Rethinking the Upper Paleolithic of the Zagros Mountains

ELHAM GHASIDIAN
Leverhulme Centre for Human Evolutionary Studies, Department of Archaeology, University of Cambridge, The Henry Wellcome Building, 13A Fitzwilliam Street, Cambridge, CB2 1QH, UNITED KINGDOM; and, DiyarMehr Institute for Palaeoloithic Research, Kermanshah PO 78144-67189, IRAN; eg488@cam.uk.ac

submitted: 20 August 2018; accepted 30 January 2019

ABSTRACT

The Upper Paleolithic (UP) assemblages from the Zagros Mountain range were traditionally assigned to the Baradostian cultural group based on the original definition from Layer C at Shanidar Cave. New chronological information from three UP core areas of the Zagros—the Northern, West-Central and Southern Zagros—points to the roughly simultaneous appearance of UP technological traits in at least the Northern and Southern Zagros, while techno-typological analysis suggests a significant degree of variability among the UP assemblages from different parts of the region. On the other hand, there is considerable evidence that colonization of the Iranian Plateau occurred by different groups of hunter-gatherers that simultaneously occupied different parts of the Zagros and developed their own cultural identity as reflected in their lithic assemblages.

This paper describes five UP sites, including Shanidar in the Northern Zagros Mountains, Yafteh, Pasangar, and Warwasi in the West-Central Zagros, and Ghār-e Boof in the Southern Zagros Mountains. Lithic techno-typological analysis from these UP assemblages reveals a more dynamic and complex nature of the UP populations in the Zagros than once thought. This paper hypothesizes that the variability among the UP assemblages indicates a limited interaction between UP populations throughout the Zagros. While Shanidar Baradostian techno-typological characteristics and raw material economy indicate more interaction towards the North, the Rostamian of the Southern Zagros stands in contrast to the UP assemblages from the Lorestan and Kermanshah (LaK) regions of West-Central Zagros. As Shanidar was culturally less connected to the southern parts of the Zagros, the question of the Baradostian as a widespread technocomplex diffusing towards the West-Central and Southern Zagros is debatable. The same appears to be true for the Rostamian cultural tradition in terms of connectivity to the West-Central Zagros, as the Rostamian is widespread throughout the Southern Zagros. Therefore, the homogeneity model of the UP that presented the Baradostian as typical for the entire Zagros is no longer valid and should be reconsidered.

INTRODUCTION

The Upper Paleolithic (UP) of the Zagros region, like other parts of the Iranian Plateau, has not received the same long history of attention given to neighboring regions such as the Levant and Europe. Nor does it produce the same heated discussion as seen in these regions, primarily because the Zagros UP has been rather sparsely studied, a fact heightened by the lack of easy access to the sites. The few studies that have been conducted have been instrumental in embedding a certain understanding of the region—an understanding that this paper questions.

The UP culture in the Zagros was originally defined based on the artifacts from Shanidar Cave, located at 765masl. in the northern Zagros (Solecki 1958), and subsequently termed the Baradostian. This term was adopted to define cultures for other UP sites (Hole and Flannery 1967; Olszewski 1993). The UP Baradostian industry was recovered from Layer C after a gap above Middle Paleolithic (MP) Layer D. Solecki interpreted this hiatus as the climatic changes when '*man could not tolerate such an icebox very long*' (Solecki 1963: 9)[1]. He concluded that the UP industry of Shanidar did not evolve out of the Zagros Mousterian MP, and, therefore, the Zagros Mousterian and Baradostian do not share clear technological and typological characteristics (Solecki 1958). In fact, he describes the Baradostian at Shanidar as flake oriented débitage and a tool array composed of different kinds of burins, carinated scrapers, side scrapers, Font-Yves points, and retouched blades (Solecki 1958, 1963). Solecki defined the lithic industry of Layer C as a unique UP blade and burin industry which is closely related to the European Aurignacian and presented it as the earliest manifestation of Aurignacian in the Near East (Solecki 1958). This issue again has been recently raised in the new excavations at Shanidar (Reynolds et al. 2018). Furthermore, based on Solecki's definition for the UP assemblage of the Northern Zagros, in the West-Central Zagros Mountains, the lithic industries of the UP were called Baradostian as well (Hole and Flannery 1967; Olszewski 1993). Here,

  ISSN 1545-0031
doi:10.4207/PA.2019.ART133

the Baradostian industry is defined as flake-based industry in which blades and bladelets are frequently present. Hole, in his expedition to the Khorramabad plain of West-Central Zagros, documented two phases of early (40,000–32,000 BP) and late Baradostian (32,000–20,000 BP) (Hole and Flannery 1967). During this long period, the Baradostian assemblage underwent techno-typological changes. Most of these changes occurred in the quantity of certain tool types and débitage (Hole and Flannery 1967). In the Khorramabad region, Hole and Flannery documented the UP industry in 12 sites (Roustaei et al. 2004). The best manifestation of the Baradostian appeared in Yafteh Cave and Pasangar, and was assigned to the early and late Baradostian, respectively (Hole and Flannery 1967). In Yafteh, the Baradostian lithic industry heavily emphasized laminar production. The characteristic tools are slender points, backed blades and bladelets, twisted bladelets with various types of light retouch, end scrapers, discoidal scrapers, side scrapers, and several kinds of burins (Hole 1970). Yafteh Cave was re-excavated by Otte, and he recovered the same industry as Hole and Flannery originally described (Otte et al. 2007). Hole believed that the Zagros Mousterian occurred during the late MP and most of the Baradostian tools represent developed forms of the Mousterian tools, for instance, the Arjeneh points (i.e., Krems/Font Yves: Solecki 1958) are the evolved form of Mousterian points (Hole and Flannery 1967). However, the gradual development of the Baradostian out of the Mousterian, as manifested in technological traits, was not documented at any site, including Yafteh (Bordes and Shidrang 2012). Contrary to the homogenous Zagros Mousterian, Hole acknowledged the variety among UP industries and reported fewer analogies between the Baradostian and the succeeding Zarzian Epipaleolithic region by region. He related this issue to the '*regionalism and/or increase in functionally-specific sites*' (Hole and Flannery 1967: 160). Therefore, he proposed that they were a '*Khorramabad variety of a particular industry even though the pan-regional similarities are obvious*' (Hole and Flannery 1967: 160).

In line with Hole's and Otte's research, Bazgir and colleagues' recent excavation in the Kaldar Cave in the Khorramabad Valley yielded two lithic industries—MP Zagros Mousterian and UP Zagros Aurignacian. The site yielded no transitional technological traits from the MP to UP despite the lack of any hiatus between two layers; taphonomic issues are yet to be considered (Bazgir et al. 2017).

In the rockshelter site of Warwasi in the Kermanshah region, the Baradostian industry was identified by Olszewski (1993a). So far, Warwasi presents the most complete Paleolithic sequence in the Zagros and could potentially define the evolution of the UP out of MP[2]. The Warwasi Baradostian is documented as an industry which in the earlier phases contains a flake-based débitage that through time becomes increasingly dominated by bladelets (Olszewski 1993a, 1999). Typologically, the early Baradostian is initially reminiscent of the MP, with numerous side scrapers, notches, and denticulates, but with gradually adopted Arjeneh points, retouched rods, carinated scrapers, and low frequencies of microliths, giving these assemblages a UP appearance. The late Baradostian is typically dominated by microliths and burins, associated with a high frequency of bladelet débitage (Olszewski 1993a and b, 1999, 2007a and b).

In the Southern Zagros Mountains, Rosenberg emphasized the similarities of his collections from Marvdasht. He proposed the Baradostian as a single and general UP tradition throughout the Zagros, despite different techno-typological characteristics (Rosenberg 1985). Rosenberg described the UP lithics as rich in burins, retouched blades and bladelets, notches and denticulates, carinated scrapers, and Arjeneh points (Rosenberg 1985: 58). The so-called Arjeneh points are only small fragments of pointed blades which are too small to be designated to the Baradostian Arjeneh point. The lack of a sequential order of dated spots in the stratigraphy of his excavated site (Eshkaft-e Gavi Cave) probably indicates the disturbed nature of the sequence. However, the dates mostly relate the occupation to the late UP phases (27–19 ka) (Rosenberg 1985).

Recent research in the Dasht-e Rostam Basht region documented the Rostamian cultural group, distinct from the Baradostian framework (Ghasidian 2014). In the Southern Zagros, the Rostamian has been recovered from the stratified site of Ghār-e Boof Cave (Ghasidian 2014) and the caves and rockshelters elsewhere in the Dasht-e Rostam Basht (Heydari-Guran 2014). The Rostamian cultural group emphasized the production of bladelets. However, the flakes, resulting from preparation and trimming of bladelet cores, were also used as tool blanks for end scrapers, and notches and denticulates, as well as retouched pieces (Ghasidian 2014). Dated to ca. 42,000 cal. BP, Ghār-e Boof documents that the production of bladelets was much older than previously thought; that is, older than the later phases of the UP (or late Baradostian). Despite a concentration on bladelet production from its early stages, the Rostamian is a UP industry relatively contemporaneous to Shanidar and slightly older than what observed in the West-Central Zagros (Yafteh) (Beccerra-Valdivia et al. 2017; Ghasidian et al. 2017).

Combining all the UP industries of the Zagros Mountains and beyond as Baradostian obscures the regional characteristics of these industries and ignores the dynamic nature of innovation during the UP (Bee 1974; Spratt 1982). Regarding the time span of the UP and high diversity among the lithics, Smith suggests that:

> *'Prehistorians find it easier to identify many more UP/Epipaleolithic 'cultures' because the great number of artifactual innovations and variability seem to cluster more neatly and predictably. In other words, strong patterning is evident in the archaeological record. This may be connected to another typical feature, regionalism….'* (Smith 1986: 25).

To this end, the UP of the Zagros is faced with several issues concerning the Baradostian—its identification and characteristics, its geographical distribution, and its relationship to other UP industries, including the Rostamian of the Southern Zagros and the Baradostian of the Northern Zagros. It is necessary to build up the UP foundation in order to address broader questions regarding 'anatomically modern humans' (AMH) dispersals into the Iranian Plateau and their cultural diffusion. Therefore, it is first essential to have a detailed understanding of the Zagros UP material culture and its temporal and spatial patterns.

Bladelet production is documented as one of the major end products in the Zagros UP assemblages, such as elsewhere in the Levant and in Europe (Le Brun-Ricalens et al. 2005; Marks 1981). The onset of its production and its specialized use temporally varies at different sites. Here, comparing the UP assemblages throughout the Zagros and searching for the spatial and temporal distribution of all so-called Baradostian lithic assemblages is seen as a proxy for population movements in and out of the Iranian Plateau. Conducting detailed techno-typological analysis of the assemblages from old excavations in the West-Central Zagros and comparison with the original Baradostian lithics from Shanidar in the Northern and the Rostamian in the Southern Zagros, this paper aims to yield a firm definition for the UP assemblages of the Zagros that considers the regional varieties. It suggests that the current definition has become too broad to address the regional elements and masks the nature of cultural variability in the Zagros. The results allow one to move beyond the superficially established framework reflecting *'considerably less cultural volatility than existed elsewhere'* [e.g., Levant] (Smith 1986: 26).

In order to understand these differences, it is essential to re-evaluate the concept of the Baradostian and to describe and explain variation within the Zagros UP in general, with the goal of answering several fundamental questions about the Baradostian and Zagros UP, including:

- Whether the Baradostian, rather than being found throughout the Zagros, is limited to the habitat areas of the Northern and West-Central Zagros;
- If different regions of the Zagros are linked to each other strongly, retaining a homogenous and inclusive culture, or rather were more isolated, indicating cultural diversity; and,
- If the data support the latter, how the Zagros UP variability pattern evolves throughout time and space.

MATERIALS AND METHODS

This paper presents the results of a detailed techno-typological analysis of lithic assemblages from the West-Central Zagros and compares it to the Northern and Southern Zagros. The UP lithics from two core areas of Khorramabad (Lurestan) and Kermanshah (LaK) intermountain valleys in the West-Central Zagros Mountains have been traditionally labelled first the 'Baradostian' (Solecki 1955, 1958) and later the "Zagros Aurignacian" (Olszewski and Dibble 1994). Elaborating a definition of the Baradostian culture can be accomplished by some rethinking of methodology and terminology. Results presented here of a detailed techno-typological analysis of the three West-Central Zagros UP sites of Yafteh, Pasangar, and Warwasi allows reconstruction of the reduction sequence from each site. Direct comparison of these sites to each other and with other Zagros sites is therefore possible using the same lithic attributes. For this purpose, the Rostamian of Ghār-e Boof and the Baradostian of Shanidar are included as representatives from other areas of the Zagros (Figure 1).

Yafteh is, so far, the most intensely occupied UP site known in the Khorramabad valley, with a deep stratigraphy (around 3m) of rich cultural deposits. Located at an elevation of 1278masl., Yafteh was first excavated in 1965 and re-excavated in 2005 and 2008 (Figure 2). The cave yielded no visible Paleolithic stratification but contained several ash concentrations indicating fire places (Hole 2012). The excavated area in most parts reached to bedrock at the depth of 240cm (Shidrang 2015). Ten cm arbitrary layers were used in all strata. The Yafteh strata suffer from bioturbated lenses in several places (Otte et al. 2017). The lack of any MP and Epipaleolithic materials attests to an exclusively UP occupation at the site. The addition of the 2005 and 2008 materials increases information about the sequence as a whole (Otte et al. 2007), blades and bladelets being a much more prominent aspect of the technology throughout these levels than what was previously known from the 1965 season (Hole and Flannery 1967), a tendency that was observed in Tsanova's recent analysis (Tsanova 2013). The 2005 and 2008 seasons yielded dates confirming previous results (Hole 2012).

The Yafteh assemblages from the 1965 excavation are housed in two places—the National Museum of Iran in Tehran and Yale University in the USA. The lithics from Squares Y4 and Y6 have been partly the subject of several studies (Bordes and Shidrang 2012; Otte and Kozlowski 2007; Tsanova 2013). The lithics from Squares Y2d and Y2e of the 1965 excavation (at Yale), which have not been studied before, are the subject of present analysis. Squares Y2d and Y2e are at the front of the cave and had the least bioturbated lenses. Concerning their location, these assemblages are far from the ash pits and bioturbated area, however, the bedrock here is higher than in other parts of the cave (Figure 3). The excavation in Yafteh was undertaken in 10cm artificial layers; altogether 21 layers were recovered from these two squares, down to a depth of 313cm. The lithic analysis includes all artifacts from all these layers in order to record any possible chronological changes.

Compared to Yafteh, the Pasangar assemblages have received less attention. The rockshelter is geographically located northwest of the Khorramabad Valley, ca. 13km as the crow flies from Yafteh, on the piedmont of Kuh-e-Sefid, at approximately 1240masl. The site (Figure 4) was excavated in 1963 in three trenches of 2m×3m, named Pa, Pb, and Pc, and reached bedrock at 220cm (Hole and Flannery 1967). According to Hole (1970), the UP deposits at Pasangar represent two successive temporary occupations of the late Baradostian and Zarzian (Epipaleolithic) and full techno-typological analysis provides a wealth of information about this division. Recent studies confirm the presence of these two occupations (Shidrang 2015). Based on techno-typological characteristics and the continuity throughout the sequence of Pasangar, Hole proposed that the Zarzian developed directly out of the Baradostian (Hole 1970). In the Zagros, so far, only the two sites of Pasangar and Warwasi

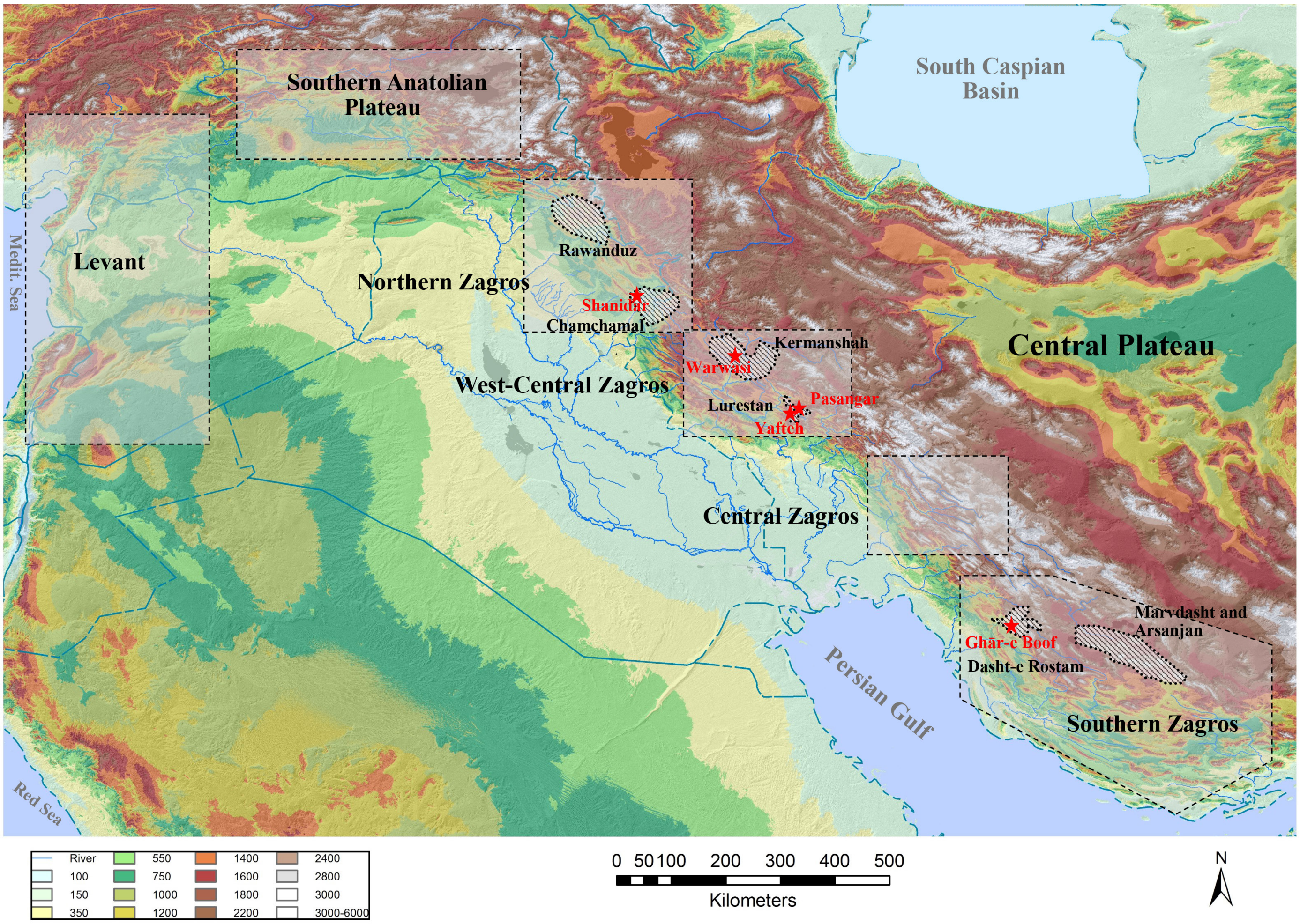


Figure 1. Map of Iran showing Zagros biogeographical zones, UP core areas, and the study sites mentioned in the text.

have the potential to examine this transition. However, no absolute dating was obtained for these sites. Therefore, an important issue regarding the later phases of the Paleolithic, namely the Zarzian, still remains: its dawn and demise.

Like Yafteh, the Pasangar lithics were divided between the National Museum of Iran and Yale University. All lithics from Square Pc, kept as part of the previously unstudied Yale collection, were examined in the present analysis. The goal was to see temporal changes throughout the arbitrary 10cm spits, especially the end phase of the so-called late Baradostian to compare it to Yafteh to observe any synchronic relationships.

The rockshelter of Warwasi is located at ca. 1350masl. in the Kermanshah region in another Paleolithic core area of the West-Central Zagros. It is situated in the Tang-e Kenesht, a strategic game outlook and (presumably) exploitation area. Excavations conducted by Howe in 1960 yielded the most complete Paleolithic sequence of 55 arbitrary 10cm layers covering the MP (CCC-JJ), UP—Early Baradostian (AA-II) and Late Baradostian (Z-P) (Figure 5)—and Epipaleolithic (Zarzian [A-O]) in Kermanshah (Olszewski and Dibble 1994). Despite the lack of absolute dating, the site is described as demonstrating a gradual change in the lithic techno-typology from the MP Zagros Mousterian to the Zarzian Epipaleolithic (Dibble and Holdaway 1993; Olszewski 1993a, b; Otte and Kozlowski 2009). The UP lithic artifacts of Warwasi were studied mainly by Olszewski (1993a, 2007) and a more recent study included part of the assemblages (Tsanova 2013).

In order to document any chrono-stratigraphic changes, all lithics from Warwasi have been examined in the present analysis. The lithics from the levels close to the chronological boundaries of the MP-UP and the UP-Epipaleolithic yielded a mix of characteristic artifacts. Based on this issue, these boundary levels were assigned to gradual chronological and cultural changes, namely a transition, from the MP to UP and UP to the Epipaleolithic (Olszewski 2017; Olszewski and Dibble 1994; Kozlowski 2014). The present research included all lithics from levels LL to J in order to record all potential changes through levels. According to the chronological frame presented for Warwasi (Olszewski and Dibble 1994), these lithics thus include early (LL-AA) and late (Z-P) UP, as well as the final UP/Epipaleolithic layers (O-J).

The taphonomic studies by Tsanova (2013) confidently establish the reliability of the Warwasi artifacts and reject

Figure 2. Yafteh Cave (courtesy of F. Hole).

the possibility of admixture of the layers. However, the issue of admixture is still open for almost all old excavations, which in this study is the case for Shanidar, Warwasi, Yafteh, and Pasangar. However, despite old excavations, the data extracted from these sites is quite reliable, since the recent excavations and lithic analysis on portions of the lithic assemblages from these sites confirm the results gained in the old excavations (Reynolds et al. 2018; Otte et al. 2007; Shidrang 2015) and suggest that the lithics considered in this research are representative of the entire assemblage from each site.

Recent research in the Zagros Mountains documented another Paleolithic core area in the Southern Zagros. Following the Paleolithic investigations mainly in Marvdasht

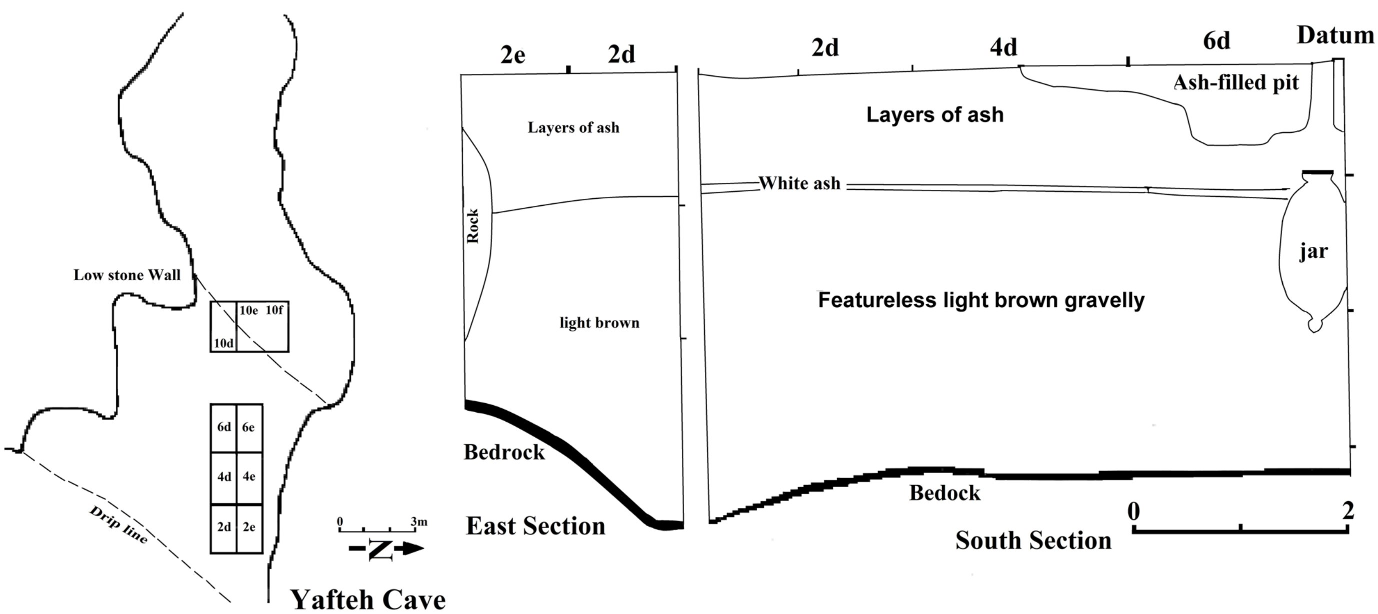


Figure 3. Yafteh Cave, stratigraphy and plan (Hole 2012).

Figure 4. Pasangar Rockshelter (courtesy of F. Hole).

	Layer	Middle Palaeolithic (H. Dibble)	Upper Palaeolithic (D. Olszewski)	M. Otte & J.K Kozlowski
1	ZZ	Unit A		
2	VV			
3	UU			
4	TT			
5	SS	Unit B		
6	QQ			Zagros Mousterian
7	OO			
8	NN	Unit C		
9	LL			
10	KK			
11	JJ	Unit D		
12	II			
13	HH		Early Zagros Aurignacian	
14	GG			Transitional layers
15	FF			
16	EE			
17	DD			
18	CC			
19	AA			
20	Z			
21	Y			
22	X			
23	W			
24	V		Late Zagros Aurignacian	
25	U			
26	T			Baradostian "*sensu stricto*"
27	S			
28	R			
29	Q			
30	P			

Figure 5. Warwasi schematic strata and time periods (Kozlowski 2014).

(Rosenberg 1985, 1988) and Arsanjan (Ikeda 1974), the Dasht-e Rostam Basht region yielded an important cluster of UP sites in the Rostam district (Heydari-Guran 2014). Geographically, the Dasht-e Rostam-Basht region is located at the southwest edge of the Iranian Plateau and connected to the Mesopotamian lowland in the west. Due to its strategic location at a confluence of a variety of different environments, this region is likely home to many cultural developments and can potentially provide important data on early human dispersal towards interior parts of the Iranian Plateau (Ghasidian 2014; Heydari-Guran 2014; Hole and Flannery 1967). The availability of water and vegetation played an important role in attracting game and UP populations, with numerous caves and rockshelters in the Dasht-e Rostam Basht region (Ghasidian 2014; Heydari-Guran 2014).

The data presented here from Ghār-e Boof stem from excavations in 2006–2007. During these two seasons, Ghār-e Boof, located at 905masl. (Figure 6), yielded four major layers—archaeological horizons I, II, III, and IV. Horizons I and II contain a mixture of Paleolithic and historical finds and were excluded from the analysis here. Archaeological horizons III and IV are solely associated with UP finds. Each of these two horizons was subdivided into three layers, altogether resulting in the following six archaeological horizons—III, IIIa, IIIb, IV, IVa, and IVb. Layers IVa and IVb yielded only three artifacts and therefore were excluded from the analysis. Due to strong regional affinities, the lithic assemblages from this cave and other UP sites in the region are described as a new UP cultural entity—the Rostamian (Ghasidian 2014). Absolute dating provided for the

Figure 6. Ghār-e Boof (Ghasidian 2014).

cave documents it, so far, as one of the earliest UP entities in Iran (Beccera-Valdivia et al. 2017; Ghasidian 2014). All lithics from Layers III, IIIa, IIIb, and IV are included in this research.

