Tor Sadaf, the bottom assemblage (Tor Sadaf A) is characterized by a greater frequency of multi-faceted butts (i.e., lower frequency of the plain butt) in comparison with the overlying assemblage (Tor Sadaf B) [Fox 2003]. As described earlier, the lithic samples from Units A–B were concentrated in the deposits (i.e., the lower part of Layer C to the upper Layer D), which could be stratigraphically lower than those in the 1983–84 units, which revealed Layers A–C.

Despite the above issues regarding intra-site variations, it would be reasonable to consider the new assemblage from Units A–B as showing IUP techno-typological characteristics, which are generally consistent with the previous collections. On the basis of these observations, this study suggests that the partially faceted butts occur in association with IUP techno-typological features at Wadi Aghar. So far, this butt type had been recognized only for the IUP and Early Ahmarian assemblages from Ksar Akil (and suggested to be present in some pieces from Boker Tachtit Levels 3–4 and Ücağızlı Layers I–H) [Ohnuma and Bergman 2013]. This butt type may be another key attribute to characterize the IUP lithic technology in both the northern and southern Levant.

However, the occurrence of the partially faceted butt may not be necessarily limited to IUP assemblages. In fact, it occurs in low frequencies in the Early Ahmarian levels at Ksar Akil [Ohnuma and Bergman 2013], and it is also expected to occur in Mousterian assemblages as a variation of multi-faceted butts. Therefore, in addition to the mere presence of the partial faceting, it is necessary to consider a technological context of this technique. In the Wadi Aghar assemblage, the partial faceting and the overhang removal by percussion are more strongly associated with blade blanks, and a half of the partially faceted butts co-occurred with the overhang removal by percussion. These technological associations indicate that the partial faceting and the overhang removal by percussion had a similar purpose, which was applied more frequently to the production of blade blanks. This technological context may characterize the use of the partial faceting in the Levantine IUP.

What remains unclear is evidence for a technological transition from the IUP to the Early Ahmarian in the southern Levant. Currently available records show an apparent technological gap between the Early Ahmarian (the southern facies: Goring-Morris and Davidzon 2006; Kadowaki *et al*. 2015) and a late phase of the IUP that is represented by Boker Tachtit Level 4, Tor Sadaf B, and Wadi Aghar. As shown in this study, the overhang removal by abrasion is virtually absent in the Wadi Aghar assemblage, but it becomes dominant for blade/bladelet blanks in the Early Ahmarian. In contrast, the appearance of the overhang removal by abrasion is more gradual in the Ksar Akil sequence, co-existing with the partial faceting [Ohnuma and Bergman 2013]. It is currently unclear whether such a gradual transition also occurred in the southern Levant. The nature of this technological transition in the southern Levant could be clarified by examining assemblages from Mughr el-Hamamah [Stutz *et al*. 2015] and Tor Fawaz [Coinman and Henry 1995].

Conclusion

The new lithic assemblage from Units A–B at Wadi Aghar, southern Jordan, shows techno-typological features indicative of the IUP, which is generally consistent with the previous collections from the site [Coinman and Henry 1995]. In order to provide a new technological aspect, this study examined the occurrence and technological context of the partially faceted butt. The results indicate that the partial faceting had the same purpose as the overhang removal by percussion and was performed often for the detachment of blade blanks. This platform preparation technology may be a common aspect of the IUP technology in the Levant, and the technological context of this technique suggests a gradual nature in the establishment of the Upper Palaeolithic blade technology in the Levant. The gradual transition from the IUP to the Early Ahmarian blade technology is more clearly attested in the northern Levant, particularly at Ksar Akil [Ohnuma 1988] and Üçağızlı [Kuhn *et al*. 2009], while the evidence for this technological transition need to be substantiated in the southern Levant. Lastly, the paper hopefully shows a significance of the platform preparation technology as a key aspect in examining the variability of IUP lithic technology.

Acknowledgements

This research derives from a joint project, entitled "Cultural history of PaleoAsia: Integrative research on the formative processes of modern human cultures in Asia," directed by Yoshihiro Nishiaki (The University of Tokyo) and funded by the Grant-in-Aid for Scientific Research on Innovative Areas (Grant No. 1802 for FY2016–2020) from the Ministry of Education, Culture, Sports, Science and Technology, Japan. The renewed fieldwork in the Jebel Qalkha area was conducted in collaboration with Donald O. Henry (The University of Tulsa) and received logistical support from the Department of Antiquities of Jordan. I am grateful to Mr. Sate Massadeh (Department of Antiquities of Jordan) and Mr. Masato Hirose (Nagoya University) for their cooperation in the fieldwork. I also appreciate long-term support and mentorship on lithic technological studies from Katsuhiko Ohnuma (Kokushikan University).

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