In an attempt to control inter-assemblage patterning, 74,344 lithic artifacts from all four sites were analysed techno-typologically, covering the regions of the West-Central and Southern Zagros (Table 1). Comparisons to the Baradostian industry of Shanidar (Figure 7) are made from information available from the literature (i.e., Otte and Kozlowski 2007; Solecki 1958). However, the Shanidar assemblage comprises a smaller number of artifacts compared to the other assemblages studied here.

The methodology adopted in this research is based on Tostevin's (2012) comparative study to provide an accurate representation of the '*behavioural domains*' in the West-Central and Southern Zagros knapping process (Tostevin 2012). The knapping process includes core reduction to maintenance and exploitation to tool manufacture and maintenance. The applied methodology in this study moves beyond a basic division of tool types to more detailed information about blanks, scar patterns, and measurements of various characteristics and attributes. This information provides a basis for systematic comparisons of lithic assemblages and reveals patterns of similarity and difference statistically rather than relying on traditional ty-

TABLE 1. UP ASSEMBLAGES: REPRESENTATION OF THE STUDIED LITHIC ARTIFACTS.

Sites	Débitage	Core	Tool	Sum
Warwasi	29,133	1478	4085	34,696
Yafteh	2640	771	1270	4681
Pasangar	1916	1195	988	4099
Ghār-e Boof	29,435	493	980	30,868
Sum	**63,124**	**3937**	**7323**	**74,344**

Figure 7. Shanidar Cave (photograph by S. Heydari-Guran).

pology, such as number of certain tool types or recording unnecessary morphological features of the artifacts (Shea 2014). Considering carefully the similarities and differences, it is possible to group lithic assemblages together into meaningful homogeneous units or divide them into distinguishable sets. The grouping of the lithic assemblages helps in understanding and comparing the social behavior and cultural aspects of each set to identify various cultural groups.

Only lithic artifacts were included in this study, because they are consistently present in adequate numbers at all studied sites. Unfortunately, bone/antler tools and personal ornaments cannot be compared and had to be excluded from these analyses due to relatively poor organic preservation, especially in the Southern Zagros.

Using lithic attribute analysis made it possible to classify the assemblages at the scale of culture and industry and recognize any variabilities synchronically, through adaptation to different environments, and diachronically, through chronological sequences, to examine potential reasons for these variabilities. These reasons may concern environmental factors or social network or demographic pressures. Therefore, the techno-typological data are closely combined with the chronological and physiogeographical data. However, among the studied sites, only Shanidar, Yafteh, and Ghār-e Boof yielded absolute dates. Physiogeographical data on these four sites include the geographical position of each site in the Zagros Mountains, latitudinal sections for both low and high geographical resolution analyses, levels of seasonality, the presence of internal geomorphological barriers, and rainfall data for each area. Using all these datasets, this study examines the potential level of connectivity among UP populations and reveals levels of inter-regional diversity.

RESULTS

LITHIC TECHNO-TYPOLOGICAL ANALYSIS OF SHANIDAR, NORTHERN ZAGROS

The data from the Shanidar UP comes from Solecki's analysis of Layer C. He was particularly interested in the typological characteristics of the retouched tools (Solecki 1958). These lithics have been recently re-analyzed (Otte and Kozlowski 2007). In this later analysis, the Aurignacian elements of the Baradostian that were proposed by Solecki have been emphasized, however, there is a lack of detailed technological description. Layer C yielded a total of 2,189 lithic artifacts including cores, débitage and tools from a depth of 490cm to 300cm (Otte and Kozlowski 2007: 12).

Cores. In his dissertation, Solecki mentions that a total of 210 cores were used for both flake and laminar production. Due to the lack of any detailed description of these cores, they were left out of the present analysis. However, there is a category among the tools, namely 'rabots' or core scrapers, which are, in fact, cores for bladelet production (Table 2). Therefore, the only detailed description on the cores is provided from the rabots. The same applies to some of the tools, including 'keeled scrapers' or carinated scrapers. Some of them are single platform bladelet cores made on flake blanks or directly prepared on raw mate-

TABLE 2. SHANIDAR LAYER C CORE FREQUENCIES.*

Levels	N	Core Type									
		single platform blade	single platform flake	double platform blade	double platform flake	double platform flake/blade	triple platform blade	triple platform flake/blade	keeled blade	keeled flake	amorphous flake
2–3	1	100	-	-	-	-	-	-	-	-	-
4–5	1	-	-	-	-	100	-	-	-	-	-
6–7	3	-	66.7	-	-	33.3	-	-	-	-	-
7–8	2	-	-	-	-	50	-	50	-	-	-
8–9	7	28.6	-	71.4	-	-	-	-	-	-	-
9–10	14	35.7	35.7	28.6	-	-	-	-	-	-	-
10–11	17	41.2	-	17.6	-	-	-	-	23.5	5.9	11.8
11–12	12	16.7	-	25	16.7	-	-	-	-	-	41.7
12–13	6	83.3	-	-	-	-	-	-	-	-	16.7
13–14	7	42.9	-	28.6	-	-	14.3	-	-	-	14.3
14–15	0	-	-	-	-	-	-	-	-	-	-
15–16	3	33.3	-	-	-	-	-	-	-	66.7	-
Sum	**73**	**35.6**	**9.6**	**23.3**	**2.7**	**4.1**	**1.4**	**1.4**	**5.4**	**4.1**	**12.3**

*Solecki's rabot category.

rial cobbles using the same preparation procedure as the bladelet cores followed. These pieces are mostly present towards the bottom of Layer C at the depth of 490–450cm (Otte and Kozlowski 2007: 9). The reduction surface occurred on the narrow side of the core and presumably the resulting bladelets are twisted in profile as documented by Otte and Kozlowski (2007: 9, 12) (Figure 8). The carinated burins documented among the tools can technologically be included among the cores, especially the ones on thick flakes or cobbles. These cores were found throughout the stratigraphy and normally have multiple removals represented by small bladelet scars. However, their under-representation in the assemblage can be interpreted as due to the different recovery technique used at the time of the excavation in the 1950s.

Débitage. A total of 1,462 pieces of débitage were recovered from Layer C. Most of these are flakes (Table 3). The blades' average size is about 3.2cm in length, while the flakes are about 2.8cm long. The relatively large number of burin spalls is outstanding and fits well with the overall reduction scheme. There is no clue as to how many blades and bladelets are among the assemblage as there was no distinction made between them. However, the large number of laminar products documents that the lithics from Layer C are significantly different from Layer D.

The upper levels of Layer C (375–275cm) contain abundant bladelets with twisted or rectilinear profile as well as several medium length blades. In contrast to the other débitage, these blades of unknown origin seem to have been brought to the site (Otte and Kozlowski 2007: 9). Otte and Kozlowski documented that by 325–300cm (Solecki's 9–10 feet level), the assemblage is very rich in débitage, among this are many burin spalls and bladelets. The carinated burins present in this layer may be responsible for these laminar productions. In the same level, straight profile blades and bladelets made on regular cores on flakes also are frequent (Otte and Kozlowski 2007: 9).

The distribution pattern of flake and laminar production throughout Layer C shows an interesting pattern. Débitage drops dramatically towards the end of Baradostian. Solecki interprets this fluctuation in the débitage distribution frequencies as due to the intensity of occupation at the site (Solecki 1958: 106). Around 8–9 feet, towards the top of Layer C, apparent heavy rockfalls might have caused a decrease in intensity of occupation. On the other hand, most of the cores were found in the upper parts of Layer C, which contrasts with the distribution pattern of the débitage.

Overall, throughout all the layers except one, flakes are consistently more numerous than blades. In most of the layers, there are two or three times as many flakes as blades present in each level (Figure 9). At the 14–15 feet level, however, blades exceed the number of flakes. Towards the end of the Baradostian, the laminar pieces seem to be far less important than flakes.

In sum, Solecki documented a strong emphasis on flakes among the Baradostian débitage (Table 4). This is also observed among the tool blanks, especially regarding burins and scrapers (Solecki 1958: p. 105).

Tools. The tool assemblage (n=341) is most abundant in the middle of Layer C (Figure 10). The tools are dominated by end scrapers (n=124) and burins (n=100) (Solecki 1958). However, this is mainly related to the fact that the type 'rabot' or core scrapers (Shea 2013) (n=73) is included in the end scraper class. Excluding this type, as these are cores rather than tools, burins (n=100, 37%) outnumber end scrapers (n=53, 20%), of which the dihedral burin (n=38, 14%) is the dominant burin type. Other tool types include notched and denticulated pieces (n=31, 11%), points (n=23, 9%, including 12 Mousterian points), carinated scrapers (n=18, 7%) and Aurignacian blades (n=13, 5%) (see Table 4). Around half of the points (52%) in the Shanidar Baradostian are present in the earlier levels and are considered Mousterian points. They have no affinity to the UP points including the Arjeneh point (Hole and Flannery 1967) and Font-Yves types (Solecki 1958: 85 and his Figure 7:b). These Mousterian points are mainly made on flakes and blades.

A closer look at the burins shows that there are different varieties (Table 5). While some of them are true burins (de Araujo Igreja et al. 2006 and references therein), some of them are simply cores on flakes on which the several burin blow scars indicate bladelet production from the narrow reduction surface (Figure 11). However, these core-burins are few in number and include 'burin nucleiform' (n=2), 'multiple burins' (n=5), and 'burin busked' (n=2).

A category of *'ordinary use retouched flakes, blades and flake-blades'* (Table 6) is an important tool category among the Shanidar Layer C assemblage, despite being briefly described (Solecki 1958: 104). It includes 169 retouched flakes, blades (probably bladelets as well; see Solecki 1958: Figure 11:2), flake-blades, and core rejuvenation flakes. Among the rejuvenation flakes as blanks, the presence of 29 flakes could indicate an intentional and independent flake production trajectory beside the opportunistic use of flakes produced in different stages of the *chaîne opératoire* for tool blanks. Certain tool types, including scrapers, were made only on flakes rather than rejuvenation pieces (Solecki 1958: 51, 52 and his Figure 11: 4-6).

Solecki did not distinguish between blade and bladelet tool blanks. Based on his detailed description of the tools (Solecki 1958), however, it is possible to identify the tool blank for the majority of tools (n=260). Flakes make up most of the tool blanks (n=148, 55%), followed by blades (n=92, 34%), while only a minority were made on bladelets (n=20, 7 %). Given the standard of excavation techniques at the time of Solecki's field work, it remains an open question whether this percentage reflects the true role of the bladelets in the technological repertoire of Shanidar's occupants.

The distribution of the tools throughout Layer C reveals a consistent picture for the Baradostian. Based on Otte and Kozlowski (2007), from 350cm to 275cm, it contains abundant carinated burins and points that are assigned to the 'Krems point' (i.e., Arjeneh points). In these top levels, more Arjeneh points, carinated burins , 'burin busque' (Otte and Kozlowski 2007: 22; plate 11), carinated scrapers, *pièces esquilles*, and burins on truncation (Otte

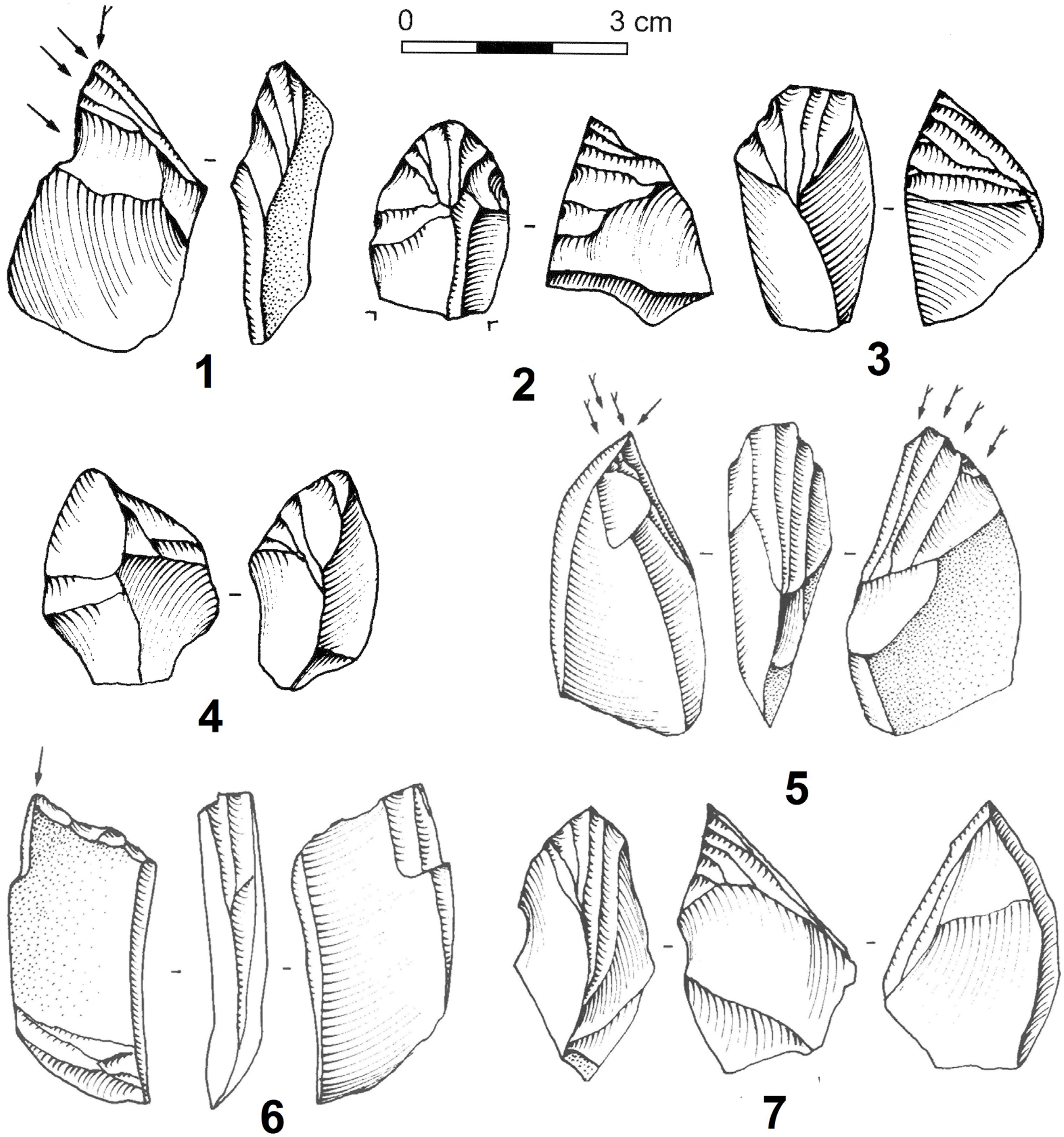


Figure 8. Shanidar bladelet cores (modified after Otte and Kozlowski 2007).

and Kozloweski 2007: 9) occur than in the other levels. The number of retouched bladelets, including Dufour bladelets, increases. The depths of ca. 325cm to 300cm include tools made on thick blade blanks retouched into scrapers or carinated burins. Otte and Kozlowski document that the characteristic Aurignacian tools including nosed end scrapers, retouched blades, abruptly retouched bladelets in Font-Yves style, as well as some carinated scrapers, large pointed bladelets and scrapers on blades are abundant at this depth (Otte and Kozlowski 2007: 12). Solecki's levels 11-12 and 10-11 from 350 to 325 cm contain several carinated burins and Arjeneh points. This level is documented as typical Baradostian or classic Aurignacian (Otte and Kozlowski 2007: 9). Deeper in the stratigraphy, at the depths of 428-408cm and 456-426cm (Solecki's Levels 14–15 and 13–14), carinated scrapers, made on thick flakes or on thick pieces of raw material, are more frequent. These pieces are considered cores rather than tools. The dominant tools in the oldest levels, at depths of 490cm to 450cm, are made on thick blade blanks often transformed into carinated burins and scrapers on blades. Generally, this level is rich in carinated burins made on large thick blades and on flakes

TABLE 3. SHANIDAR LAYER C DÉBITAGE.

Débitage	N	%
blade/bladelet	406	27.8
burin spall	143	9.8
flake	913	62.4
Sum	**1462**	**100**

(Otte and Kozlowski 2007: 9). Some artifacts with Mousterian characteristics, including Mousterian-like points and large pointed blades, are among them as well, challenging the issue of a gap between Layers D and C and potentially indicating admixture between MP and UP layers.

TECHNO-TYPOLOGICAL ANALYSIS OF THE LITHIC ARTIFACTS FROM YAFTEH CAVE, WEST-CENTRAL ZAGROS

Cores (Figures 12–14, Table 7). Most of the cores at Yafteh were made on cobbles and the number of cores on flakes increases slightly towards the surface. In all chronological phases, single platform bladelet cores comprise the majority, and double and opposed platform cores are relatively rare. This pattern was observed throughout the Yafteh sequence. The negative scars on the cores tend to be twisted towards the apex of the core, indicating that the bladelets have a twisted profile. The few blade cores can be considered as part of the same technical process as bladelet cores, since the overall size and width of the last negative shows that the end products were small blades with a width between 10mm and 12mm, consistent with the débitage and tool blanks.

Preparation of the platform bladelet cores was done simply through the removal of small flakes and cresting adjacent to the intended reduction surface or removal of laminar products in the same or opposite direction of the reduction surface towards the apex of the core, leading to a pyramidal shape. These removals contributed to establishing the convexity of the flaking surface and are found particularly in the upper layers of Y90–Y123. Here, the beginning of bladelet production mostly occurred by removing a laminar blank on, or opposed to, the intended flaking surface. Cresting is found in greater frequencies deeper in the stratigraphy, although preparation of cores on flake-blanks via cresting is less common. In the latter, bladelet production was initiated by removing one or two laminar products following the ridge of the intended reduction surface. Flake cores are extremely rare; only seven discoidal cores for flake production were observed, distributed equally throughout the middle part of the stratigraphy.

The reduction surface on the cores from Y90–Y223 is mostly on the narrow side of the core. By removing a single flake adjacent to the apex of the core, intended to be the reduction face, more volume of the raw material was saved for bladelet production. Using the wide side of the core as the reduction surface was only observed in the bottom levels of Y289–Y313 and in the Y112–Y123 levels at the top of the stratigraphy. There is a positive relationship between cresting and using the broad face as the reduction surface, for example, in Y278–Y313 the broad face of the cores was mostly used as the reduction surface and applying a crest to prepare the surface for bladelet production was more common.

Different core blanks are found among the cores in Yafteh. Despite the majority consisting of single platform cores on small cobbles, there are a few carinated scrapers and burins among the blanks pointing to the intensive production of twisted bladelets (see Table 7).

The size of the cores decreases through time. However, this trend does not reflect different initial sizes or differences in raw material, but rather the intensity of reduction. As observed by Tsanova (2013), the cores from the oldest

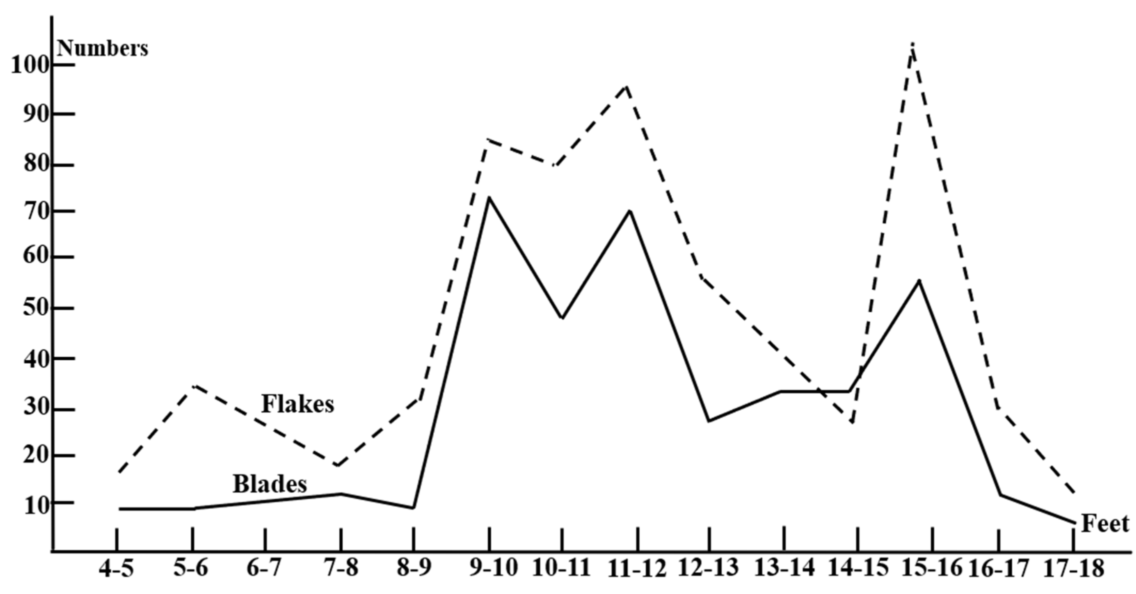


Figure 9. Distribution of flakes and blades in Shanidar Layer C (Solecki 1958).

TABLE 4. FREQUENCIES OF SHANIDAR LAYER C TOOLS EXCLUDING ORDINARY RETOUCHED PIECES.

Tool Type	N	%	Blank				Levels														
			blade	flake	bladelet	core?	?	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18
end scraper	**25**	9.2	56	44	0	0	8	8	-	4	8	4	16	4	24	-	16	8	-	-	-
circular scraper	**2**	0.7	0	100	-	-	-	-	-	-	50	50	-	-	-	-	-	-	-	-	-
thumbnail scraper	**1**	0.4	-	100	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
scraper on Aurignacian blade	**3**	1.1	100	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-
carinated scraper	**18**	6.6	-	50	-	50	-	-	5.5	5.5	-	11.1	27.8	22.2	16.7	-	11.1	-	-	-	-
nosed scraper	**4**	1.5	-	100	-	-	-	-	-	-	25	25	-	25	-	-	-	25	-	-	-
combination perforator	**1**	0.4	100	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-
perforator	**2**	0.7	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	-	-
retouched blade	**1**	0.4	100	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
utilized bladelet	**2**	0.7	-	-	100	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-
truncated blade	**1**	0.4	100	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-
one edge retouched blade	**3**	1.1	33.3	-	66.6	-	-	-	-	-	66.7	-	-	-	-	-	-	-	33.3	-	-
both edges retouched blade	**1**	0.4	100	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
Aurignacian blade	**10**	3.7	70	-	30	-	10	-	-	-	20	-	-	-	-	-	10	10	50	-	-
strangled blade	**3**	1.1	100	-	-	-	-	-	-	-	-	-	-	-	-	-	66.7	-	33.3	-	-
willow leaf point	**1**	0.4	-	100	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
burin	**100**	36.9	26	74	-	-	-	-	-	1	2	2	6	16	23	19	18	6	6	-	1
point (12 Mousterian points from 12–18)	**23**	8.5	52.2	26.1	21.7	-	13	-	-	4.3	-	-	4.3	13	-	13	13	4.3	13	17.4	4.3
pick (flake/blade core?)	**2**	0.7	-	-	-	100	-	-	-	-	-	-	-	50	50	-	-	-	-	-	-
notch	**25**	9.2	40	52	8	-	-	4	16	-	-	16	40	8	4	4	8	-	-	-	-
denticulate	**6**	2.2	16.7	83.3	-	-	-	-	-	16.7	-	-	50	33.3	-	-	-	-	-	-	-
splinter piece	**1**	0.4	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-
side scraper	**19**	7	42.1	57.9	-	-	-	-	-	-	-	-	5.2	31.6	15.7	15.8	5.2	-	26.3	-	-
little scraper	**2**	0.7	-	100	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-
segment of circlen (lunate)	**1**	0.4	-	-	100	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-
backed blade (may be intrusive from Layer B)	**5**	1.8	20	-	80	-	-	20	-	-	-	-	-	-	-	80	-	-	-	-	-
inversely retouched blade	**1**	0.4	-	-	100	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-
chisel (pièce esquillée)	**2**	0.7	100	-	-	-	-	-	-	-	-	-	50	50	-	-	-	-	-	-	-
fragment of scraper	**6**	2.2	-	100	-	-	-	-	-	-	-	16.7	-	50	-	-	16.7	16.7	-	-	-
Sum	**271**	**99.9**	**33.9**	**54.6**	**7.4**	**4.1**	**3.6**	**1.8**	**2.3**	**1.8**	**5.5**	**5.5**	**15.9**	**15.9**	**10**	**9.5**	**10**	**5.9**	**9.5**	**1.8**	**0.9**

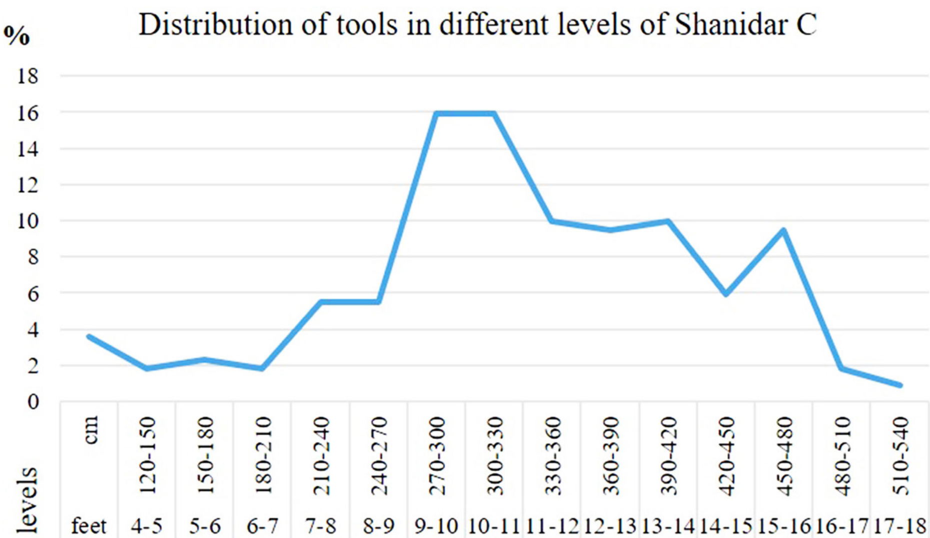


Figure 10. Distribution of tools in different levels of Shanidar C (%).

occupation at Yafteh at Y278–Y313 are small, giving the impression of highly reduced artifacts, but they, in fact, were abandoned before being completely exhausted (see Table 7). In contrast, the cores from the middle of the sequence (Y145–Y201) show more intensive reduction, being abandoned only after losing the volume and convexity necessary to maintain the reduction angle. It is the intensity of reduction in the middle layers, rather than the size of the original cores, that results in a pattern of size reduction of the cores which reflects a diachronic cultural signal at Yafteh.

Débitage. At the time of excavation, the débitage from the sites of Yafteh and Pasangar were not completely recovered; only the significant pieces were collected (personal communication with Hole, 2016). The collected débitage from Yafteh is characterized by a high degree of homogeneity in laminar production, consisting mostly of bladelets, among which the great majority are twisted bladelets and blades. Non-twisted bladelets and blades are more frequent in the deeper levels (Y234–Y313). Flakes are rare, al-

TABLE 5. SHANIDAR LAYER C BURINS.

Burin Type	N	flake blank does not include all numbers	blade blank does not include all numbers
combination end scraper/burin	33	3	6
straight dihedral	13	2	?
twisted dihedral	9	?	1
multiple dihedral	8	?	3
concave truncation	8	1	2
angled dihedral	7	2	2
multiple	5	3	?
oblique truncation	4	?	2
plane/flat	3	0	3
multiple ret. truncated	3	0	3
nuclieform	2	0	2
busked	2	2	0
angled dihedral	1	0	1
burin on notch blade	1	1	0
Noailles	1	0	1
Sum	**100**		

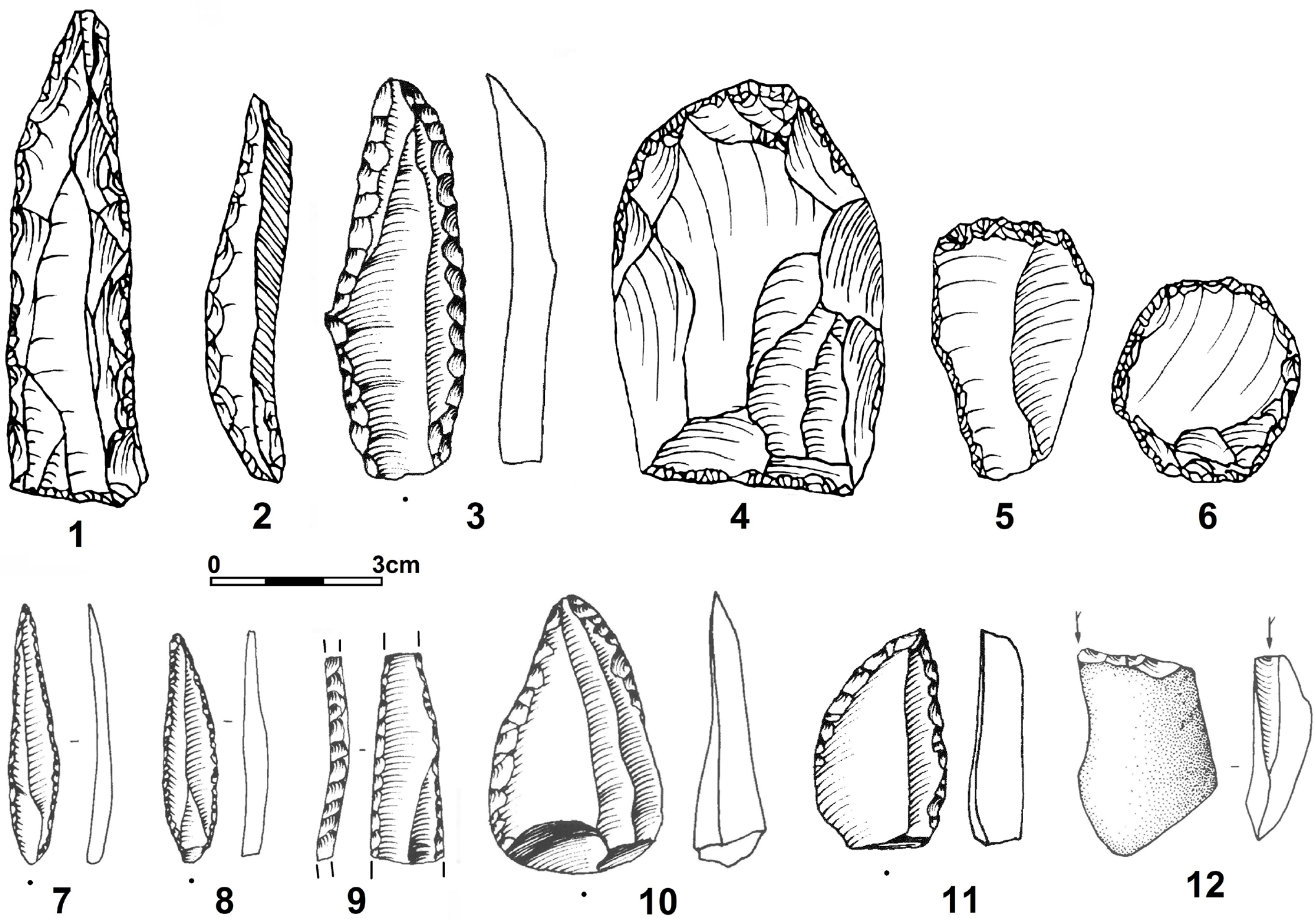


Figure 11. Shanidar tools: 1, 3) scraper, 2) retouched bladelet, 4, 5) end scraper, 6) round scraper, 7–9) pointed bladelet, 10–11) point (Mousterian?), 12) burin (modified after: 1, 2, 4–6: Solecki 1958; 3, 7–12: Otte and Kozlowski 2007).

though this may be due to the strategy of artifact recovery during the original excavation. Nevertheless, the preserved débitage is consistent with the negative removals on the cores, more than 90 % of which are specialized for laminar production (e.g., bladelets, Table 8).

Tools (Figure 15). Tool types at Yafteh are relatively homogeneous through the strata, although there are certain abrupt changes between the different levels. In the levels close to the surface, Y90–Y123, the majority of the tools are made on flakes, although flake cores are absent from these levels (Table 9).

TABLE 6. SHANIDAR LAYER C RETOUCHED PIECES.*

Blank	N	%
flake	29	17.1
blade (or bladelet)	20	11.8
flake/blade	44	26.0
core rejuvenation flakes	76	45.0
Sum	**169**	

*ordinary use retouched flakes, blades, flake/blades

In Levels Y90–Y134, end scrapers are the most frequent tool type, while different kinds of retouched bladelets are the most important tools in the rest of the sequence. Furthermore, most of the bladelets in Levels Y90–123 have direct bilateral retouch, also observed at the bottom of the sequence, from Level Y234 to the bottom. Unilateral direct retouch is the most common type of retouch in Levels Y134–Y223, with alternately retouched bladelets being common from Level Y123 to the bottom. Throughout the sequence, most of the bladelets have a twisted profile, although this decreases slightly towards the bottom (see Table 9; Table 10).

In Levels Y134–Y223, the use of bladelets as blanks increases, which, together with blades, comprise the majority of blanks. Using bladelet blanks reaches its maximum extent in Layers Y234–Y313 (see Table 9). Burins comprise an important tool type at Yafteh, being most abundant in the middle of the stratigraphy (Y134–Y267). Most of the burins are simple and made on flakes, although blades were also sporadically used as burins (Table 11). Carinated scrapers, an important element of the UP tool repertoire, are present

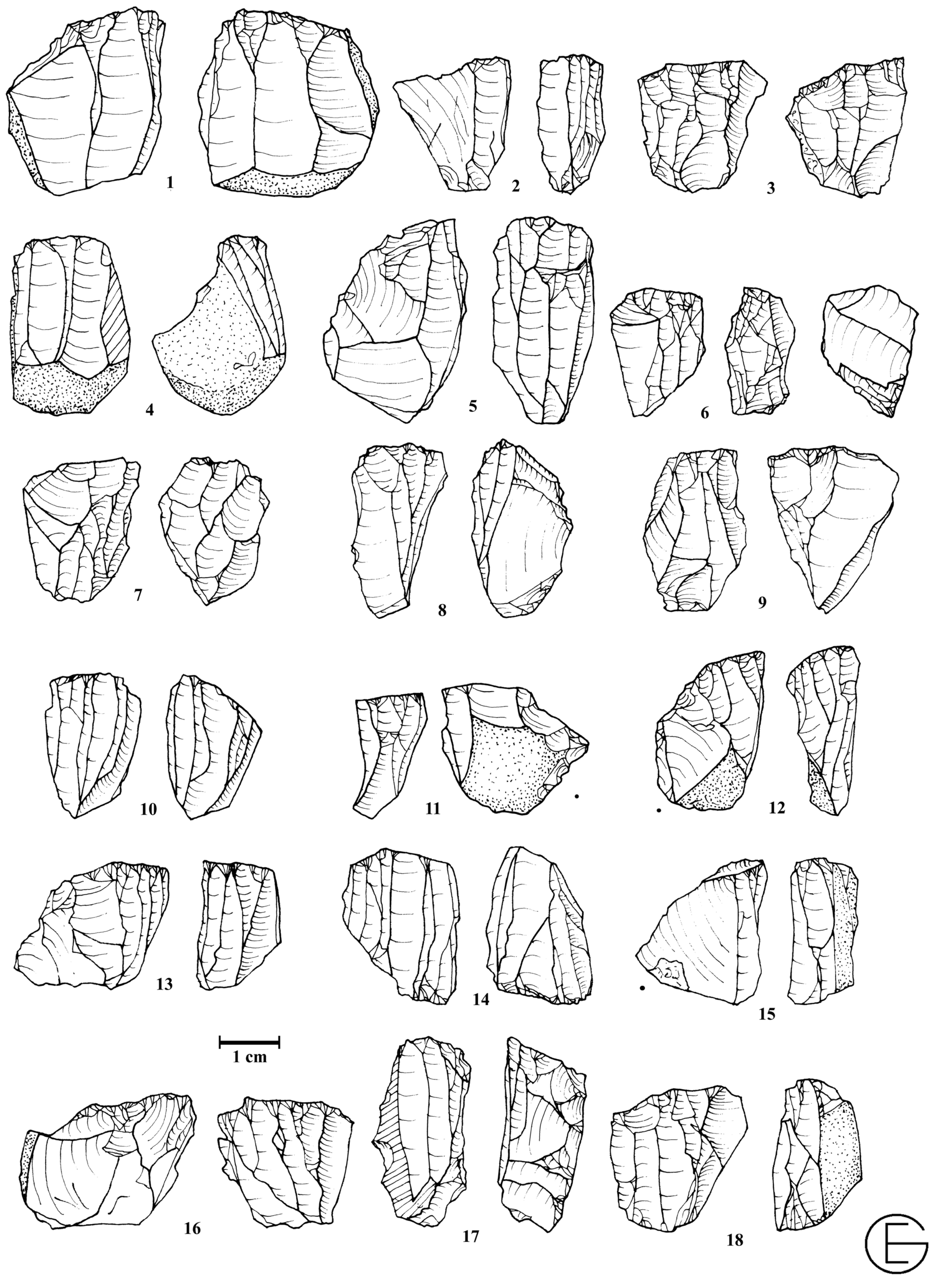


Figure 12. Yafteh bladelet cores Y101–Y157 (1–2: Y101; 3–6: Y112; 7–8: Y123; 9–12: Y134; 13–15: Y145; 16–18: Y157).

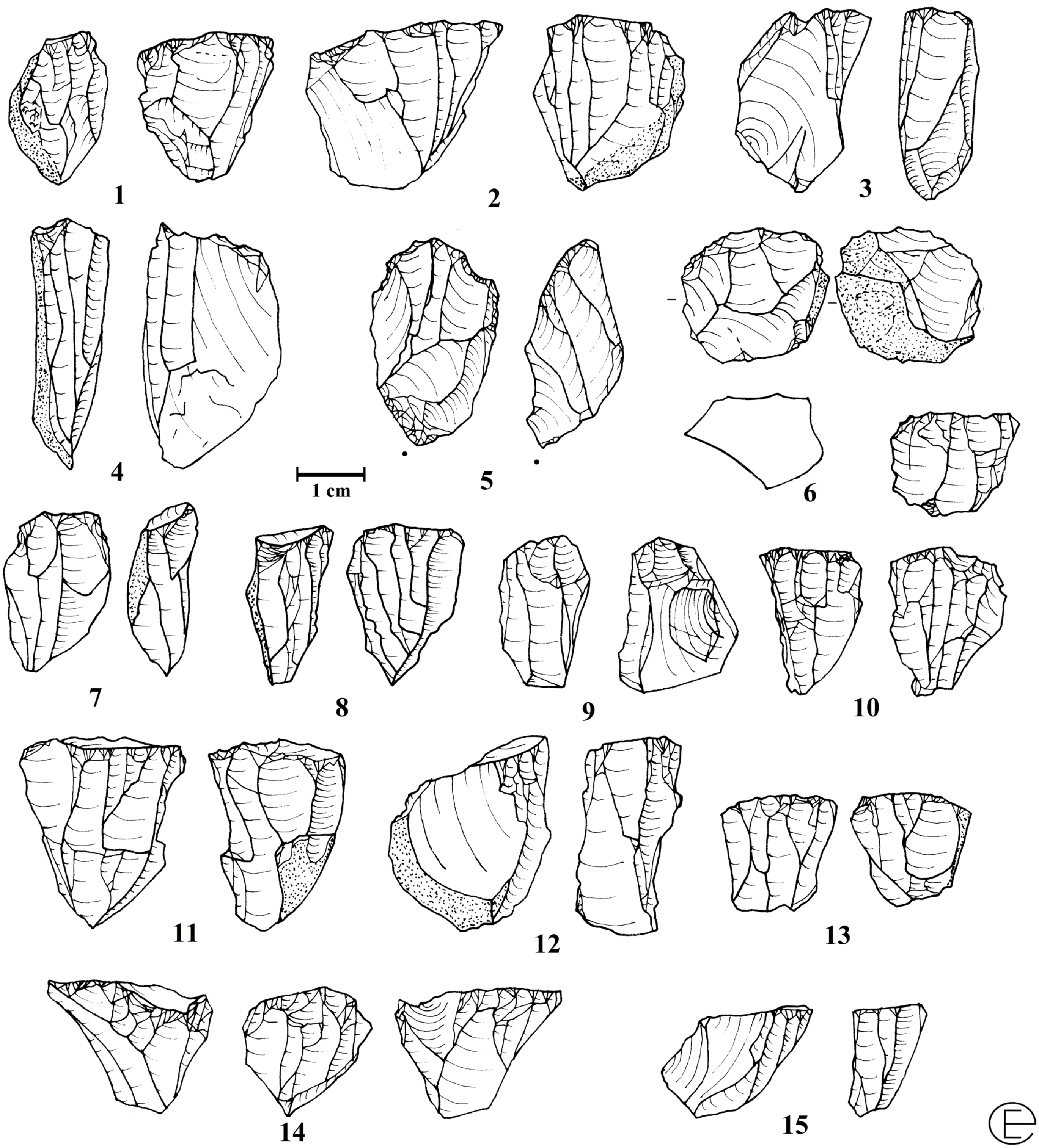


Figure 13. Yafteh bladelet cores Y167–Y201 (1–3: Y167; 4–8: Y179; 9–12: Y190; 13–15: Y201).

in small numbers in the middle of the stratigraphy (Y201–Y278).

Yafteh yielded a good number of points made on both blade and bladelet blanks (Table 12). Based on the original definition by Hole (Hole and Flannery 1967; personal communication with F. Hole, 2016) the Arjeneh points have straight or slightly curved profiles with semi-abrupt to abrupt, sometimes close to backed, retouch. Therefore, the typical Arjeneh points occur mostly at the bottom of the UP layers and gradually decrease towards the top layers (see Table 12).

Notches, denticulates and end scrapers are mostly

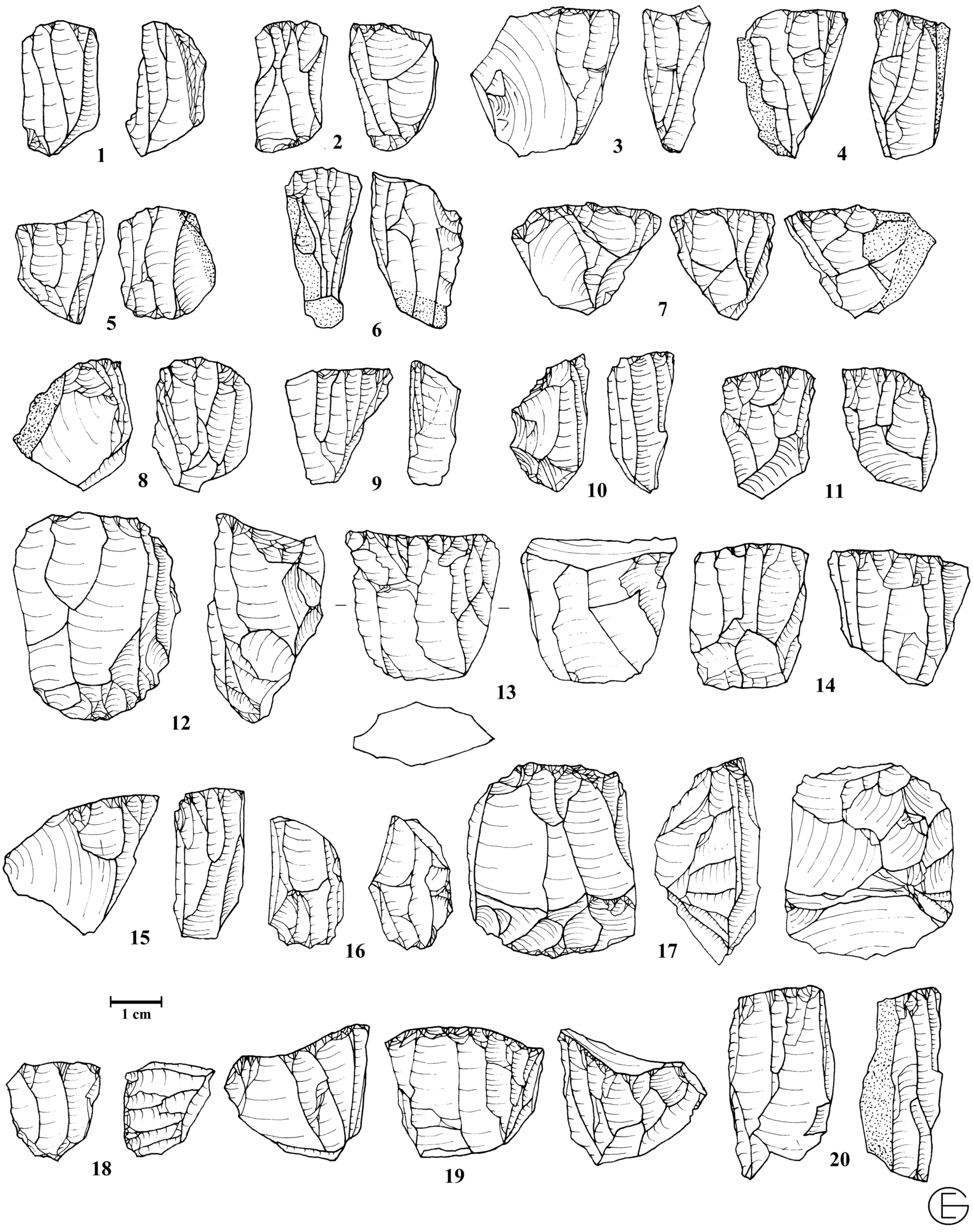


Figure 14. 1–16, 18–20) Yafteh bladelet cores, 17) flake core, Y212–Y313 (1–3: Y212; 4–5: Y234; 6–7: Y245; 8–9: Y256; 10–12: Y267; 14–16: Y278; 17–18: Y289; 19: Y301; 20: Y313).

TABLE 7. YAFTEH CORE FREQUENCIES.

Levels	N	Core Type							Platform Preparation		
		platform blade	platform bladelet	carinated scraper	burin	platform flake	centripetal flake	discoidal flake	plain	coarse	fine
Y 90	1	-	100	-	-	-	-	-	100	-	-
Y 101	12	-	100	-	-	-	-	-	91.7	8.3	-
Y 112	22	-	100	-	-	-	-	-	91	4.5	4.5
Y 123	39	-	100	-	-	-	-	-	94.9	2.6	2.6
Y 134	48	-	97.9	-	-	2.1	-	-	87.5	12.5	-
Y 145	49	-	100	-	-	-	-	-	87.7	12.3	-
Y 157	65	1.5	98.5	-	-	-	-	-	92.3	7.7	-
Y 167	24	-	100	-	-	-	-	-	95.8	4.2	-
Y 178	51	-	88.2	2	2	4	-	4	92.2	7.8	-
Y 190	41	-	92.7	4.9	-	2.4	-	-	92.7	7.3	-
Y 201	72	-	94.4	1.4	-	2.8	-	1.4	97.2	2.8	-
Y 212	98	-	97.9	-	1	1	-	-	80.6	15.3	4.1
Y 223	37	-	97.3	-	-	-	2.7	-	81.1	18.9	-
Y 234	58	1.7	93.1	1.7	-	-	-	3.4	84.5	10.3	5.2
Y 245	39	-	97.4	2.6	-	-	-	-	92.3	5.1	2.6
Y 256	21	-	100	-	-	-	-	-	90.5	4.8	4.8
Y 267	32	-	96.9	-	-	-	-	3.1	71.9	28.1	-
Y 278	32	3.1	93.7	-	-	3.1	-	-	87.5	9.4	3.1
Y 289	22	-	86.4	-	9.1	4.5	-	-	86.4	13.6	-
Y 301	4	-	100	-	-	-	-	-	50	50	-
Y 313	2	50	50	-	-	-	-	-	100	-	-
Sum	**769**										

present in the more recent phases of the stratigraphy, found from the surface until a depth of ca. 200cm, where they disappear or are present in small numbers, and other tool types, such as Arjeneh points, begin to appear (see Table 10). The blanks for end scrapers, notches, and denticulates are mostly blades, the latter only rarely being made on bladelet blanks. This selection of blades is considered a marker of diachronic change among the tool types at Yafteh.

TECHNO-TYPOLOGICAL ANALYSIS OF THE LITHIC ARTIFACTS OF PASANGAR ROCK-SHELTER, WEST-CENTRAL ZAGROS

Cores (Figures 16–18). Most of the cores at Pasangar are consistently made on small cobbles as blanks rather than flakes (Table 13), also reflected in the relatively constant size of the cores throughout the sequence. The negative scars on the cores tend to twist towards the apex of the core, indicating that the bladelet had a twisted profile.

Most of the cores found throughout the stratigraphy are single platform bladelet cores (see Table 13). The preparation of the platforms is done simply by removing one or a maximum of two flakes. Fine preparation on the platform is nearly absent, limited to less than 1% of cores, and this pattern remains the same throughout the sequence. Bladelet cores comprise the majority in all the levels at Pasangar, although platform blade and flake cores appear in small numbers deeper in the stratigraphy and increase towards the bottom. Nevertheless, the size of the cores remains homogenous. The blade cores are part of the same *chaîne opératoire* as the bladelet cores, since they follow the same procedure of preparation and production. Many blades were probably produced in the first stages of the *chaîne opératoire*. A positive relationship has been observed between the presence of blade cores and the frequency of blades among the débitage as well as among the tool blanks.

Platform preparation of the bladelet cores remains homogenous throughout the strata. Cresting or removal of laminar products in the same or opposite direction of the reduction surface occurred at the same time, with no apparent difference in preference for either of these methods

TABLE 7. YAFTEH CORE FREQUENCIES (continued).

Levels	Platform Orientation				Reduction Face				Core Blank	
	single	double adjacent	opposed	more than 2	narrow	wide	max. size	discard	flake	cobble
Y 90	100	-	-	-	100	0	28	100	0	100
Y 101	91.7	-	8.3	-	75	25	25.6	91.7	25	75
Y 112	81.8	13.6	4.5	-	40.1	59.1	27.6	100	9.1	90.9
Y 123	69.2	23.1	7.7	-	38.5	61.5	28.5	97.4	7.7	92.3
Y 134	77.1	20.8	2.1	-	66.8	33.3	29.6	97.9	33.3	66.7
Y 145	61.2	26.5	6.1	6.1	57.1	42.8	27.2	100	30.6	69.4
Y 157	72.3	24.6	3.1	-	63.1	36.9	26.2	96.9	40	60
Y 167	79.2	16.7	4.2	-	70.8	29.2	31	100	37.5	62.5
Y 178	82.3	9.8	5.9	2	52.9	47	26.5	92.1	33.3	66.7
Y 190	80.5	14.6	4.9	-	65.8	34.1	28.6	87.8	24.4	75.6
Y 201	90.3	8.3	1.4	-	55.5	44.4	28.4	88.9	33.3	66.7
Y 212	83.7	11.2	4.1	1	67.3	32.6	29.3	81.6	33.7	66.3
Y 223	81.1	13.5	2.7	2.7	56.7	43.2	30	86.5	35.1	64.9
Y 234	84.5	12.1	1.7	1.7	44.8	55.2	32.5	82.7	44.8	55.2
Y 245	66.7	25.6	5.1	2.6	52.5	47.5	31.9	87.2	45	55
Y 256	95.2	4.8	-	-	71.4	28.6	30.4	80.9	47.6	52.4
Y 267	75	18.7	6.2	-	62.5	37.5	31.2	84.4	53.1	46.9
Y 278	78.1	18.7	-	3.1	69.7	30.3	33.1	84.4	36.4	63.6
Y 289	63.6	13.6	22.7	-	9.1	90.1	34.7	50	13.6	86.4
Y 301	75	-	25	-	50	50	34.1	25	0	100
Y 313	100	-	-	-	0	100	46.5	100	0	100

observed throughout the stratigraphy. In both cases, the ultimate shape of the cores is pyramidal. The removal of a few flakes was also used for maintaining the convexity of the flaking surface.

The reduction of the cores from the top stratigraphic levels P1–P101 mainly occurred on the wide side of the core. However, use of the narrow side increases towards the bottom, from P112 to P201. This observation is associated with the increase in the number of twisted bladelets deeper in the stratigraphy, making it likely that reduction of the narrow side of the core is useful for getting more twisted laminar products. The pattern of abrading the overhangs of the core platform remains the same throughout the strata and indicates the application of soft stone hammer.

Among the 1,195 cores studied from all levels, only 5 discoidal cores were observed (from the middle strata P56–P112). Together with the rare centripetal and platform cores, cores specialized for flake production comprise around 7% of all the cores at Pasangar. Platform flake cores are present throughout the strata, although at slightly higher frequencies towards the bottom of the sequence, where centripetal or discoidal cores are absent.

Based on the size and the pattern of preparation and rejuvenation of the cores throughout the strata, the main reason for abandonment of the cores is exhaustion—intense reduction removed too much of the cores' volume for further production (see Table 13).

Débitage. Consistent with the little variability among the cores, the analysis of débitage from Pasangar documents a high degree of homogeneity in laminar production. Bladelet production reaches its maximum frequency in the upper levels, gradually decreasing towards the bottom of the sequence, where the frequency of blades and flakes increases. The relative frequency of flakes, blades, and bladelets throughout the Pasangar sequence is consistent with both blade and flake cores becoming more common deeper in the stratigraphy (Table 14).

Twisted bladelets are the most common form of débitage in all levels. However, blades increase dramatically towards the bottom of the strata. Flakes are a small component of the lithic assemblage at Pasangar, which is presumably due to the recovery system and disposal of most of the débitage at the site at the time of excavation.

Tools (Figure 19). Using flakes as blanks is dominant

TABLE 8. YAFTEH DÉBITAGE FREQUENCIES.

Levels	N	twisted bladelet	non-twisted bladelet	twisted blade	non-twisted blade	burin spall	flake	Levallois flake	Levallois blade	Kombewa flake	core rejuvenation & preparation pieces
Y 101	33	78.8	3.0	3.0	12.1	-	3.0	-	-	-	-
Y 112	48	79.2	6.2	10.4	2.1	-	-	-	-	-	2.1
Y 123	149	91.9	3.3	2.7	-	-	1.3	-	-	-	0.7
Y 134	80	87.5	2.5	3.8	5.0	-	1.3	-	-	-	-
Y 145	120	89.2	0.8	4.2	3.3	-	1.7	-	-	-	0.8
Y 157	160	90.6	3.1	0.6	1.2	-	2.5	-	-	-	1.9
Y 167	72	80.5	13.9	2.8	2.8	-	-	-	-	-	-
Y 178	136	89.0	5.1	4.4	1.5	-	-	-	-	-	-
Y 189	201	79.1	7.0	3.5	2.3	-	2.3	-	-	-	5.8
Y 201	188	86.7	4.2	5.3	1.1	-	-	-	-	-	2.7
Y 210	308	85.1	7.1	3.6	1.9	-	-	-	-	-	2.3
Y 223	181	94.5	2.8	-	0.5	-	1.1	-	-	-	1.1
Y 234	253	76.3	11.8	7.5	3.5	-	-	-	-	-	0.8
Y 245	273	71.8	16.1	2.9	5.9	-	0.4	-	-	-	2.9
Y 256	79	24.0	41.8	12.6	10.1	-	1.3	-	-	-	10.1
Y 267	152	69.7	12.5	10.5	2.6	-	0.6	-	-	-	3.9
Y 278	164	57.9	21.9	7.3	10.4	-	-	-	-	-	2.4
Y 289	88	60.2	14.8	20.4	4.5	-	-	-	-	-	-
Y 290	27	48.1	33.3	11.1	7.4	-	-	-	-	-	-
Y 301	27	66.7	3.7	11.1	18.5	-	-	-	-	-	-
Y 313	27	50.0	18.7	31.2	-	-	-	-	-	-	-
Sum	**2640**										

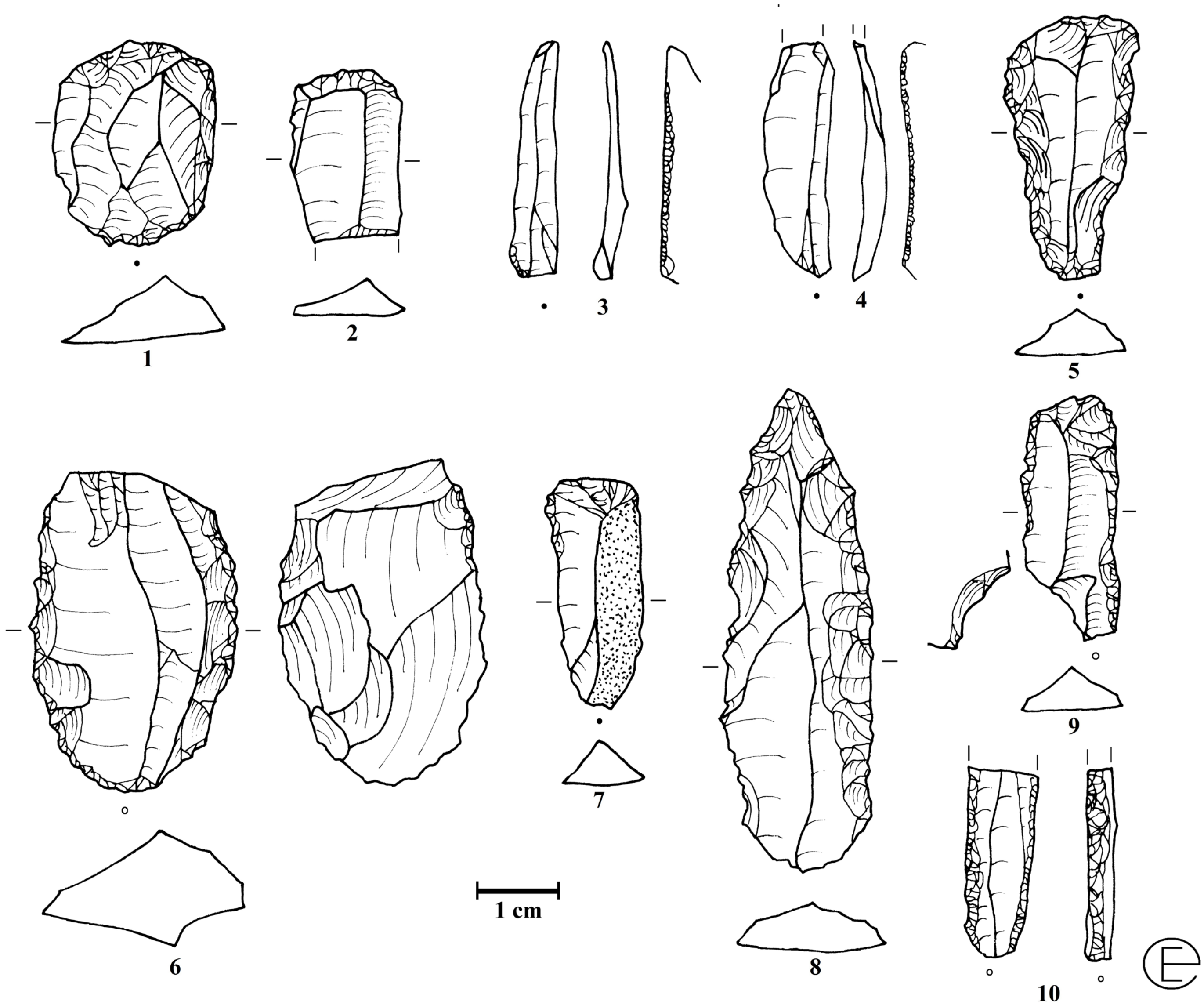


Figure 15. Yafteh tools: 1–2) end scraper, 3–4) inversely retouched bladelet, 5) scraper on blade, 6) bifacially retouched flake, 7,9) end scraper, 8) scraper, 10) abruptly retouched bladelet (1-2: Y45; 3: Y89; 4: Y90; 5: Y123; 6–7: Y134; 8–9: Y178; 10: Y256).

in the top (P1–P67) and bottom (P17–P212) levels of Pasangar (Table 15); towards the bottom levels, blade blanks are also common, and these increase in the middle levels (P78–167). Bladelets remain important tool blanks throughout the stratigraphy but are not dominant. In the top layers (P1–P67), they are mostly non-twisted, however, twisted bladelets increase towards the bottom of the stratigraphy. In some layers, the blades with twisted profiles were used as the main tool blanks (P78–P167).

Tool types are similar throughout the stratigraphy. The main change concerns the number of certain tools rather than the appearance or disappearance of certain tool types (Table 16). The most common tool type throughout the sequence is end scrapers without any clear pattern of blank use for their production. All end scrapers are made on flakes or blades (Table 17).

Retouched blades are the second most common tool, and they increase in frequency throughout the stratigraphy. The number of notches and denticulates is higher in the upper levels, while different types of burins increase deeper in the strata. These consist of mostly simple burins, although other burin types occur towards the bottom levels, especially multiple burins. Most of the burins are made on flakes (Table 18).

Points are poorly documented in all levels and show no diachronic pattern. Only 6 points were found in total, of which 3 can be considered as Arjeneh points. The other points are on twisted bladelets with backed retouch. Recent studies of the Pasangar assemblage stored in the National Museum of Iran ('Pasangar a' collection), noted the total lack of points (either pointed bladelets or Arjeneh) in the UP sequence of Pasangar (Shidrang 2015).

In general, the Pasangar industry tends to be flake based towards the upper levels and blade dominant in the

TABLE 9. YAFTEH TOOL BLANK FREQUENCIES.

Levels	N	non-twisted blade	non-twisted bladelet	twisted bladelet	twisted blade	flake	Levallois flake	core rejuvenation & preparation pieces	other
Y 90	1	-	-	-	-	100	-	-	-
Y 101	28	28.6	3.6	14.3	3.6	50	-	-	-
Y 112	27	51.8	-	7.4	7.4	33.3	-	-	-
Y 123	71	31	1.4	15.5	7	43.7	-	-	1.4
Y 134	61	32.8	3.3	19.7	4.9	37.7	-	1.6	-
Y 145	61	29.5	-	44.3	-	26.2	-	-	-
Y 157	78	33.3	2.6	25.6	6.4	32.1	-	-	-
Y 167	27	25.9	7.4	40.7	-	25.9	-	-	-
Y 178	49	20.4	2	38.8	8.2	26.5	-	2	2
Y 189	44	31.8	2.3	27.3	-	34.1	-	-	4.5
Y 201	95	21	6.3	46.3	-	24.2	-	1.1	1.1
Y 210	76	21	14.5	30.3	1.3	32.9	-	-	-
Y 223	40	12.5	5	42.5	5	32.5	-	2.5	-
Y 234	113	12.4	18.6	46	0.9	22.1	-	-	-
Y 245	90	13.3	40	31.1	2.2	12.2	-	1.1	-
Y 256	106	10.4	23.6	50.9	3.8	10.4	-	0.9	-
Y 267	88	13.6	23.9	48.9	1.1	11.4	-	1.1	-
Y 278	96	21.9	26	43.8	1	7.3	-	0	-
Y 289	97	6.2	20.6	50.5	11.3	9.3	-	2.1	-
Y 301	21	9.5	85.7	-	-	4.8	-	-	-
Y 313	13	7.7	23.1	69.2	-		-	-	-
Sum	**1282**								

TABLE 10. YAFTEH TOOL TYPE FREQUENCIES.

Levels	ret. blade	ret. blt.	ret. flake	end scraper	notch	dent.	all burin	strangled blade	carinated scraper	trunc.	truncated facetted	pièce esquillée	multiple tools	point	geometric	thumbnail scraper	nosed scraper	scraper
Y 90	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Y 101	7.1	14.3	3.6	32.1	7.1	3.5	25	-	-	-	-	-	-	-	3.5	3.5	-	-
Y 112	14.8	7.4		40.7	3.7	-	18.5	3.7	7.4	-	-	-	-	-	-	-	-	3.7
Y 123	11.3	18.3	7	25.3	4.2	7	23.9	-	-	1.4	-	-	-	-	-	1.4	-	-
Y 134	14.8	23	8.2	27.9	3.3	1.6	16.4	1.6	-	1.6	-	-	-	-	-	-	-	1.6
Y 145	9.8	44.3	3.3	14.7	3.3	1.6	16.4	-	-	1.6	-	-	-	-	-	-	-	4.9
Y 157	12.8	28.2	11.5	28.2	-	1.3	14.1	-	-	-	-	1.3	-	-	-	1.3	-	1.3
Y 167	15.4	46.2	7.7	7.7	3.8	7.7	7.7	-	-	-	-	3.8	-	-	-	-	-	-
Y 178	14.6	41.7	10.4	12.5	2.1	2.1	6.2	-	-	6.2	-	2.1	-	-	-	-	-	2.1
Y 189	16.7	31	4.8	4.8	4.8	4.7	19	2.3	-	-	2.3	4.7	-	-	-	-	-	4.7
Y 201	16	51.1	8.5	2.1	-	-	9.5	-	1.1	2.1	-	2.1	2.1	1	-	-	-	4.2
Y 210	19.5	40.2	3.9	3.9	-	-	22	-	2.6	1.2	-	1.2	-	5.1	-	-	-	-
Y 218	-	-	25	-	-	-	-	-	50	-	-	-	-	-	-	-	-	25
Y 223	5.6	52.8	13.9	8.3	-	-	11.1	-	-	2.7	-	2.7	2.7	-	-	-	-	-
Y 234	9.6	54.4	3.5	4.4	-	-	10.5	-	4.3	-	0.8	0.8	0.8	8.7	-	-	-	1.7
Y 245	6.6	53.8	5.5	2.2	-	1.1	7.7	-	1.1	-	1.1	-	-	19.7	-	-	-	1.1
Y 256	9.4	58.5	5.7	5.7	-	-	0.9	0.9	1.9	1.8	-	-	-	15.1	-	-	-	-
Y 267	9.1	65.9	6.8	2.3	-	-	1.1	-	1.1	2.2	-	-	1.1	9.1	-	-	-	1.1
Y 278	16.7	57.3	1	4.2	2.1	1	-	-	3.1	-	-	-	-	13.5	-	-	1	-
Y 289	4.4	64.4	4.4	2.2	4.4	-	2.2	-	-	-	-	2.2	-	13.3	-	-	-	2.2
Y 290	2.5	80	2.5	2.5	2.5	-	2.5	-	-	-	-	-	-	5	-	-	-	2.5
Y 301	9.5	71.4	4.8	-	-	-	-	-	-	-	-	-	-	14.2	-	-	-	-
Y 313	7.7	76.9	-	-	-	-	-	-	-	-	-	-	-	15.3	-	-	-	-

TABLE 11. YAFTEH BURIN FREQUENCIES.

Levels	N	simple	dihedral	polyhydric	multiple
Y 90	0	-	-	-	-
Y 101	7	14.3	28.6	-	57.1
Y 112	5	60	-	20	20
Y 123	17	35.3	11.8	-	52.9
Y 134	10	30	60	10	-
Y 145	10	40	30	10	20
Y 157	11	45.5	18.2	9.1	27.3
Y 167	2	50	50	-	-
Y 178	3	33.3	-	66.7	-
Y 190	8	-	25	25	50
Y 201	9	44.4	33.3	22.2	-
Y 212	17	64.7	5.9	11.8	17.6
Y 223	4	50	-	-	50
Y 234	12	66.7	8.3	8.3	16.6
Y 245	7	71.4	-	-	28.6
Y 256	1	100	-	-	-
Y 267	1	100	-	-	-
Y 278	0	-	-	-	-
Y 289	2	50	-	-	50
Y 301	0	-	-	-	-
Y 313	0	-	-	-	-
Sum	126				

TABLE 12. YAFTEH POINT FREQUENCIES.

Levels	N	pointed bladelet	pointed blade	Arjeneh point
Y 90	0	-	-	-
Y 101	0	-	-	-
Y 112	0	-	-	-
Y 123	0	-	-	-
Y 134	0	-	-	-
Y 145	3	100	-	-
Y 157	1	-	100	-
Y 167	0	-	-	-
Y 178	0	-	-	-
Y 190	1	100	-	-
Y 201	2	50	-	50
Y 212	6	-	33.3	66.7
Y 223	1	-	100	-
Y 234	13	7.7	15.4	76.9
Y 245	22	13.6	4.5	81.8
Y 256	21	19	4.8	76.2
Y 267	17	47.1	5.9	47.1
Y 278	17	17.6	5.9	76.5
Y 289	8	-	-	100
Y 301	3	-	-	100
Y 313	2	-	-	100
Sum	117			

earlier phases. Except for a few geometric microliths and microburins, no Epipaleolithic (Zarzian) elements were observed. Accordingly, the assemblage is recognized as belonging to the later phases of UP.

TECHNO-TYPOLOGICAL ANALYSIS OF THE LITHIC ARTIFACTS OF WARWASI ROCKSHELTER, WEST-CENTRAL ZAGROS

In order to document chrono-stratigraphic changes, all lithics from Warwasi were examined. Based on the techno-typological analysis, the site was originally assigned to three main chronological phases—MP (MM-CCC), two phases of the UP (P-Z and AA-LL) and the Epipaleolithic (A-O). In the absence of an absolute chronology and field documentation, these divisions among the archaeological horizons are based solely on the lithic analysis. Therefore, by plotting techno-typological characteristics of the lithics from all levels we are able to track changes across the chronological sequence. The lithics from the transitional levels throughout the Warwasi stratigraphy yield mixed techno-typological characteristics of upper and lower chronological phases. These characteristics have led some scholars to interpret the Warwasi sequence as reflecting a gradual local change from MP to UP, and from UP to the Epipaleolithic (Olszewski 2017; Olszewski and Dibble 1994).

Within the UP levels, there are marked shifts in technology. From Layer LL upwards, there is a major shift in techno-typological traits, marked by the appearance of bladelet production. On this basis, the UP at Warwasi was divided into two phases, early and late Baradostian (Olszewski and Dibble 1994; Otte and Kozlowski 2007; Tsanova 2013)—Levels LL-AA were designated as Early Zagros Aurignacian and Levels Z-P as Late Zagros Aurignacian (Figures 20–22) (Olszewski 2017). Here, Levels O-J were also included to see the possible gradual change at the beginning of the so-called Zarzian (Epipaleolithic) periods.

Cores. The cores are mostly on cobbles in all phases (Table 19), although Levels Q-AA show a higher number of cores made on flake blanks.

The size of the cores shows small fluctuations through levels. At the beginning of the UP levels from LL-AA they are somewhat larger than the levels above to Level J. The change in size and blank of the cores does not necessarily result in a significant change in the production of both

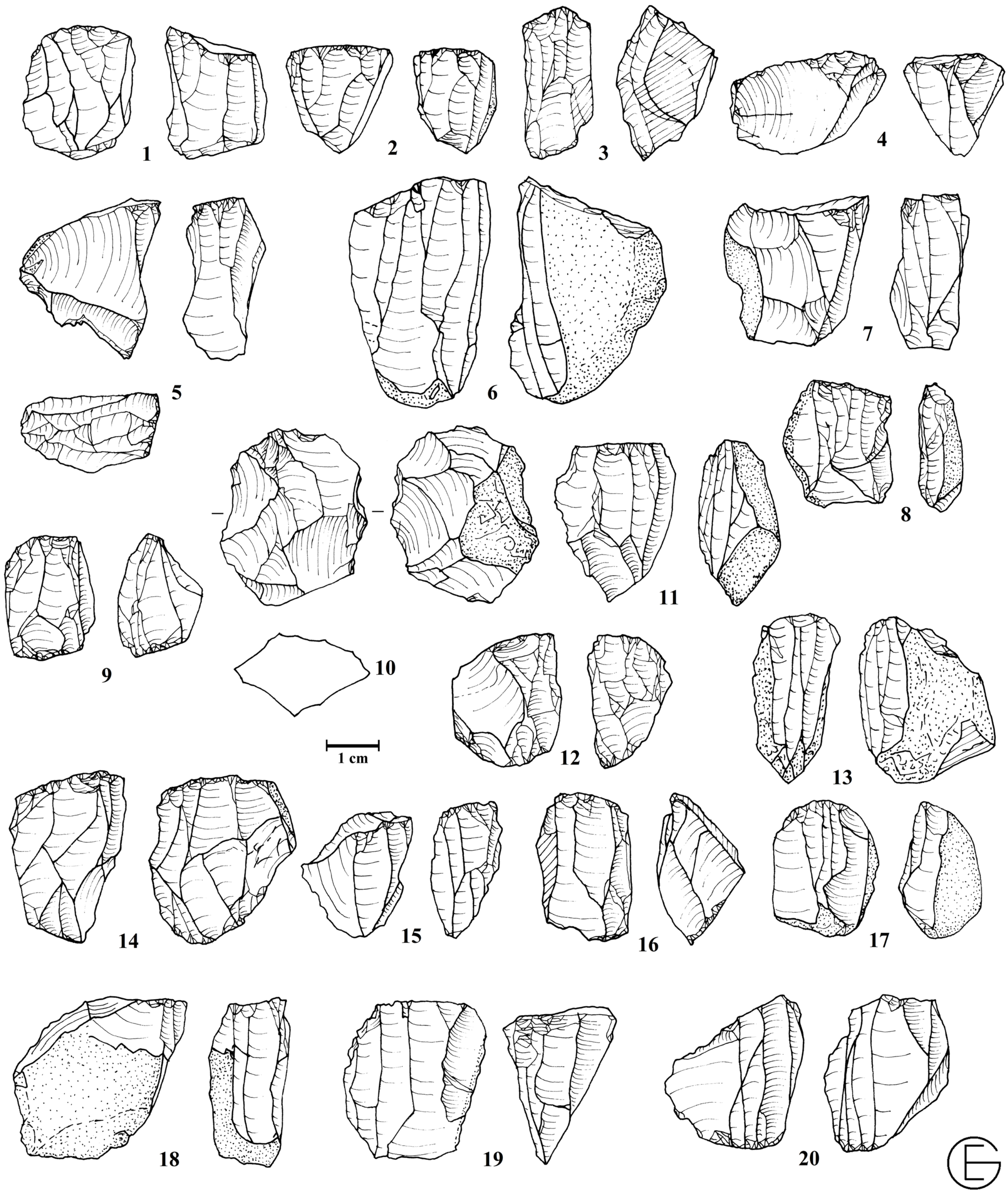


Figure 16. Pasangar bladelet cores P45–P112 (1–6: P45; 7–8: P78; 9–13: P89; 14–17: P101; 18–20: P112).

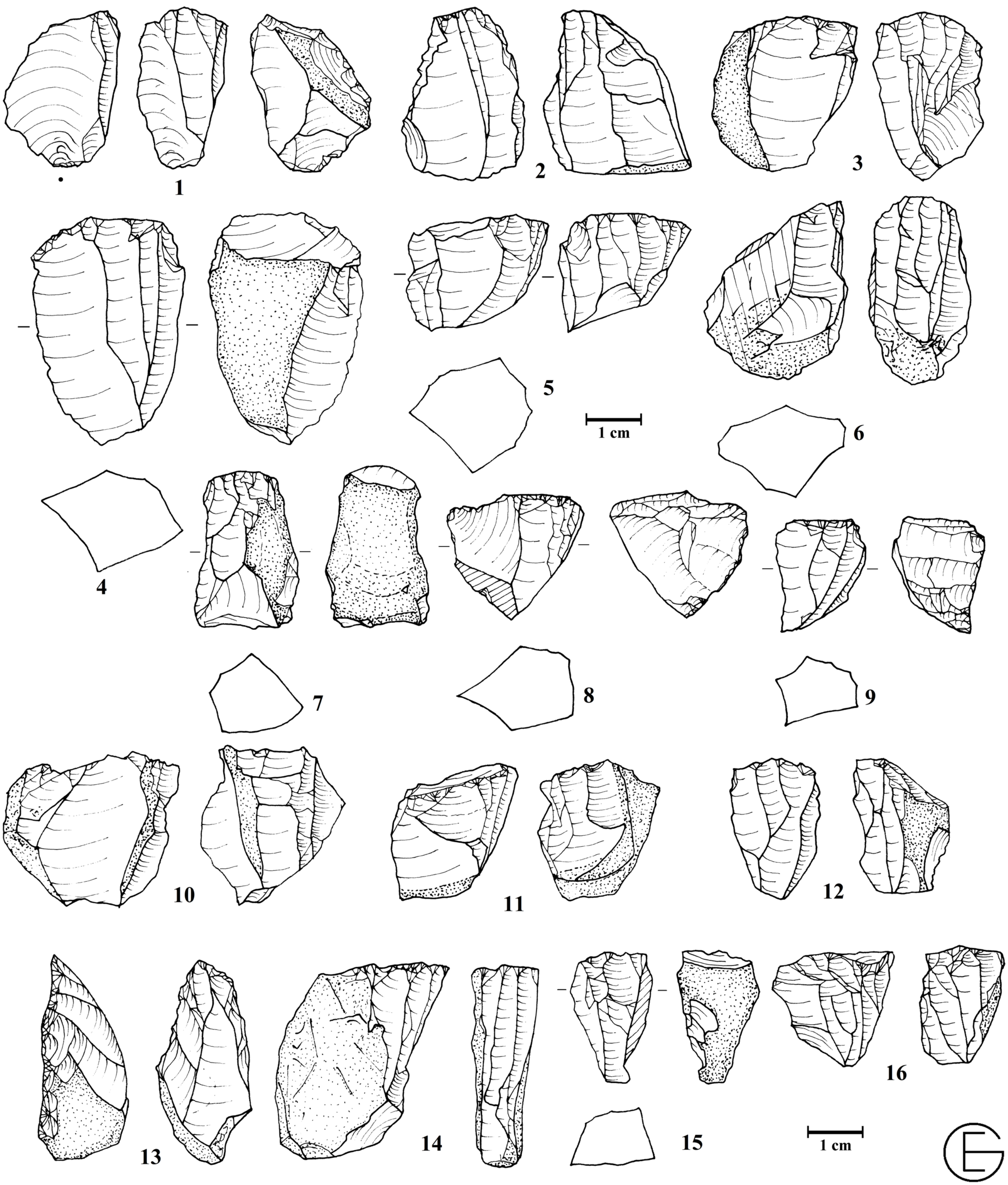


Figure 17. Pasangar bladelet cores P123–P201 (1–3: P123; 4–6: P134; 7–9: P156; 10–11: P167; 12–16: P201).

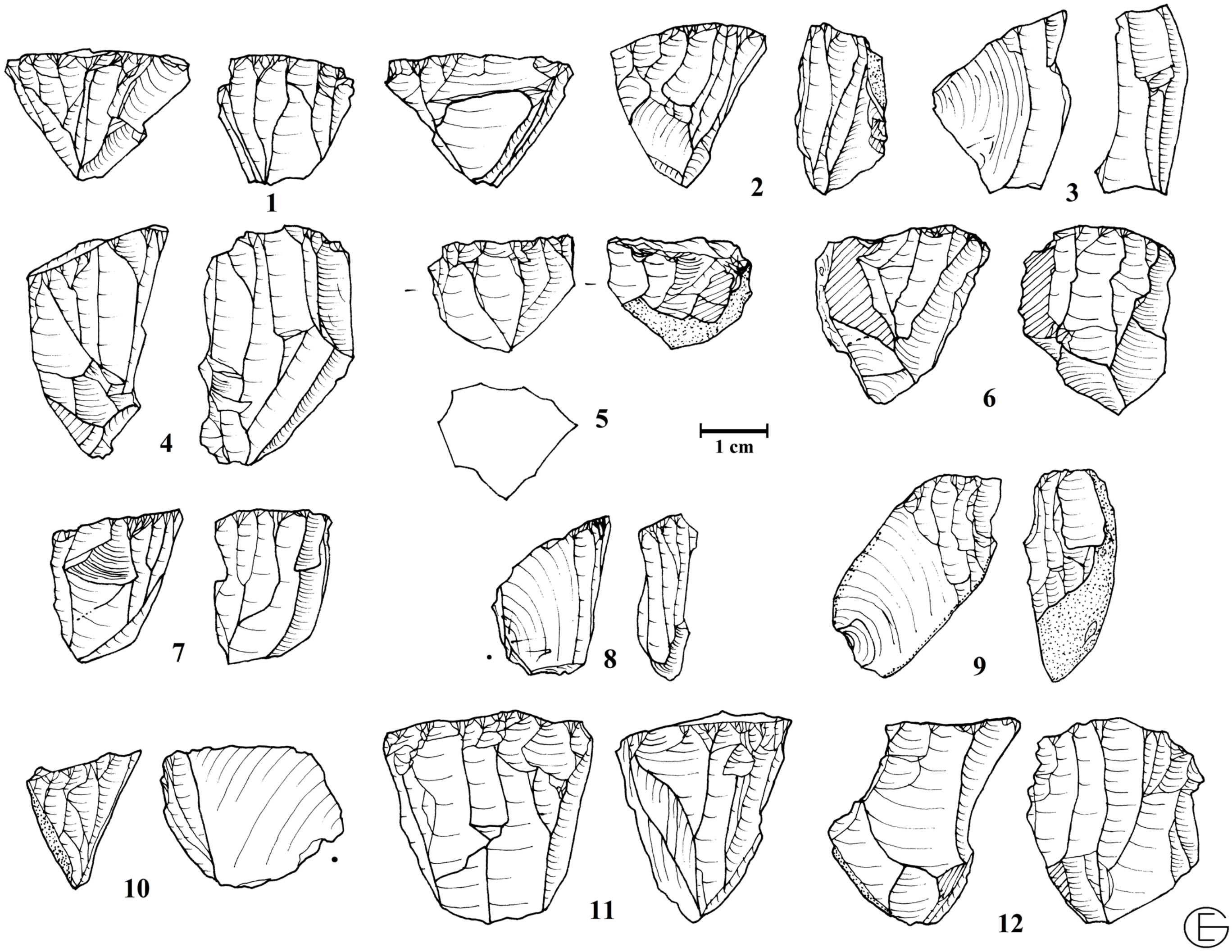


Figure 18. Pasangar bladelet cores P212–P256 (1–6: P212; 7–9: P234; 10–12: P256).

twisted and non-twisted bladelets (see subsection on débitage). Most of the cores in Levels J-AA are platform bladelet cores. Their numbers tend to shrink throughout the sequence, reaching minimum frequency in the last level of LL. Single platform cores comprise the majority throughout the UP sequence; double and opposed platform cores also occur, but in smaller numbers that decrease towards the early phases. Other types of bladelet cores, including carinated scrapers and burins, are infrequent and concentrated mostly in the upper levels of P-W. Platform flake cores are present in all UP levels, but decrease towards the bottom; in contrast, parallel and inclined cores for flake production increase especially from Level QQ downwards. Platform blade and flake cores, as well as flake cores on discoidal and parallel cores, also increase towards the bottom of the sequence, but less markedly. Small discoidal cores, which were also observed at Yafteh, are present at Warwasi in small numbers in both the early and late UP phases.

There is a significant increase in the number of bladelet cores throughout the Warwasi sequence upwards. Bladelet cores on flakes were made on normal thick flakes rather than carinated scrapers or burins. The latter appear in small numbers in the late UP phase. The early UP phase at Warwasi is characterised by the presence of Levallois, including parallel cores, and a few Kombewa cores (up to Level BB), where bladelet cores occur at minimum frequency. Parallel cores represent mostly recurrent Levallois technique to produce small Levallois flakes.

Using the wide side of the core as the reduction surface was preferred in the very late and the early UP phases. There is a sharp shift towards using the narrow reduction face in Levels S to AA. Nevertheless, no relationship between using the narrow reduction face and the production of more twisted bladelets was observed throughout the UP levels.

In all levels, the cores were intensively reduced. Their abandonment occurred after sufficient volume and convexity were lost, so that there was no volume left to maintain the reduction angle.

Débitage. The débitage at Warwasi clearly reflects the two chronological phases of the UP sequence at the site. In Levels J-V, laminar production comprises the main part

TABLE 13. PASANGAR CORE FREQUENCIES.

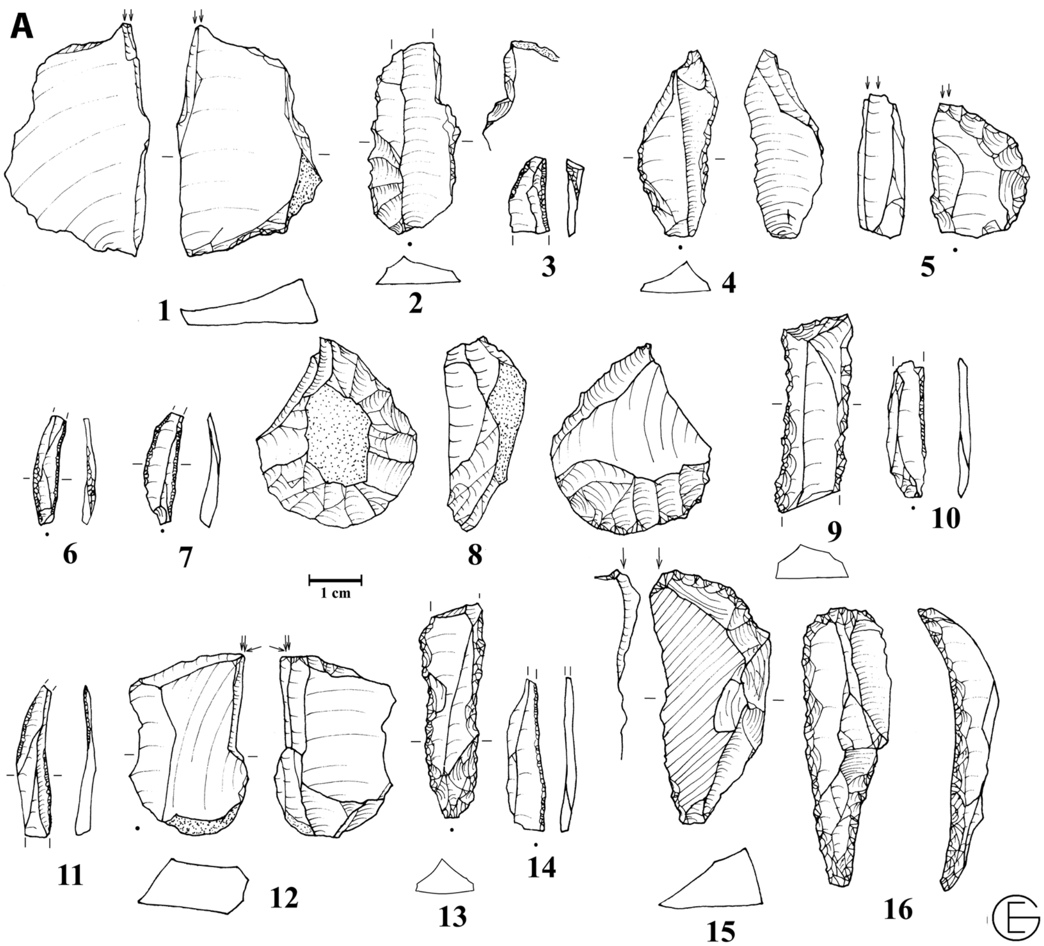
Levels	N	Core Type									Platform Preparation		
		platform blade	platform bladelet	platform mixed blade & flake	carinated scraper	burin	platform flake	centripetal	discoidal	bullet bladelet	plain	coarse	fine
P 1	27	-	96.3	-	-	-	3.7	-	-	-	96.3	3.7	-
P 12	16	-	87.5	6.2	-	-	6.2	-	-	-	100	-	-
P 23	29	-	93.1	-	-	-		-	-	6.9	93.1	6.9	-
P 34	96	-	95.8	-	-	1	3.1	-	-	-	99	-	1
P 45	106	-	94.3	2.8	-	-	2.8	-	-	-	99	1	-
P 56	92	3.2	93.5	-	-	-	1.1	1.1	1.1	-	97.8	2.2	-
P 67	74	1.4	94.6	1.4	-	-	2.6	-	-	-	97.3	2.7	-
P 78	37	-	89.2	-	-	-	10.8	-	-	-	100	-	-
P 89	150	2.7	94.7	-	-	-	0.7	2	-	-	90	10	-
P 101	82	2.4	89	-	-	-	6.1	-	2.4	-	91.5	8.5	-
P 112	96	5.2	88.5	-	-	-	2.1	2.1	2.1	-	91.7	8.3	-
P 123	87	-	85.1	-	-	2.3	12.6	-	-	-	96.6	3.4	-
P 134	72	1.4	91.7	-	-	2.8	4.2	-	-	-	91.7	5.6	2.8
P 145	2	-	100	-	-	-		-	-	-	100	-	-
P 156	43	-	93	4.6	-	-	2.3	-	-	-	95.3	4.7	-
P 167	22	-	86.4	-	-	-	13.6	-	-	-	100	-	-
P 178	69	4.3	81.2	-	-	1.4	13.1	-	-	-	98.6	1.4	-
P 189	55	-	70.7	-	-	3.1	26.1	-	-	-	90.9	2.3	1.8
P 201	22	-	95.4	-	-	-	4.6	-	-	-	95.4	4.5	-
P 212	18	11.1	83.3	-	-	-	5.6	-	-	-	88.9	5.6	5.6
Sum	1195												

TABLE 13. PASANGAR CORE FREQUENCIES (continued).

Levels	Platform Orientation				Reduction Face				Core Blank	
	single	double adjacent	opposed	more than 2	narrow	wide	max. size	discard	flake	cobble
P 1	70.4	3.7	25.9	-	25.9	74.1	31	96.3	7.4	92.6
P 12	31.2	6.2	56.2	6.2	31.2	68.7	32	100	6.2	93.7
P 23	72.4	10.3	17.2	-	24.1	75.9	32	89.7	-	100
P 34	88.5	5.2	5.2	1	47.9	52.1	31	15.6	15.6	84.4
P 45	87.7	7.5	4.7	-	29.2	70.7	30.1	22.6	12.3	87.7
P 56	83.7	15.2	1	-	36.9	63.1	33.9	15.2	9.8	90.2
P 67	83.8	9.4	5.4	1.3	35.1	64.9	34	24.3	4.1	95.9
P 78	81.1	10.8	-	8.1	56.7	43.2	30.7	48.6	16.2	83.8
P 89	84.7	12.6	2	0.7	50.1	49.9	30.5	38.7	22.6	77.3
P 101	87.8	7.3	4.9	-	41.4	58.5	30.9	30.5	8.5	91.5
P 112	83.3	12.5	4.2	-	59.4	40.6	33	58.3	17.7	82.3
P 123	77	16.1	4.6	2.3	52.9	47.1	34.6	66.7	25.3	74.7
P 134	81.9	11.1	4.2	2.8	51.4	48.6	34.3	79.2	16.7	83.3
P 145	100	-	-	-	100	-	34.7	100	50	50
P 156	69.8	27.9	2.3	-	44.2	55.8	35.2	76.7	18.6	81.4
P 167	81.8	13.6	4.5	-	86.4	13.6	36.9	54.5	18.2	81.8
P 178	84.1	8.7	4.3	2.9	59.4	40.6	29.9	97.1	8.7	91.3
P 189	90.9	9.1	-	-	49.5	50.5	30.9	89.1	13.4	86.6
P 201	72.7	27.3	-	-	63.6	36.4	33.8	81.8	50	50
P 212	94.4	5.6	-	-	38.9	61.1	35.3	72.2	11.1	88.9

TABLE 14. PASANGAR DÉBITAGE FREQUENCIES.

Level	N	twisted bladelet	non-twisted bladelet	twisted blade	non-twisted blade	flake	Levallois flake	Levallois blade	Kombewa flake	core rejuvenation & preparation pieces
P 1	154	57.1	27.3	11.7	3.2	0.6	-	-	-	-
P 12	178	49.4	37.1	8.4	5.0	-	-	-	-	-
P 23	222	57.2	32.0	7.6	3.1	-	-	-	-	-
P 34	184	54.3	33.1	7.6	3.8	-	-	-	-	1.1
P 45	119	58.0	20.2	14.3	7.6	-	-	-	-	-
P 56	50	70.0	12.0	10.0	8.0	-	-	-	-	-
P 67	46	65.2	10.9	21.7	2.2	-	-	-	-	-
P 78	64	57.8	9.4	23.4	-	1.6	-	-	-	7.7
P 89	80	70.0	7.5	18.8	3.7	-	-	-	-	-
P 90	64	70.3	17.2	6.2	-	-	-	-	-	6.2
P 101	74	86.5	5.4	8.1	-	-	-	-	-	-
P 112	109	59.6	10.1	19.3	5.5	2.7	-	-	-	2.7
P 123	80	77.5	11.2	5.0	3.7	2.5	-	-	-	-
P 134	157	77.7	7.0	10.2	4.4	0.6	-	-	-	-
P 145	130	59.2	23.1	12.3	5.4	-	-	-	-	-
P 156	98	64.3	7.1	17.3	9.2	2.0	-	-	-	-
P 167	13	46.1	15.4	23.1	15.4	-	-	-	-	-
P 178	32	62.5	18.7	6.2	12.5	-	-	-	-	-
P 189	31	74.7	4.4	12.5	6.3	2.2	-	-	-	-
P 201	21	57.1	9.5	14.3	9.5	4.8	-	-	-	4.8
P 212	10	40.0	-	60.0	-	-	-	-	-	-
Sum	1916									



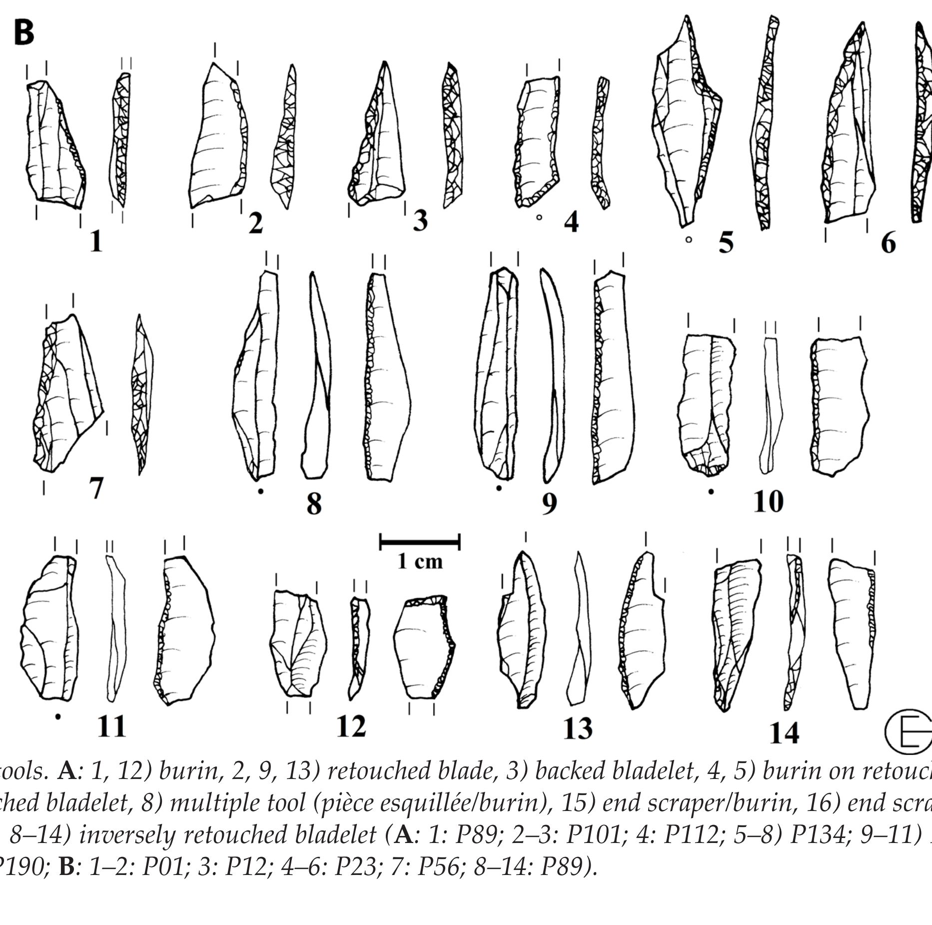


Figure 19. Pasangar tools. **A***: 1, 12) burin, 2, 9, 13) retouched blade, 3) backed bladelet, 4, 5) burin on retouched flake/blade, 6, 7, 10, 11, 14) twisted retouched bladelet, 8) multiple tool (pièce esquillée/burin), 15) end scraper/burin, 16) end scraper.* **B***: 1–4) microliths, 5–7) backed bladelets, 8–14) inversely retouched bladelet (***A***: 1: P89; 2–3: P101; 4: P112; 5–8) P134; 9–11) P145; 12: P156; 13–14: P167; 15: P178; 16: P190;* **B***: 1–2: P01; 3: P12; 4–6: P23; 7: P56; 8–14: P89).*

TABLE 15. PASANGAR TOOL BLANK FREQUENCIES.

Level	N	non-twisted blade	non-twisted bladelet	twisted bladelet	twisted blade	flake	Levallois flake	core rejuvenation & preparation pieces	other
P 1	83	10.8	32.5	4.8	9.6	42.2	-	-	-
P 12	85	7	29.4	7	7	47.1	-	2.4	-
P 23	94	7.4	25.5	13.8	5.3	46.8	-	1.1	-
P 34	72	18.1	36.1	4.1	1.4	40.3	-	-	-
P 45	64	14.1	32.8	6.2	4.7	40.6	-	1.6	-
P 56	40	15	20	10	2.5	50	-	2.5	-
P 67	60	13.3	31.7	3.3	6.7	43.3	-	1.7	-
P 78	32	43.8	6.2	9.4	3.1	37.5	-	-	-
P 89	84	39.3	13.1	19	2.4	22.6	-	3.5	-
P 101	43	34.9	23.2	16.3	7	18.6	-	-	-
P 112	47	6.4	21.3	10.6	8.5	53.2	-	-	-
P 123	35	25.7	11.4	17.1	11.4	28.6	-	5.7	-
P 134	64	39.1	14.1	15.6	9.4	21.9	-	-	-
P 145	44	25	2.3	29.5	22.7	20.4	-	-	-
P 156	55	27.3	12.7	25.4	7.3	23.6	-	3.6	-
P 167	29	31	10.3	13.8	27.6	13.8	-	3.4	-
P 178	34	20.6	-	5.9	14.7	47.1	-	5.9	5.9
P 189	13	23.1	23.1	-	15.4	38.5	-	-	-
P 201	7	14.3	-	-	28.6	57.1	-	-	-
P 212	3	-	-	33.3	-	66.6	-	-	-
Sum	988								

TABLE 16. PASANGAR TOOL TYPE FREQUENCES.

Level	ret. blade	ret. blt.	ret. flake	end scr.	notch	dent.	all burin	strangled blade	carinated scraper	trunc.	truncated facetted	borer	point	geometric	thumbnail scraper	nosed scraper	microburin	scraper	chopper
P 1	6	10.8	2.4	20.5	27.7	9.6	1.2	1.2	2.4	3.6	-	-	-	1.2	1.2	1.2	-	10.8	-
P 12	14.1	8.2	1.2	37.6	11.8	12.9	-	1.1	2.3	5.8	-	-	-	-	-	1.1	1.1	2.3	-
P 23	17.2	9.7	4.3	38.7	15.1	8.6	2.1	2.1	1	-	-	1	-	-	-	-	-	-	-
P 34	2.8	9.8	1.4	27.8	18.1	22.2	4.1	2.7	5.5	-	-	2.7	1.3	-	-	-	-	1.3	-
P 45	11.1	4.8	4.8	30.2	17.5	17.4	-	3.1	3.1	1.5	-	3.1	-	-	-	-	-	3.1	-
P 56	12.5	12.5	2.5	37.5	17.5	5	5	-	-	-	-	2.5	-	-	-	-	2.5	2.5	-
P 67	5.2	10.3	6.9	20.7	19	10.3	3.4	3.4	1.7	-	-	-	1.7	-	8.6	1.7	-	0.7	-
P 78	9.4	3.1	12.5	28.1	12.5	9.3	6.2	-	6.2	-	3.1	-	3.1	-	-	-	-	6.2	-
P 89	25	5.9	5.9	16.7	1.2	10.7	26.2	-	-	-	-	2.4	-	-	1.2	1.2	-	3.6	-
P 101	18.6	16.3	14	11.6	2.3	4.6	25.5	-	2.3	-	-	-	2.3	-	-	-	-	2.3	-
P 112	14.9	12.8	-	34	8.5	14.9	10.6	-	-	-	-	-	-	-	2.1	-	-	2.1	-
P 123	20	20	11.4	22.9	-	2.8	1.1	-	2.8	-	-	-	-	-	-	2.8	-	5.7	-
P 134	24.2	9.7	3.2	37.1	1.6	8	14.5	1.6	-	-	-	-	-	-	-	-	-	-	-
P 145	34.1	11.4	4.5	25	-	-	18.1	-	-	2.2	-	-	-	-	2.2	2.2	-	-	-
P 156	25.5	12.7	14.5	25.4	-	1.8	14.5	-	-	-	-	-	1.8	-	3.6	-	-	-	-
P 167	10.3	10.3	13.8	24.1	3.4	3.4	20.6	3.4	3.4	-	3.4	-	-	-	-	-	-	3.4	-
P 178	5.9	14.7	11.8	32.3	2.9	2.9	14.7	-	-	2.9	-	-	2.9	-	-	-	-	2.9	5.9
P 189	-	30	12.5	28.7	6.2	-	16.2	-	-	-	-	-	-	-	-	6.2	-	-	-
P 201	-	14.3	14.3	28.6	-	-	14.2	-	-	-	-	-	-	-	-	-	-	28.5	-
P 212	33.3	-	-	-	-	-	66.6	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 17. PASANGAR END SCRAPER FREQUENCIES.

Level	N	Blank	
		blade	flake
P 1	17	47.1	52.9
P 12	32	34.4	65.6
P 23	33	21.2	78.8
P 34	17	41.2	58.8
P 45	19	57.9	42.1
P 56	15	6.7	93.3
P 67	7	28.6	71.4
P 78	9	66.6	33.3
P 89	14	57.1	42.8
P 101	5	60	40
P 112	16	6.2	93.7
P 123	8	50	50
P 134	20	85	15
P 145	11	63.6	36.4
P 156	14	28.6	71.4
P 167	7	100	-
P 178	10	25	75
P 189	4	-	100
P 201	2	100	-
Sum	**260**		

TABLE 18. PASANGAR BURIN FREQUENCIES.

Level	N	simple	dihedral	polyhydric	multiple
P 1	1	100	-	-	-
P 12	0	-	-	-	-
P 23	2	100	-	-	-
P 34	3	100	-	-	-
P 45	0	-	-	-	-
P 56	2	100	-	-	-
P 67	2	50	-	-	50
P 78	2	50	-	-	50
P 89	21	38.1	-	9.5	52.4
P 101	10	60	10	10	20
P 112	5	80	-	-	20
P 123	4	50	25	-	25
P 134	9	66.7	11.1	-	22.2
P 145	8	37.5	-	50	12.5
P 156	8	50	12.5	12.5	25
P 167	6	50	-	33.3	16.7
P 178	5	80	-	-	20
P 189	2	50	-	-	50
P 201	1	-	100	-	-
P 212	2	-	-	-	100
Sum	93				

of the débitage, mostly represented by twisted bladelets (Table 20). In all levels, a large portion of the débitage consists of core rejuvenation and preparation pieces, and an increase was observed in Levels V-AA. This may be the result of using more flakes as core blanks and the need to prepare the flakes for laminar production, resulting in the production of more rejuvenation and preparation pieces. From Level BB downwards, flakes increase significantly. Consistent with the types of cores in the different levels, the first Levallois pieces appear sporadically from the beginning of the early UP along with Kombewa flakes. Blades are present throughout the UP levels with a slightly higher frequencies towards the early UP levels and mostly appear with twisted profiles. In general, the UP levels at Warwasi represent a gradual change from flake to laminar, mostly bladelet, production. It shows that the later UP industry at Warwasi is based on bladelet production, as observed in previous studies (Olszewski 1993a, Olszewski and Dibble 1994), while the early UP is mostly flake based, which confirms the original views of Hole when defining the early and late Baradostian at the Khorramabad sites (Hole and Flannery 1967).

Tools. In terms of tool blanks, the Warwasi UP sequence shows a shift from flakes in the Early Baradostian to an increasing use of twisted bladelets (and blades) in the late UP (Levels L-AA) (Table 21). This stands in stark contrast to the assemblages of Yafteh and Pasangar, in which the use of bladelet (and blade) blanks is most common in the early phase of the UP. At Warwasi, the bottom UP levels show tools made on Levallois flakes; these MP elements gradually disappear higher up in the UP stratigraphy at the site (see Table 21).

The tools at Warwasi are diverse throughout the stratigraphy (Table 22). Different types of retouched bladelets comprise the majority of tools in the upper levels and gradually decrease towards the bottom of UP, where the main types of tools are retouched flakes and Levallois pieces. Retouched blades are present in all chronological phases, although their number increases slightly throughout the UP levels. Carinated scrapers are present only in the upper levels (J-Z). Notches, denticluates, and end scrapers are absent in the bottom UP levels and increase dramatically higher up in the sequence to become well represented in the upper levels (J-P). Truncated-facetted pieces occur in the earliest UP levels, with an increase in frequency in Levels BB-FF. They remain an element of the early UP at Warwasi until the bottom of late UP phase, when they stop being made and used. The same pattern is observed among different

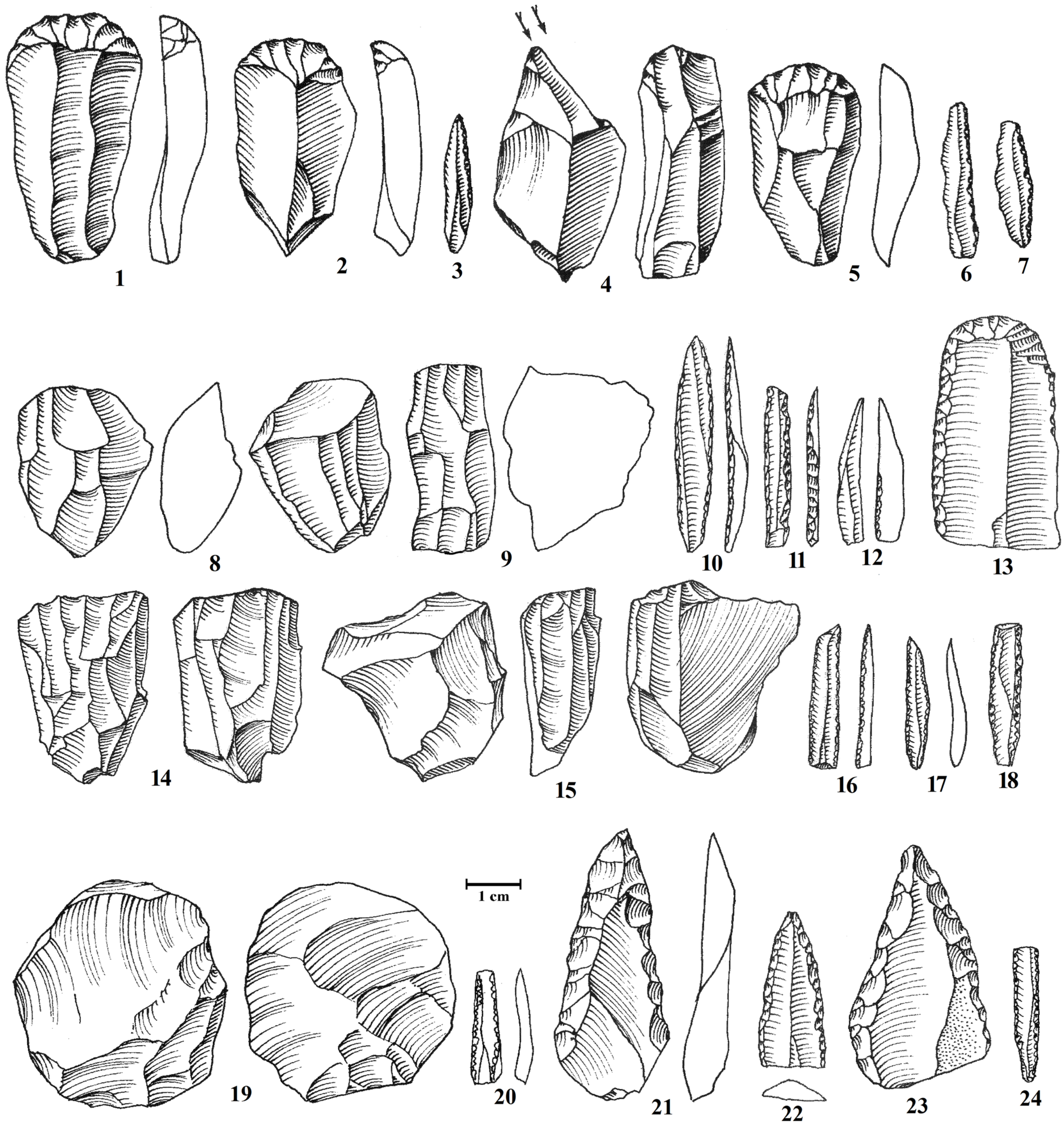


Figure 20. Warwasi artifacts P-U. 1, 2, 5) end scraper, 3, 6, 7, 11, 17) retouched bladelet, 12, 15, 16) backed bladelet, 4, 8, 9, 10, 13, 14) bladelet core, 18) carinated scraper (1–3: P; 4–7: Q; 8–10: R; 11–13: S; 14–15: T; 16–18: U) (modified after Otte and Kozlowski 2007).

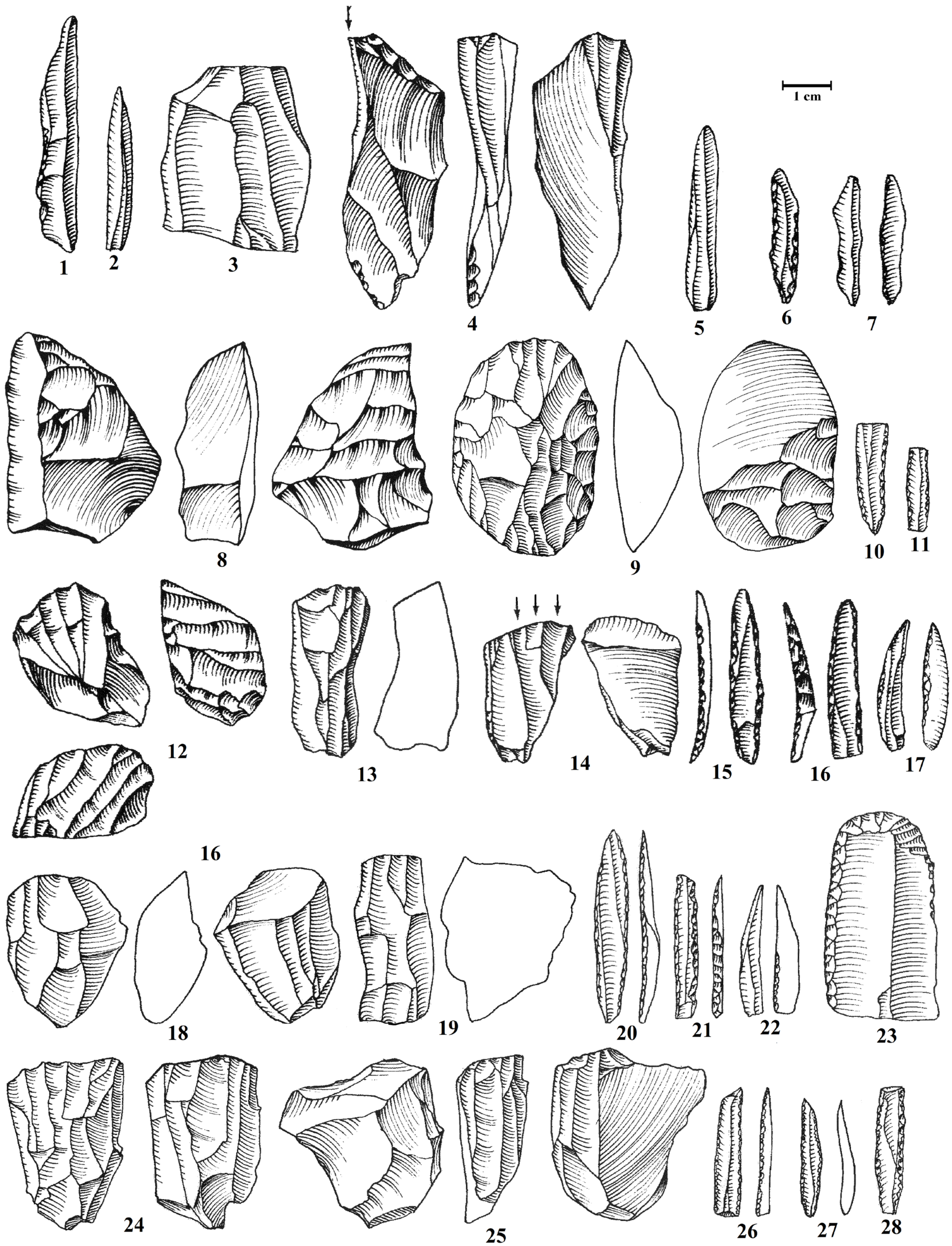


Figure 21. Warwasi artifacts V-CC. 1, 6, 10, 11, 15, 16, 20) retouched bladelet, 2, 5) bladelet, 3) core rejuvenation face flake, 4) burin, 7, 17, 22) inversely retouched bladelet, 8, 12–14, 18, 19, 24, 25) bladelet core, 9) pièce esquillée, 21, 26, 27, 28) backed bladelet, 23) end scraper (1–3: V; 4–7: W; 8: X; 9–11: Y; 12–17: Z; 18–23: AA; 24–28: CC) (modified after Otte and Kozlowski 2007).

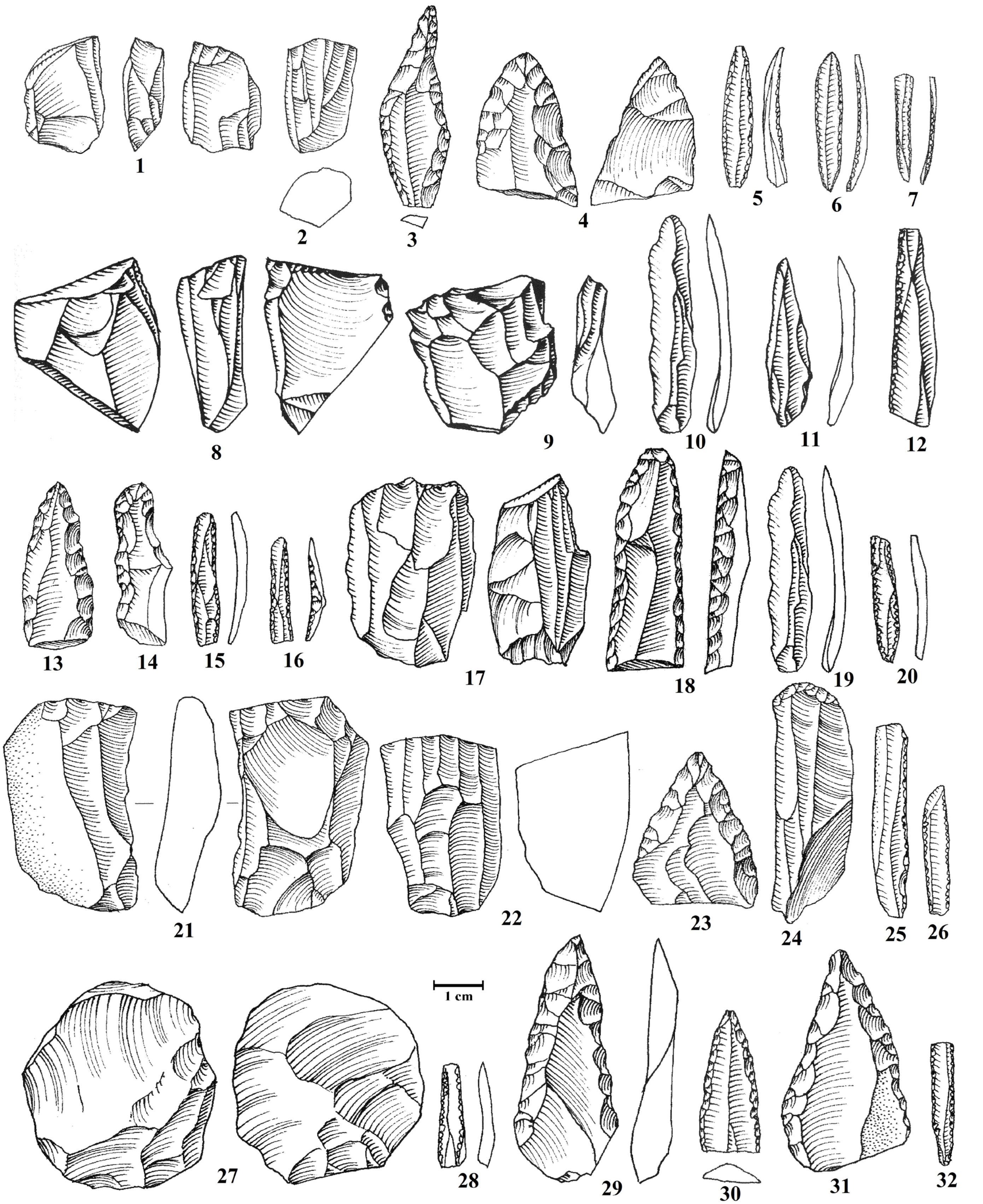


Figure 22. Warwasi DD-LL. 1, 2, 8, 9, 17, 22) bladelet core, 3) borer, 4, 13, 18, 23, 29–31) scraper, 5–7, 12, 15, 16, 20, 25, 26, 28, 32) retouched bladelet, 10, 11, 19) bladelet, 14) denticulate/end scraper, 21, 27) flake core, 24) end scraper (1–7: DD; 8–12: EE; 13–16: FF; 17–20: GG; 21–26: HH; 27–28: II; 29: JJ; 30–31: KK; 32: LL) (modified after Otte and Kozlowski 2007).

TABLE 19. WARWASI CORE FREQUENCIES.

Levels	N	Core Type												Platform Preparation		
		platform blade	platform bladelet	platform mixed blade & flake	carinated scraper	burin	Levallois	platform flake	parallel flake	inclined flake	centripetal flake	discoidal flake	Kombewa	plain	coarse	fine
J	68	-	80.6	-	4.8	-	-	9.7	4.8	-	-	-	-	95.6	2.9	1.5
K	61	1.9	75	3.8	-	-	-	11.5	1.9	-	-	5.8	-	86.9	11.5	1.6
L	56	-	60.6	3	-	-	-	24.2	12.1	-	-	-	-	87.5	12.5	-
M	53	-	88.2	-	-	-	-	7.8	-	-	-	3.9	-	75.5	24.5	-
N	63	-	90.4	-	-	-	-	3.8	-	-	-	5.8	-	90.5	4.7	4.7
O	90	-	78.5	4.4	-	-	-	11.8	-	-	-	4.4	-	83.3	11.1	5.6
P	67	-	76.2	9.5	-	3.2	-	9.5	-	-	-	1.6	-	91	9	-
Q	65	7	91.2	1.8	-	-	-	-	-	-	-	-	-	95.4	3.1	1.5
S	66	2.7	75.7	1.3	1.3	6.8	-	9.5	-	-	-	2.7	-	89.4	10.6	-
T	63	4.5	70.1	4.5	-	10.4	-	7.5	-	-	-	3	-	74.6	25.4	-
U	64	-	86.4	-	1.1	2.3	-	6.8	-	-	-	3.4	-	95.3	4.7	-
V	56	3	80.6	3	-	-	-	10.4	-	-	-	3	-	89.3	10.7	-
W	55	-	75.4	1.8	-	5.2	-	17.5	-	-	-	-	-	87.3	12.7	-
X	24	2.1	91.5	-	-	-	-	6.4	-	-	-	-	-	91.7	8.3	-
Y	42	3.9	96.1	-	-	-	-	-	-	-	-	-	-	88.1	9.5	2.4
Z	57	3.2	79.4	-	11.1	-	-	6.3	-	-	-	-	-	75.4	22.8	1.7
AA	50	4	70	-	10	-	-	4	-	-	-	12	-	94	4	2
BB	64	4.7	48.4	1.6	-	-	-	18.7	23.4	-	-	3.1	-	73.4	7.8	18.7
CC	28	10.7	39.3	3.5	-	-	3.5	28.6	3.5	-	-	10.7	-	75	14.3	10.7
DD	46	4.4	40	6.7	-	-	-	11.1	17.8	-	-	20	-	76.1	15.2	8.7
EE	30	3.3	40	-	-	-	-	30	6.7	-	-	20	-	70	10	20
FF	17	5.9	29.4	5.9	-	-	-	35.3	17.6	-	5.9	-	-	82.3	11.8	5.9
GG	33	-	30.3	-	-	-	-	24.2	36.4	-	-	-	9.1	54.5	21.2	24.2
HH	31	-	25.8	-	-	-	-	25.8	48.4	-	-	-	-	48.4	45.2	6.4
II	26	3.8	7.7	3.8	-	-	-	15.4	65.4	-	-	-	3.8	38.5	30.8	30.8
JJ	27	3.7	18.5	-	-	-	-	29.6	37	3.7	-	3.7	3.7	55.6	33.3	11.1
KK	19	5.2	15.8	-	-	-	-	47.4	26.3	-	-	-	5.2	21.1	42.1	36.8
LL	21	14.3	4.8	4.8	-	-	4.8	23.8	38.1	9.5	-	-	-	38.1	52.4	9.5
Sum	1342															

TABLE 19. WARWASI CORE FREQUENCIES (continued).

Levels	Platform Orientation				Reduction Face		max. size	discard	Core Blank	
	single	double adjacent	opposed	more than 2	narrow	wide			core on flake	cobble
J	71.9	18.7	-	9.4	7	93	28.7	98.5	8.8	91.2
K	70.2	22.8	3.5	3.5	19	80.1	29.1	93.4	4.7	95.3
L	77.8	11.1	1.9	9.3	20.8	79.2	33.4	100	29.2	70.8
M	69.2	19.2	1.9	9.6	21.8	78.2	28	100	14.5	85.5
N	61	23.7	8.4	6.8	37.5	62.5	30.2	100	21.4	78.6
O	69.7	22.5	4.5	3.4	39.1	60.9	28.7	100	20.3	79.7
P	62.1	21.2	10.6	6.1	25.8	74.2	27.2	98.5	17.4	82.6
Q	61.5	32.3	4.6	1.5	43.9	56.1	29.4	95.5	40.9	59.1
S	57.8	18.7	10.9	12.5	59.1	40.9	29.7	98.5	35.4	64.6
T	49.1	33.9	8.5	8.5	52.2	47.7	30.2	100	17.9	82.1
U	51.5	21.9	12.5	14.1	63.3	36.7	28	100	38.9	61.1
V	64.3	16.1	8.9	10.7	59.7	40.3	26.1	100	22.2	77.8
W	46.3	20.4	16.7	16.7	64.7	35.3	28.6	96.4	28.3	71.7
X	52	20	16	12	57.1	42.8	30.7	100	32.1	67.9
Y	59.5	35.7	4.7	-	55.7	44.3	27.4	100	36.1	63.9
Z	50.9	28.1	15.8	5.3	69.1	30.9	30.4	100	32.3	67.7
AA	55.6	30.5	8.3	5.6	46	54	31.5	96	26	74
BB	68.1	12.8	6.4	12.8	15	85	31.4	95.3	15.6	84.4
CC	60	15	10	15	27.3	72.7	35.5	82.1	21.4	78.6
DD	53.1	28.1	6.2	12.5	17.5	82.5	33.2	100	10.9	89.1
EE	48	24	16	12	6.7	93.3	31.8	100	10	90
FF	53.3	20	6.7	20	10.5	89.5	30.1	100	11.8	88.2
GG	38.9	27.8	5.6	27.8	9.3	90.7	32	97	27.3	72.7
HH	47.1	11.8	11.8	29.4	20	80	36.4	100	16.1	83.9
II	42.8	14.3	-	42.8	-	100	33	92.3	23.1	76.9
JJ	42.9	14.3	7.1	35.7	8.3	91.7	34.1	96.3	14.8	85.2
KK	50	25	-	25	16.7	83.3	30.6	94.7	10.5	89.5
LL	57.1	-	-	42.9	33.3	66.7	38	71.4	14.3	85.7

TABLE 20. WARWASI DÉBITAGE FREQUENCIES.

Level	N	twisted bladelet	non-twisted bladelet	twisted blade	non-twisted blade	burin spall	flake	Levallois flake	Levallois blade	Kombewa flake	core rejuvenation & preparation pieces
J	1568	54.5	-	19.2	0.3	1.1	-	-	-	-	24.9
K	1167	63.1	-	19.7	0.1	0.8	5.9	-	-	-	10.5
L	916	53.4	-	22.2	-	1.1	3.5	-	-	-	19.9
M	991	44.8	-	18.7	-	2.8	6.9	-	-	-	26.8
N	930	49.6	-	20.2	-	1.6	7.0	-	-	-	21.6
O	1220	44.3	-	9.6	-	3.3	0.1	-	-	-	42.7
P	996	44.3	-	13.7	0.2	6.0	0.2	-	-	-	35.6
Q	1049	40.9	-	10.7	0.2	5.0	0.1	-	-	-	43.2
S	1196	34.7	-	15.9	0.8	5.0	0.2	-	-	-	43.6
T	1161	49.2	-	12.7	1.0	5.7	0.2	-	-	-	31.3
U	1307	53.9	0.1	8.3	1.3	7.4	0.2	-	-	-	28.7
V	2112	59.7	-	11.4	1.0	3.4	-	-	-	-	24.5
W	326	0.0	-	13.8	0.9	20.2	-	-	-	-	65.0
X	1352	39.1	-	8.2	-	0.2	1.1	0.5	-	-	50.8
Y	1330	39.6	0.1	10.7	0.5	2.7	2.5	-	-	-	43.9
Z	1382	36.7	-	7.2	0.4	2.9	1.7	0.1	-	-	50.9
AA	1262	32.6	0.3	11.2	0.3	2.5	4.8	0.8	-	0.2	47.3
BB	812	20.9	0.5	13.3	1.7	2.8	31.6	4.0	-	-	25.1
CC	668	23.2	0.2	12.9	1.2	0.6	16.2	0.9	0.1	0.1	44.5
DD	599	21.0	0.2	7.8	1.8	1.3	29.0	3.2	0.7	0.8	34.0
EE	543	17.3	-	6.8	0.7	2.6	57.1	3.3	0.2	0.4	11.6
FF	277	18.8	1.4	9.0	4.7	3.6	45.1	4.7	-	0.7	11.9
GG	251	23.9	-	5.6	5.2	6.8	21.1	10.0	0.8	0.4	26.3
HH	296	18.2	0.7	11.8	6.1	1.2	45.6	9.8	0.7	-	6.1
II	337	8.6	1.8	6.8	3.3	2.7	50.4	2.4	0.3	0.9	22.8
JJ	440	8.4	0.9	7.0	2.0	1.4	68.6	1.6	1.1	-	8.7
KK	271	12.9	0.4	7.7	5.9	1.1	58.7	4.0	-	1.1	8.1
LL	201	2.0	1.0	3.5	3.5	-	79.6	8.0	-	0.5	2.0
Sum	**24,960**										

TABLE 21. WARWASI TOOL BLANK FREQUENCIES.

Level	N	non-twisted blade	non-twisted bladelet	twisted bladelet	twisted blade	flake	Levallois flake	core rejuvenation & preparation pieces	other
J	286	19.6	33.2	10.5	13.6	19.9	-	3.1	-
K	206	17.5	14.1	19.9	21.3	25.2	-	1.9	-
L	142	9.1	6.3	28.9	24.6	28.9	-	2.1	-
M	147	6.1	12.9	27.2	21.1	28.6	-	4.1	-
N	160	11.9	11.9	31.9	15.6	25	-	3.7	-
O	143	16.8	5.6	32.2	14.7	28.7	-	2.1	-
P	108	19.4	7.4	26.9	10.2	31.5	-	4.6	-
Q	111	10.8	4.5	36.9	15.3	27	0.9	4.5	-
S	163	12.3	8	23.3	9.2	43.5	-	3.7	-
T	99	14.1	3	20.2	8.1	53.5	-	1	-
U	154	14.3	7.8	17.5	6.5	49.3	-	4.5	-
V	133	12.8	3	21.1	5.3	53.4	-	3	1.5
W	120	11.7	4.2	25	8	41.7	1.7	7.5	-
X	120	7.5	5	12.5	5	63.3	0.8	5	0.8
Y	122	8.2	7.4	9.8	6.5	59	4.1	4.9	-
Z	111	7.2	2.7	15.3	10.8	54.1	6.3	3.6	-
AA	117	8.5	16.2	6.8	11.1	43.6	6.8	6.8	-
BB	123	9.7	8.1	12.1	4.9	56.1	6.5	1.6	0.8
CC	110	8.1	7.3	2.7	4.5	66.4	2.7	7.3	0.9
DD	96	14.6	1	6.2	4.2	59.4	7.3	7.3	-
EE	77	10.4	2.6	5.2	7.8	67.5	5.2	1.3	-
FF	68	17.6	-	4.4	4.4	61.8	4.4	4.4	2.9
GG	73	9.6	5.5	1.4	4.1	63	6.8	9.6	-
HH	67	25.4	3	4.5	4.5	58.2	4.5	-	-
II	42	23.8	-	4.8	2.4	61.9	7.1	-	-
JJ	54	11.1	3.7	-	-	72.2	13	-	-
KK	42	9.5	-	-	-	83.3	4.8	2.4	-
LL	26	3.8	15.4	-	3.8	65.4	7.7	3.8	-
Sum	**3220**								

TABLE 22. WARWASI TOOL TYPE FREQUENCIES.

Level	ret. bld.	ret blt.	ret. flk.	end scr.	notch	denticulate	all burins	strangled bld.	carinated scr.	trunc.	truncated facetted	pièce esquillée	awl	borer
J	18.2	26.6	5.2	9.4	6.3	4.9	2.4	0.7	4.5	1.4	0.3	0.3	-	1.3
K	21.8	24.3	4.9	3.4	6.8	5.8	1.9	1.9	6.3	3.8	-	-	-	0.5
L	15.5	26.1	10.6	4.9	5.6	14.8	2.1	2.1	4.2	6.3	-	-	-	-
M	16.3	31.3	8.8	6.1	6.1	7.5	8.1	2	4.7	1.3	-	0.6	-	-
N	21.9	39.4	-	7.5	5	9.4	3.7	-	3.1	3.1	1.2	1.2	-	-
O	14.7	33.6	8.4	10.5	14.7	8.3	4.9	0.7	-	1.3	-	0.7	-	-
P	7.4	28.7	13	3.7	8.3	12	12	-	3.7	2.7	1.8	-	-	2.8
Q	11.7	40.5	13.5	5.4	6.3	1.8	13.5	1.8	0.9	1.8	-	0.9	0.9	-
S	10.4	28.2	12.3	5.5	6.1	5.5	26.4	1.8	-	1.2	-	-	0.6	0.6
T	8.1	22.2	12.1	7.1	3	1	30.3	1	1	1	2	-	-	1
U	11.7	22.7	17.5	5.2	5.8	0.6	17.5	-	3.2	3.9	1.9	-	1.3	2.6
V	12	22.5	18	3.8	1.5	1.5	24.8	-	5.2	3	-	-	0.7	0.7
W	5.8	25.8	18.3	2.5	1.7	2.5	23.3	-	-	6.6	1.6	-	0.8	1.6
X	10.3	17.9	21.4	5.9	2.6	4.2	28.2	-	1.7	-	2.5	-	-	0.8
Y	10.1	17.6	33.6	-	2.5	4.2	18.4	-	4.2	-	0.8	-	-	1.6
Z	13.5	18	23.4	1.8	4.5	3.6	1.6	-	2.7	3.6	3.6	-	-	-
AA	12.1	21.6	19.8	7.8	3.4	4.3	14.6	-	-	0.8	2.5	-	1.7	0.8
BB	10.6	20.3	33.3	1.6	1.6	0.8	9.7	-	0.8	-	4	0.8	-	-
CC	8.2	9.1	41.8	3.6	0.9	4.5	9.1	-	0.9	0.9	9.1	-	0.9	-
DD	15.6	8.3	30.2	-	4.2	5.2	0.8	-	-	1	5.2	-	-	4.1
EE	18.2	7.8	32.5	1.3	1.3	1.3	6.5	-	-	1.3	7.7	-	-	-
FF	16.2	8.8	35.3	4.4	1.5	2.9	4.4	-	-	1.5	5.8	1.5	2.9	-
GG	9.6	6.8	42.5	1.4	1.4	-	5.5	-	-	2.7	1.4	-	2.7	-
HH	25.5	6	22.4	3	3	-	1.5	-	-	4.4	3	-	3	-
II	25.6	5.1	41	-	-	-	-	-	-	-	2.5	-	-	-
JJ	5.6	3.7	46.3	7.4	3.7	-	3.7	-	-	3.7	1.8	1.8	-	-
KK	4.8	-	71.4	2.4	-	2.4	2.4	-	-	7.1	4.7	-	-	-
LL	7.7	15.4	38.5	3.8	-	-	11.5	-	-	-	1.1	-	-	-

TABLE 22. WARWASI TOOL TYPE FREQUENCIES (continued).

Level	combined tool	Arjeneh point	geometric	thumbnail scr.	nosed scr.	microburin	serrated	ret. Lev. flk	scraper	convergent scr.	dejete scr.	side scr.	Mousterian point	bifacially ret. scr.
J	-	-	14.3	-	-	1.7	0.3	-	3.5	-	-	-	-	-
K	1.4	-	10.2	4.3	-	-	-	-	1.4	-	-	-	-	0.5
L	-	-	1.4	4.2	-	-	-	-	2.1	-	-	-	-	-
M	0.6	-	2	2.7	-	-	-	-	0.6	-	-	-	-	0.6
N	-	-	2.5	-	-	-	-	-	1.8	-	-	-	-	-
O	-	-	-	0.7	-	-	-	-	1.4	-	-	-	-	-
P	1.8	-	-	0.9	-	-	0.9	-	-	-	-	-	-	-
Q	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-
S	-	-	0.6	0.6	-	-	-	-	-	-	-	-	-	-
T	3	-	-	1	1	-	4	-	1	-	-	-	-	-
U	-	-	0.6	-	-	-	0.6	-	3.8	-	-	0.6	-	-
V	-	-	-	-	-	-	-	-	3	-	-	-	-	1.5
W	-	-	-	-	0.8	-	1.7	-	4.1	2.5	-	-	-	-
X	-	-	-	2.5	-	-	-	0.8	0.8	-	-	-	-	-
Y	0.8	-	-	-	0.8	-	-	0.8	2.5	-	-	-	0.8	0.8
Z	-	-	-	-	-	-	3.6	3.6	-	-	-	1.8	-	-
AA	0.8	1.7	-	-	-	-	-	-	1.7	5.2	0.8	-	-	-
BB	0.8	-	-	-	-	-	-	-	8.9	3.2	-	-	-	-
CC	2.7	-	-	-	-	-	-	-	3.6	1.8	-	0.9	-	-
DD	-	-	-	-	-	-	-	-	7.3	7.3	-	2.1	-	-
EE	2.5	-	-	-	1.3	-	-	-	9.1	6.4	-	1.3	-	-
FF	-	-	-	-	-	-	-	-	5.8	5.9	-	1.5	-	-
GG	-	-	-	-	-	-	-	-	15	5.4	-	4.1	-	-
HH	1.5	-	3	-	1.5	-	-	-	11.9	5.9	1.5	1.5	-	-
II	-	-	-	-	-	-	-	-	17.9	5.1	-	2.5	-	-
JJ	-	-	-	-	-	-	-	-	11.1	5.5	-	-	-	-
KK	-	-	-	-	-	-	-	-	-	2.4	-	-	-	-
LL	-	-	-	-	-	-	-	-	-	7.7	-	-	-	-

TABLE 23. WARWASI POINT FREQUENCIES.

Level	N	pointed bladelet	pointed blade	pointed flake	Arjeneh point
J	3	100	-	-	-
K	0	-	-	-	-
L	0	-	-	-	-
M	0	-	-	-	-
N	0	-	-	-	-
O	0	-	-	-	-
P	0	-	-	-	-
Q	0	-	-	-	-
S	0	-	-	-	-
T	0	-	-	-	-
U	0	-	-	-	-
V	0	-	-	-	-
W	2	50	-	-	-
X	3	-	-	-	-
Y	6	50	-	-	-
Z	0	-	-	-	-
AA	7	-	57.1	28.6	-
BB	2	-	-	-	-
CC	5	-	20	-	-
DD	2	-	-	-	-
EE	0	-	-	-	-
FF	1	-	-	-	-
GG	7	14.3	-	-	-
HH	1	-	100	-	-
II	3	-	-	-	-
JJ	0	-	-	-	-
KK	0	-	-	-	-
LL	0	-	-	-	-
Sum	**42**				

types of scrapers, with the exception of nosed scrapers, which appear sporadically throughout the whole UP sequence. Although in small number, thumbnail scrapers are present in the later UP levels.

A striking point about the Warwasi UP tool assemblage is the small number of points (Table 23). Altogether, 42 pointed pieces were recovered from the Warwasi UP, of which only 2 are characteristic Arjeneh points as observed at Yafteh, coming from the top of the early UP phase (Level AA). Most of the points at Warwasi were made on bladelet blanks and occur in the late UP levels, while the few pointed blades occur in the early UP part of the sequence, where points on flakes are also found. The latter gradually replace convergent scrapers that are found only at the bottom of the early UP phase.

Most of the burins (Table 24) are found in the upper levels of the early UP and beginning of the late phase (P-DD). These are mostly simple or multiple burins and comprise the majority of burin types. Most of the burins of all types are made on flakes; among them a very few are core rejuvenation flakes (>3%).

In summary, the UP tools at Warwasi show two different patterns. On the one hand, a gradual change in the number of certain tool types, such as retouched blades, bladelets, and flakes, is present throughout the sequence; on the other, there is a total replacement of certain tools

TABLE 24. WARWASI BURIN FREQUENCIES.

Level	N	Burin Typology				Blank		
		simple	dihedral	polyhydric	multiple	flake	blade	bladelet
J	7	71.4	14.3	-	14.3	100	-	-
K	4	25	-	-	75	100	-	-
L	3	75	-	-	25	100	-	-
M	12	25	-	8.3	66.7	91.7	8.3	-
N	6	16.7	33.3	16.7	33.3	-	-	-
O	7	57.1	14.3	-	28.6	85.7	14.3	-
P	13	-	46.1	23.1	30.8	100	-	-
Q	15	13.3	33.3	13.3	40	66.7	33.3	-
S	43	34.9	27.9	7	30.2	97.7	-	2.3
T	30	36.7	23.3	-	40	93.3	6.7	-
U	27	40.7	25.9	3.7	29.6	85.2	14.8	-
V	33	39.4	21.2	15.1	24.2	81.8	15.2	3
W	28	32.1	-	14.3	53.6	64.3	3.6	-
X	33	57.6	12.1	-	30.3	97	3	-
Y	22	68.2	4.5	9.1	18.2	90.9	9.1	-
Z	18	66.7	-	-	33.3	94.4	5.6	-
AA	17	64.7	5.9	-	29.4	88.2	11.8	-
BB	12	50	33.3	-	16.7	100	-	-
CC	10	50	10	10	30	100	-	-
DD	8	50	25	12.5	12.5	100	-	-
EE	5	-	20	40	40	100	-	-
FF	3	100	-	-	-	100	-	-
GG	4	75	-	-	25	50	50	-
HH	1	100	-	-	-	100	-	-
II	0	-	-	-	-	-	-	-
JJ	2	-	-	-	100	100	-	-
KK	1	-	-	-	100	100	-	-
LL	3	75	25	-	-	100	-	-
Sum	367							

by others, such as carinated and thumbnail scrapers, awls, and borers. These tools, especially carinated and thumbnail scrapers, largely coincide with the shift from Early to Late UP.

TECHNO-TYPOLOGICAL ANALYSIS OF THE LITHIC ARTIFACTS OF GHĀR-E BOOF CAVE, SOUTHERN ZAGROS

The full techno-typological analysis of the Rostamian industry of Ghār-e Boof has been presented elsewhere (Ghasidian 2014). This section includes some brief remarks on the techno-typological aspects of the Ghār-e Boof UP assemblage for direct comparison to the material from the three sites in the West-Central Zagros described earlier.

Cores (Figures 23-26). The majority of the cores in all layers at Ghār-e Boof are made on small river cobbles, a pattern that remains constant throughout the UP layers (III-IV). In Layers IV and IIIb, at the bottom of the UP sequence, the number of cores made on flakes increases, although these cores show the same reduction procedure as those made on small cobbles (Table 25).

In Layer III, despite having more cores on flakes, the size of the cores, in general, is smaller than in other UP levels at Ghār-e Boof, this mostly being due to the intensity of reduction. However, this does not account for 23% of the cores in Layer III that were abandoned before being ex-

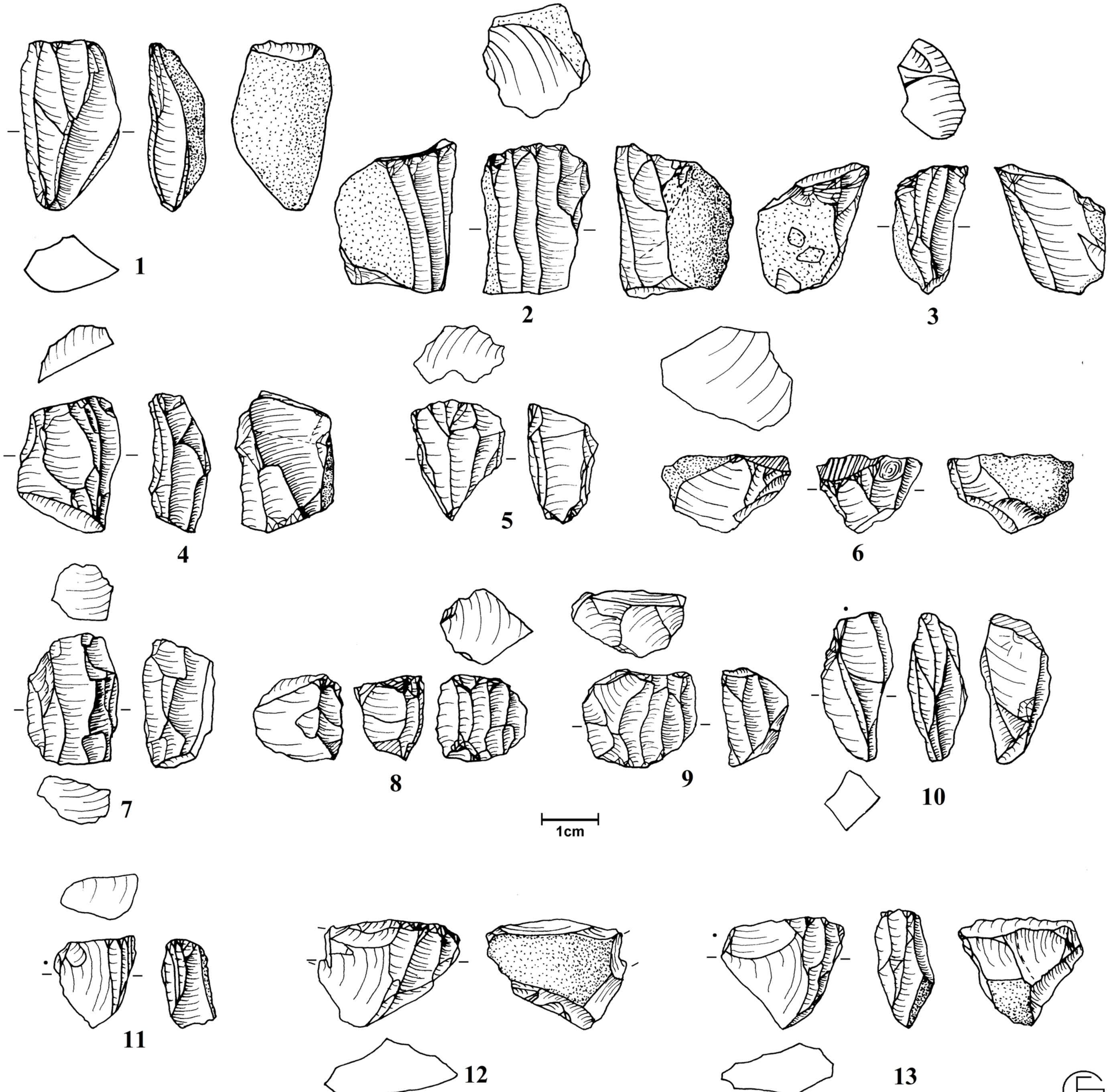


Figure 23. Ghār-e Boof bladelet cores Layer III (modified after Ghasidian 2014).

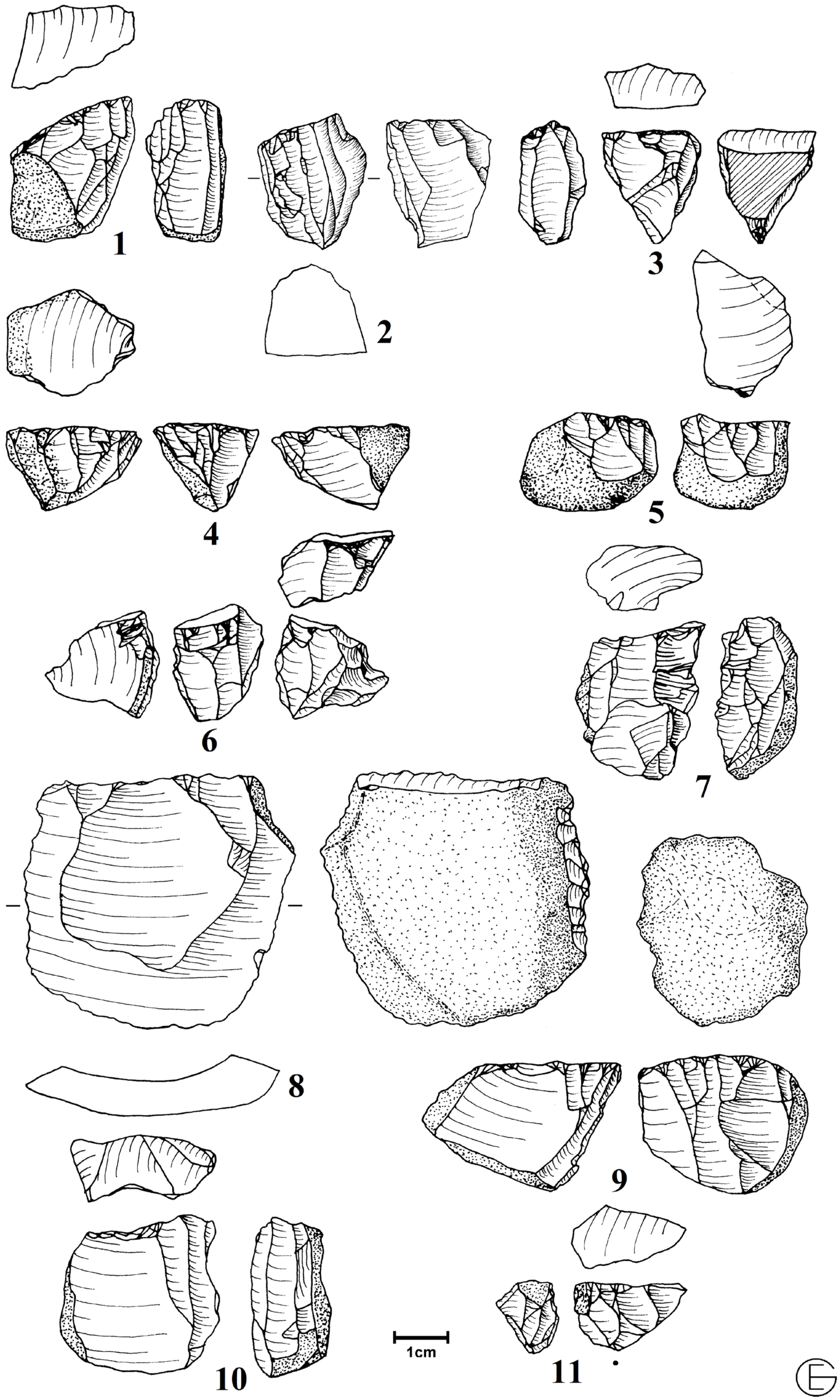


Figure 24. Ghār-e Boof cores Layer IIIa. 1–7, 9–11) bladelet core, 8) Kombewa core (modified after Ghasidian 2014).

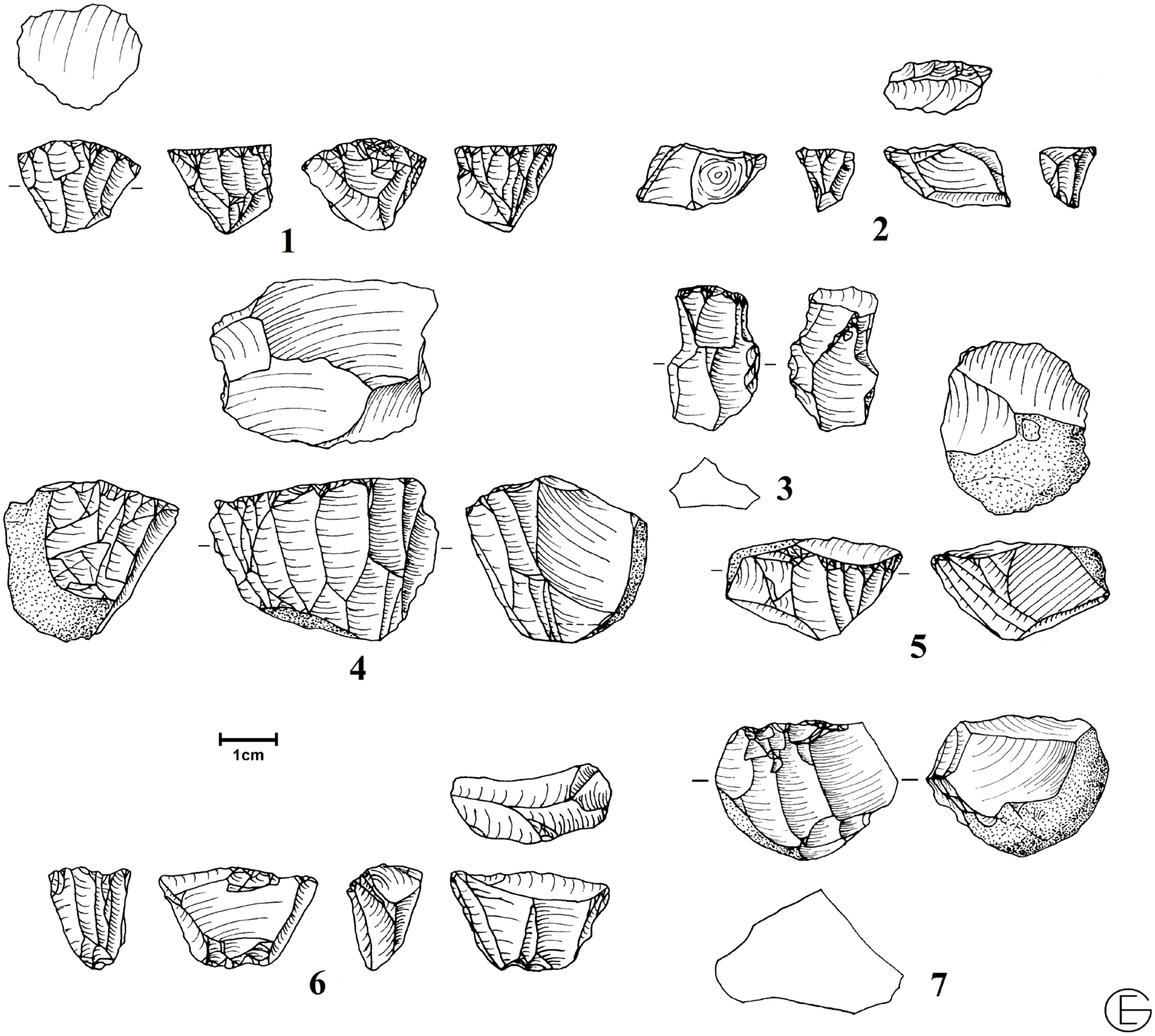


Figure 25. Ghār-e Boof bladelet cores Layer IIIb (modified after Ghasidian 2014).

hausted. This technical signal was also observed at Yafteh and Pasangar.

Most of the cores throughout the sequence at Ghār-e Boof are single platform bladelet cores. Only Layer IV yielded several cores that also have flake scars. The use of carinated scrapers and burins is rare. Discoidal flake cores, which were present in Yafteh and, in higher number, at Warwasi, are almost absent at Ghār-e Boof, where they are limited to two pieces in the upper part of the sequence (see Table 25). A Kombewa core (see Figure 24: 8), deeper in the stratigraphy in IIIa, is an interesting technological trait bearing resemblance to Kombewa cores among the early UP levels of Warwasi (GG-KK).

The platforms of the cores are mostly prepared by removing a single flake. The cores often have single platforms, while the use of opposed and two platform bladelet cores increases towards the bottom of the sequence. The use of cresting for preparing the core reduction surface for bladelet production is uncommon. The preparation of the reduction surface of bladelet cores is mostly done by removing a laminar blank and using the parallel spur as a ridge. Using the broad reduction surface is preferred throughout the UP sequence (see Table 25). The narrow reduction surface is mostly used for cores on flakes. No relation has been observed between using the narrow reduction surface and the increased production of twisted products.

Débitage. Most of the débitage at Ghār-e Boof, in all chronological phases, consists of flakes, many of them resulting from the preparation, rejuvenation, and decortication of the cores. Some of these flakes have laminar

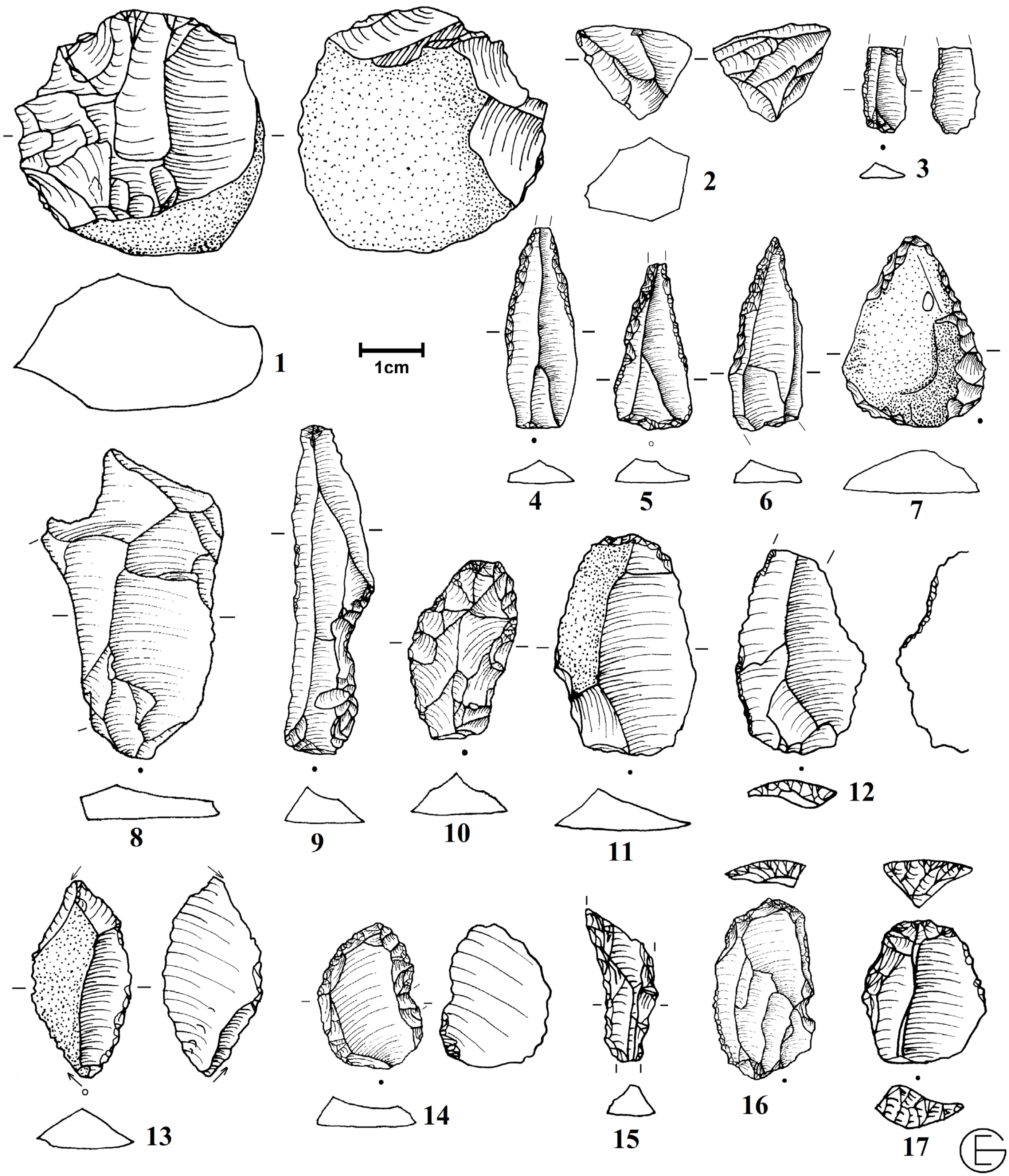


Figure 26. Ghār-e Boof cores and tools Layer IV. 1) flake core, 2) bladelet core, 3) inversely retouched bladelet, 4–6) pointed blade, 7) point, 8) flake, 9) strangled blade, 10) scraper, 11) end scraper, 12, 14) retouched flake, 13) burin, 15) retouched blade, 16) end scraper, 17) double end scraper (modified after Ghasidian 2014).

TABLE 25. GHĀR-E BOOF CORE FREQUENCIES.

Levels	N	Core Type								Platform Preparation		
		platform blade	platform bladelet	platform mixed blade & flake	carinated scraper	burin	platform flake	centripetal flake	Kombewa	plain	coarse	fine
III	401	1	95.3	-	0.2	2.2	0.7	0.4	-	34.7	63.1	2.2
IIIa	54	-	98.1	-	-	-	-	-	1.9	14.8	85.2	-
IIIb	32	1	100	-	-	-	-	-	-	9.4	90.6	-
IV	7	-	71.4	28.6	-	-	-	-	-	-	100	-

TABLE 25. GHĀR-E BOOF CORE FREQUENCIES (continued).

Levels	Platform Orientation				Reduction Face				Core Blank	
	single	double adjacent	opposed	more than 2	narrow	wide	max. size	discard	core on flake	cobble
III	75.3	20.2	4	0.5	19.7	80.2	26.4	77.8	13.7	86.3
IIIa	81.5	14.8	3.7	-	18.5	81.5	29.4	98	7.7	92.3
IIIb	65.6	28.1	6.2	-	17.5	82.5	28.9	96.8	10	90
IV	57.1	14.3	28.6	-	11.1	88.9	31.7	85.7	22.2	77.8

negative scars on the dorsal side. Bladelets are present in high numbers throughout the sequence. The non-twisted profile bladelets are abundant in most layers, IIIa represents the only outlier to this pattern, where twisted bladelets outnumber non-twisted bladelets. Blades are mostly non-twisted as well. Despite the presence of a Kombewa core, no Kombewa flakes were found among the débitage. Among all technological categories, there is no evidence of Levallois technique (Table 26).

Tools (see Figures 26; Figures 27–29). The stratigraphic sequence at Ghār-e Boof shows interesting changes in the use of tool blanks. In the earliest UP phase, preserved in Layer IV, non-twisted blades are the main tool blank, with straight or only slightly curved bladelets. The flakes resulting from the preparation and rejuvenation of cores were frequently used as tool blanks throughout the stratigraphy, decreasing slightly towards the bottom. Layer III is the only layer where twisted blades were used as tool blanks (Table 27).

Consistent with the variation in tool blanks, tool types at Ghār-e Boof vary diachronically (Table 28). Both retouched bladelets and blades are present throughout the stratigraphy, as are scrapers and points. Nevertheless, retouched bladelets become the dominant tool type in the upper archaeological levels, while retouched blades, together with notches, vary in frequency across the levels. Retouched flakes and end scrapers are particularly numerous in the deeper layers. Carinated scrapers are absent in IV, and rare throughout the upper part of the sequence. The upper part of the sequence (III) has the majority of scrapers, pointed flakes, and burins, while denticulates, truncated-facetted, and thumbnail and nosed scrapers only appear in the upper parts of III.

A closer look at points, most of which have semi-abrupt retouch, shows that most of them are made on blades with a straight or slightly curved profile, consistent with the pattern of tool blanks. The points show the characteristics of Arjeneh points and resemble the ones from Yafteh Cave (Table 29). They are most frequent in Layer III.

Burins consist of only simple and polyhydric burins, all of them made on flakes. They are poorly represented throughout the stratigraphy, being mostly found in Layer III (Table 30).

DISCUSSION

CORRELATIONS AND COMPARISONS

The main techno-typological characteristics of Warwasi, Yafteh, Pasangar, Shanidar, and Ghār-e Boof are listed in Table 31. In contrast to the Baradostian of Shanidar, all studied sites show a decline in the number of lithic artifacts toward the bottom of their stratigraphies. These are the main techno-typological similarities and differences:

- The results of the techno-typological analysis are in agreement with the division of the UP at Warwasi into two major chronological phases above Level LL (Olszewski 1999, 2006). Nevertheless, the present analysis considered Levels J-O as still part of the UP sequence, which is usually considered part of the Zarzian Epipaleolithic tradition. Although these levels contain an increasing number of geometrics, they also retain strong UP characteristics, and may indeed reflect the overlap of UP and Epipaleolithic traditions in this part of the Zagros. Throughout the UP levels, there are clear shifts in technology. From Level LL towards the surface, the major shift is marked by the appearance of bladelet production, gradually increasing toward the upper layers. On this basis, the UP at Warwasi was divided into two phases, early and late (Olszewski and Dibble 1994, Tsanova 2013, Otte and Kozlowski 2007). This shift was not obvious at Ghār-e Boof, Yafteh, and Pasangar, where bladelets are the main products throughout the stratigraphy. At Shanidar, a slight change occurred among the lithics towards the end of Baradostian, from 8–9 feet upwards, where the production of flakes significantly declines; however, laminar production remains the main product throughout Cayer C.
- Except in Yafteh, using small cobbles more than flakes as core blanks was preferred at Warwasi, Ghār-e Boof, and Pasangar, as well as Shanidar ('rabots').
- Cores were larger in the bottom levels at Yafteh, Pasangar, and Warwasi. Ghār-e Boof shows a generally smaller size category and stays relatively homogenous with a small increase in size in Layer IV. At Warwasi, the use of flakes as core blanks occurs in the middle levels (AA-Q); at Yafteh, it is observed more frequently in the lower archaeological horizons. At Ghār-e Boof, cores on flakes slightly increase towards the upper layer, while Pasangar does not show a clear pattern. Measurements of the maximum size of the cores at the studied sites shows that using different blanks has no direct effect on the size of the cores.
- The cores throughout the Warwasi sequence, Ghār-e Boof, and Yafteh upper levels (Y90–Y178) are intensively reduced and their abandonment was due to loss of volume. Levels P34 to P167 at Pasangar show the least reduced cores among all sites and yield the largest cores, with enough retaining volume to undergo more reduction.
- Yafteh and Ghār-e Boof comprise the most homogenous pattern of bladelet cores. At Warwasi Levels BB to LL, platform flake cores occur in larger numbers, as well as the parallel flake cores reminiscent of small MP cores, which is unique to the lower part of the Warwasi UP sequence. It was proposed that the occurrence of a small number of bladelet cores in the early UP phase of Warwasi (Levels LL-FF), along with large number of bladelets, might indicate that the latter were imported into the site rather than being produced there (Olszewski 2017).
- In contrast to Yafteh, in Ghār-e Boof, the wide surface of the core was preferred throughout the sequence, with slightly increasing numbers close to the bottom of the UP sequence (IV). At Pasangar, using the broad surface was preferred in the upper levels of P1–P67 and afterwards the pattern changed to using the narrow side

TABLE 26. GHĀR-E BOOF DÉBITAGE FREQUENCIES.

Levels	N	twisted bladelet	non-twisted bladelet	twisted blade	non-twisted blade	flake	Levallois flake	Levallois blade	Kombewa flake	core rejuvenation & preparation pieces
III	4170	5.5	30.7	0.1	5.4	50.6	-	-	-	7.4
IIIa	530	30.2	1.1	-	4.1	57.1	-	-	-	6.5
IIIb	387	16	40.8	-	5.9	31.8	-	-	-	4.9
IV	280	7.1	16.8	1.4	9.6	59.3	-	-	-	5.7

TABLE 27. GHĀR-E BOOF TOOL BLANK FREQUENCIES.

Levels	N	non-twisted blade	non-twisted bladelet	twisted bladelet	twisted blade	flake	Levallois flake	core rejuvenation & preparation pieces	other
GB III	809	17.3	16.6	24.7	1.5	6.3	-	31.6	1.9
GB IIIa	70	15.7	30.1	2.7	-	15.7	-	28.6	7.2
GB IIIb	75	36	25.5	3.8	-	8	-	25.3	1.3
GB IV	24	41.7	25	-	-	12.5	-	20.8	-

TABLE 28. GHĀR-E BOOF TOOL TYPE FREQUENCIES.

Levels	N	ret. bld.	ret blt.	ret flk.	end scr.	notch	denticulate	all burins	carinated scr.	trunc.	truncated facetted	awl & borer	Arjeneh point	geometric	thumbnail scr.	nosed scr.	pointed flk.	scraper	other
GB III	809	20	37.4	11.9	10.3	4.8	2.2	1.5	1.3	0.1	0.1	0.5	5.7	0.3	0.9	0.3	0.3	1.3	1
GB IIIa	70	15.9	40.2	15.9	11	3.7	-	2.4	3.7	-	-	-	1.2	-	-	-	-	4.9	1.2
GB IIIb	75	22.1	29.4	20.6	14.7	2.9	-	-	2.9	1.5	-	1.5	2.9	-	-	-	-	1.5	-
GB IV	24	10.7	17.9	17.9	17.9	3.6	-	3.6	-	3.6	-	-	10.7	-	-	-	7.1	7.1	-

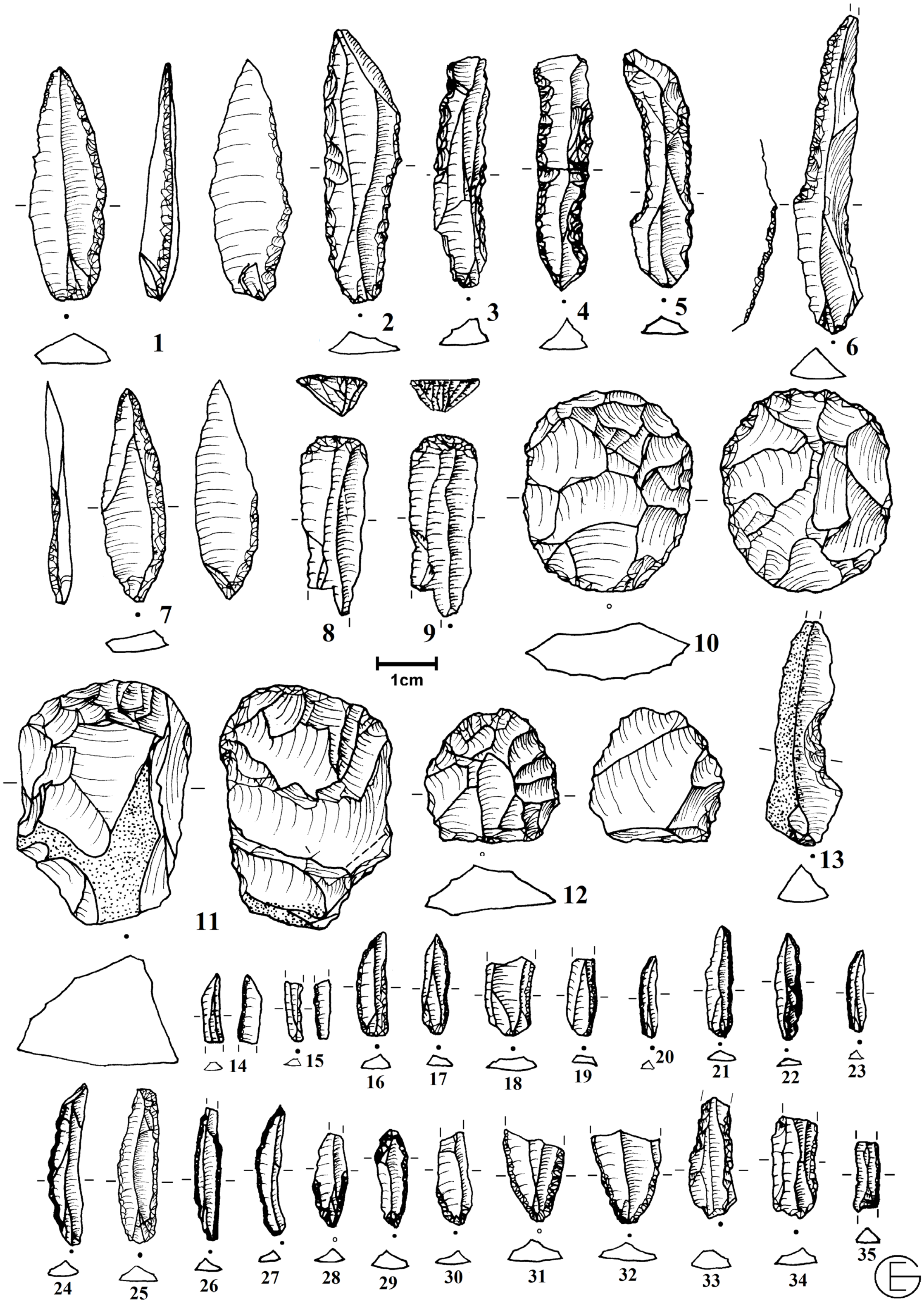


Figure 27. Ghār-e Boof tools Layer III. 1, 7) point, 2) scraper on blade, 3–4) retouched blade, 5, 6) strangled blade, 8, 9) end scraper, 10) bifacial scraper, 11) pièce esquillée, 12) truncated-facetted, 13) notch, 14, 15) inversely retouched bladelet, 16–18, 23–25, 30–32, 34) retouched bladelet, 19–22, 26–29, 33, 35) backed bladelet (modified after Ghasidian 2014).

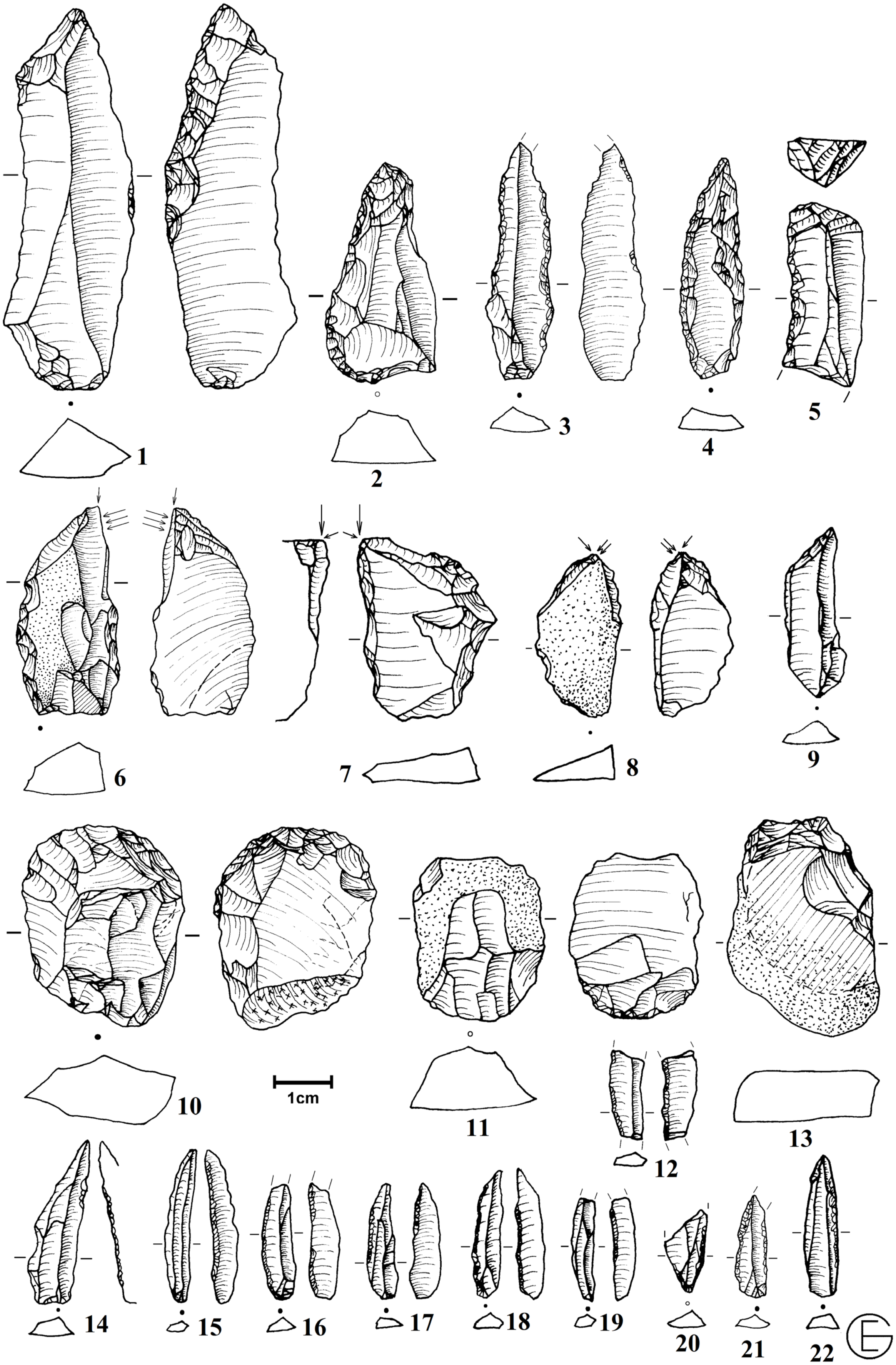


Figure 28. Ghār-e Boof tools Layer IIIa. 1, 2) scraper, 3, 4) point, 6–8) burin, 9) truncated bladelet, 10, 11) pièce esquillée, 12, 14–19) inversely retouched bladelet, 13) awl, 20–22) backed badelet (modified after Ghasidian 2014).

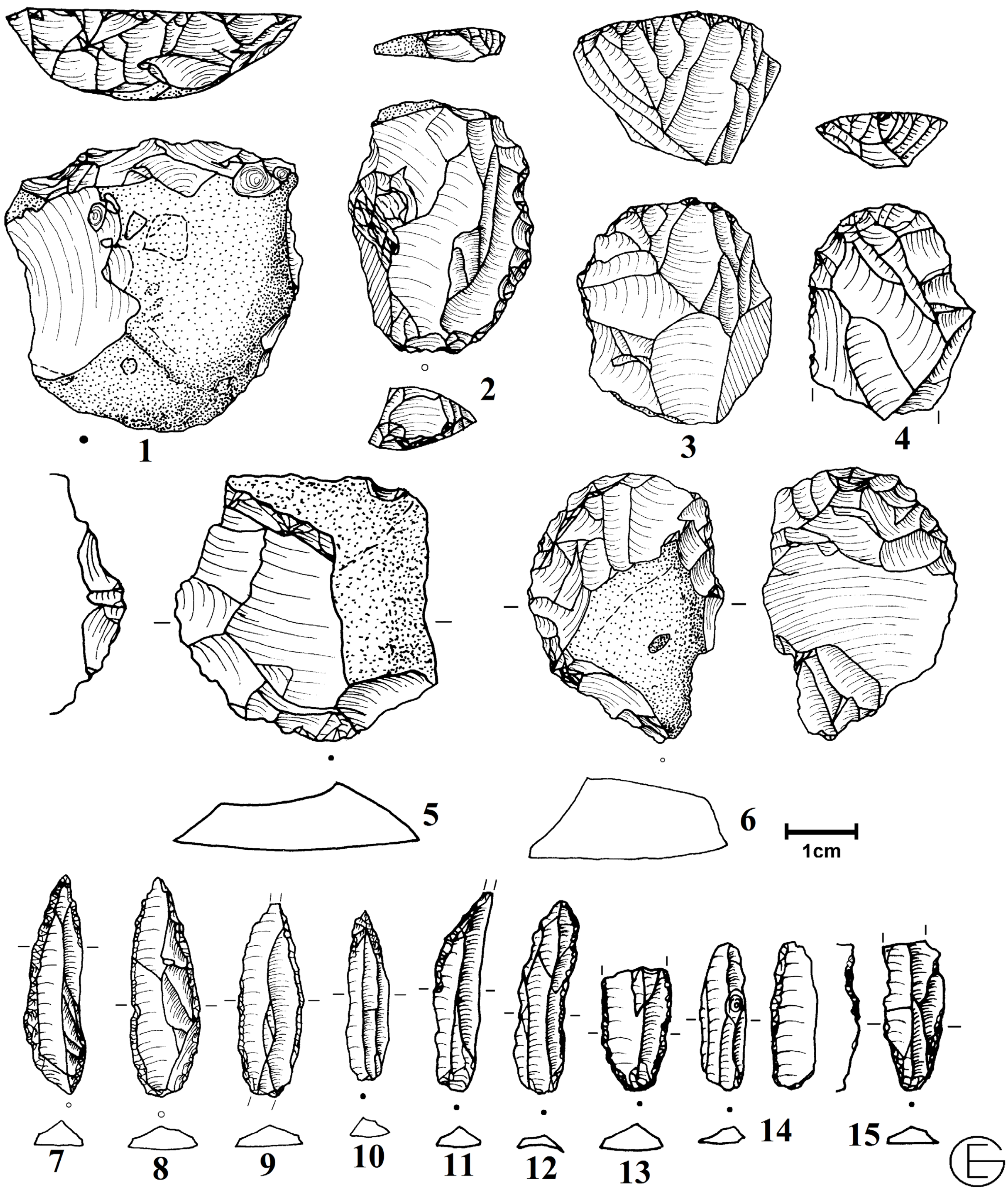


Figure 29. Ghār-e Boof tools Lyer IIIb 1, 2, 4) end scraper, 3) carinated scraper, 5) retouched flake, 6) pièce esquillée, 7–10) point, 11–15) retouched bladelet (modified after Ghasidian 2014).

TABLE 29. GHĀR-E BOOF POINT FREQUENCIES.

Levels	N	pointed bladelet	Arjeneh points	pointed flake
III	46	4.3	91.3	4.3
IIIa	1	-	100	-
IIIb	2	100	-	-
IV	5	-	60	40

TABLE 30. GHĀR-E BOOF BURIN FREQUENCIES.

Levels	N	simple	polyhydric
III	12	75	25
IIIa	2	100	-
IIIb	0	-	-
IV	1	100	-

of the core. However, three patterns were observed in Warwasi—in the upper Levels J-P and the lowermost UP levels of AA-LL, using the wide reduction surface was preferred, while the narrow side was used mostly in Levels Q-Z. At Shanidar, the information on the carinated and busque burins and rabots documents the use of narrow reduction surface (see Figure 8).

- At Ghār-e Boof, the flakes were produced for rejuvenation and maintenance of the cores. However, at Shanidar, Warwasi, Pasangar, and Yafteh (based on the cores and tool blanks), flake production occurred independently in addition to the main laminar products.
- Despite the high number of bladelet cores, flakes (including core preparation and rejuvenation pieces) comprise the majority of tool blanks in Ghār-e Boof. The same pattern was observed at Shanidar. However, Yafteh yielded bladelets (twisted and non-twisted) as the main tool blank, which is proportionate to the cores. In Warwasi Levels J-Q, bladelet, and in Levels S-LL flake, blanks are dominant.
- Except Pasangar, different retouched bladelets are present at all sites as one of the main tool types; their number is different, however, at different sites. Retouched bladelets are the most abundant tools in all Yafteh levels, Warwasi Levels J-Q, Ghār-e Boof Layers III–IIIb, and Shanidar Levels 10–12 (300–350cm).
- At Yafteh, Tsanova documents two major types of bladelet tools, including Arjeneh points, with a relatively curved profile and direct bilateral semi-abrupt retouch and Dufour bladelets with a twisted profile and alternate retouch, both made on bladelet blanks and technologically belonging to the same reduction sequence and strategy (Tsanova 2013: 59). The new analysis of Yafteh shows that the points are quite variable. They are made on both blades and bladelets. The blade blanks are rectilinear with little or no curved profile. More than half of the bladelet blanks for points are twisted. They are often retouched directly on both edges with semi-abrupt to abrupt retouch. The same pattern was observed among the points at Shanidar. Except for one specimen, all points are made on bladelet blanks with a twisted profile (Solecki 1958: 85–87). The points at Pasangar do not show a specific pattern. At Warwasi, most of the points have a straight profile and only two of them are retouched thoroughly and abruptly. At Ghār-e Boof, despite most of the points being made on bladelets, very few of them (2 specimens) have a twisted profile. Most of them have steep retouch, from semi-abrupt to crossed abrupt, and in several cases (n=12; 3 from IIIb and 9 from III) they are backed.
- Notches and denticulates, which comprise of 10% of the assemblage from Shanidar, are not the main tool type at Ghār-e Boof and Yafteh, but are better documented at Pasangar and in the Warwasi late UP. End scrapers as the main tool type throughout Pasangar sequence are well represented in the Yafteh terminal levels, all of the UP sequence of Ghār-e Boof, especially IIIb and IV, and Shanidar 13–14 to 7–8 feet, but are under-represented at Warwasi.
- Burins are well documented in Yafteh, the later UP phase of Warwasi (P-Y), and significantly in Shanidar in Levels 15–16 to 9–10, but only in small numbers at Ghār-e Boof and Pasangar. Retouched flakes are well represented in the entire Ghār-e Boof sequence and the Warwasi early UP levels (mostly BB-LL downwards). These tools are documented in large numbers in all levels of Shanidar Layer C (Solecki 1958: 104); like Ghār-e Boof, most of these retouched pieces are on rejuvenation flakes.

To further explore the extent to which the UP traditions from each of the study sites, except Shanidar, differ, as well as to identify potential archaeological levels that share significant techno-typological features across sites, a discriminant analysis was performed. The analysis aimed at discriminating among the four sites using the incidence of 20 techno-typological attributes in each of 71 archaeological horizons treated as independent cases. Two archaeological levels, one from Yafteh (Y90) and one from Pasangar (P145) were excluded as their restricted range of variability and/or missing data overly influenced the analysis. The analysis was performed with prior probabilities set according to the number of archaeological horizons per site, with 1,000 sample bootstrapping of the canonical functions and their properties, and cross-validation of classification results (i.e., each case is classified by the functions derived from all cases other than that case). The analysis obtained three significant canonical functions (Function 1: Wilk's λ=0.018, x^2=232.492, p<.0.0001; Function 2: Wilk's λ=0.123, x^2=121.670, p<.0.0001; Function 3: Wilk's λ=0.462, x^2=44.823, p<.0.0001) defined by the absolute correlation of particular techno-typological attributes with each function (Table 32). These discriminant functions achieve high levels of correct

TABLE 31. SUMMARY OF TECHNO-TYPOLOGICAL DIFFERENCES THAT DISTINGUISH THE THREE CULTURAL GROUPS FROM THE SOUTHERN AND WEST-CENTRAL ZAGROS MOUNTAINS.

main techno-typological characteristics	Warwasi	Yafteh	Ghār-e Boof	Pasangar	Shanidar
core blank	on cobble are dominant in entire sequence; cores on flake increase slightly in later phase	on cobble are dominant at the bottom and terminal levels; cores on flake increase significantly in intermediate levels	on cobble are dominant in entire sequence; cores on flake increase slightly in early phase	on cobble are dominant in entire sequence	both on cobble and on flake
core type	flake cores (including platform, discoidal and parallel) as well as platform bladelet cores in early phase; platform bladelet cores in later phase	platform bladelet cores dominant in entire sequence	platform bladelet cores dominant in entire sequence	platform bladelet cores dominant in entire sequence, but platform blade and flake cores also present	single platform laminar cores (blade/bladelet) dominant mostly in the middle of the stratigraphy; double platform laminar cores comprises the second largest core type, also dominant in the middle of the occupation
core main reduction face	on broad side in early phase (BB-LL), then on narrow side in late phase (Q-AA) and again on broad side in terminal levels (J-P)	on narrow side in entire sequence except three deepest levels (Y289–Y313)	broad side in entire sequence	narrow side except terminal levels (P1–P67)	N/A
tool blank	flakes in early phase and bladelet dominant in later phase	bladelet dominant, mostly twisted in entire sequence, except bottom levels (Y289–Y313) are non-twisted bladelet dominant; flake and blade dominant in terminal levels (Y90–Y134)	flakes (including core rejuvenation and preparation flakes) and non-twisted bladelets in entire sequence; tendency to use more twisted bladelets in AH III	blades, bladelets, and flakes	flakes are dominant tool blanks; blades (probably including bladelets) are the second most common
main tool type	retouched flakes and blades, scrapers, and truncated-facetted in early phase; retouched bladelets and blades, notches, denticulates and burins in later phase	retouched bladelets and blades, burins, scrapers and end scrapers, and Arjeneh points in entire sequence; end scrapers and denticulates increase in terminal levels	retouched bladelets, retouched blades and flakes, end scrapers, and points in entire sequence	end scrapers, retouched blades and bladelets, notches and denticulates in entire sequence	burins, end scrapers, notches, carinated scrapers, and other kinds of scrapers in entire sequence
débitage	flake based in early phase and gradually become more laminar; in late phase is bladelet oriented	bladelet oriented in entire sequence	consist of mostly flakes but the intended end products are bladelets	blade and bladelet oriented in entire sequence	flakes are dominant tool blanks; blades (probably including bladelets) are the second most common

TABLE 32. POOLED WITHIN-GROUPS CORRELATIONS BETWEEN DISCRIMINATING VARIABLES AND STANDARDIZED CANONICAL DISCRIMINANT FUNCTIONS.

Variables	Function 1	Function 2	Function 3
% of end scrapers	0.421*	-0.199	-0.137
% of bladelet platform cores	0.314*	0.206	-0.100
% of Levallois flakes	-0.313*	-0.163	0.046
% retouched flakes	-0.310*	-0.124	0.247
% convergent scrapers	-0.251*	-0.131	0.037
% parallel flaked cores	-0.238*	-0.124	0.035
% retouched Levallois flakes	-0.233*	-0.122	0.034
% discoid cores	-0.207*	-0.088	-0.044
% sidescrapers	-0.182*	-0.095	-0.027
% geometrics	-0.117*	-0.036	0.018
% retouched bladelets	0.011	0.565*	-0.428
% Arjeneh points	0.122	0.396*	-0.063
% denticulates	0.096	-0.322*	0.067
% notches	0.123	-0.249*	0.173
% narrow side reduced surface	0.154	0.030	-0.419*
% cores on flakes	-0.059	0.177	-0.348*
% bladelets	0.153	0.311	-0.339*
% scrapers	-0.062	-0.115	0.191*
% retouched blades	-0.001	-0.012	0.187*
% all burins	0.031	-0.096	-0.134*

*Largest absolute correlation between each variable and any discriminant function.

classification of each archaeological horizon to its original site of origin (95.8%), even when cross-validated (87.3%). The cross-validated classification results correctly identify 27 of the 28 archaeological horizons from Warwasi as belonging to the site, 17 of the 20 archaeological horizons from Yafteh, 15 of the 19 archaeological horizons from Pasangar, and 3 of the 4 from Ghār-e Boof (Figure 30).

These results suggest that the UP assemblages from each of the four sites as defined by the 20 techno-typological attributes considered are distinct through time, forming largely independent diachronic trajectories that may reflect both cultural and functional differences and relatively small foraging ranges. However, a number of other aspects of these UP assemblages are revealed by the analysis.

First, the two earliest archaeological horizons at the site of Yafteh, although correctly classified as belonging to the site, are clearly different from the rest of the site's assemblage (as measured by the Squared Mahalanobis Distance to the group's centroid). This suggests that these earliest assemblages at Yafteh have unique features which are later lost as the local traditions at the sites develop. The same is the case with horizons W-Z from Warwasi, which, although recognized as sharing more techno-typological attributes with the rest of the assemblage at the site, clearly has unique features (Figure 31).

Second, the misclassified horizons offer insights into moments in the UP history of each site when potential exchanges of information across the sites took place, as reflected by the introduction of techno-typological novelties at a site which are identified in the analysis as typical of a different site/area of the Zagros Mountains. The cross-validated analysis misclassified 9 archaeological horizons (Table 33). Among these misclassifications, it is worth noting that the four earliest horizons at Pasangar are atypical in terms of the subsequent UP tradition at the site and approximate the techno-typological profile of the other two sites in the West Central Zagros, namely Warwasi in the case of the earliest level at Pasangar, and Yafteh for the following 3 levels. This may suggest that the site of Pasangar was originally settled by UP foragers already present in the area, who later developed a UP tradition of local character. It is also interesting to note that the earliest horizon at Ghār-e Boof also differs significantly from the subsequent Rostamian tradition at the site, showing distant techno-typological affinities to the site of Warwasi. The three subsequent UP levels at Ghār-e Boof are correctly identified as belonging to the site with extremely high probabilities (GB III: 0.999; GBIIIa: 0.808; GBIIIb: 0.988), while the classification of GBIV as Warwasi has an associated probability of 0.0001. This means that no archaeological horizon in the dataset approximates the techno-typological profile at the earliest UP level at Ghār-e Boof, strongly supporting the view that the UP in the Southern Zagros is an independent tradition from the one that develops in the West-Central

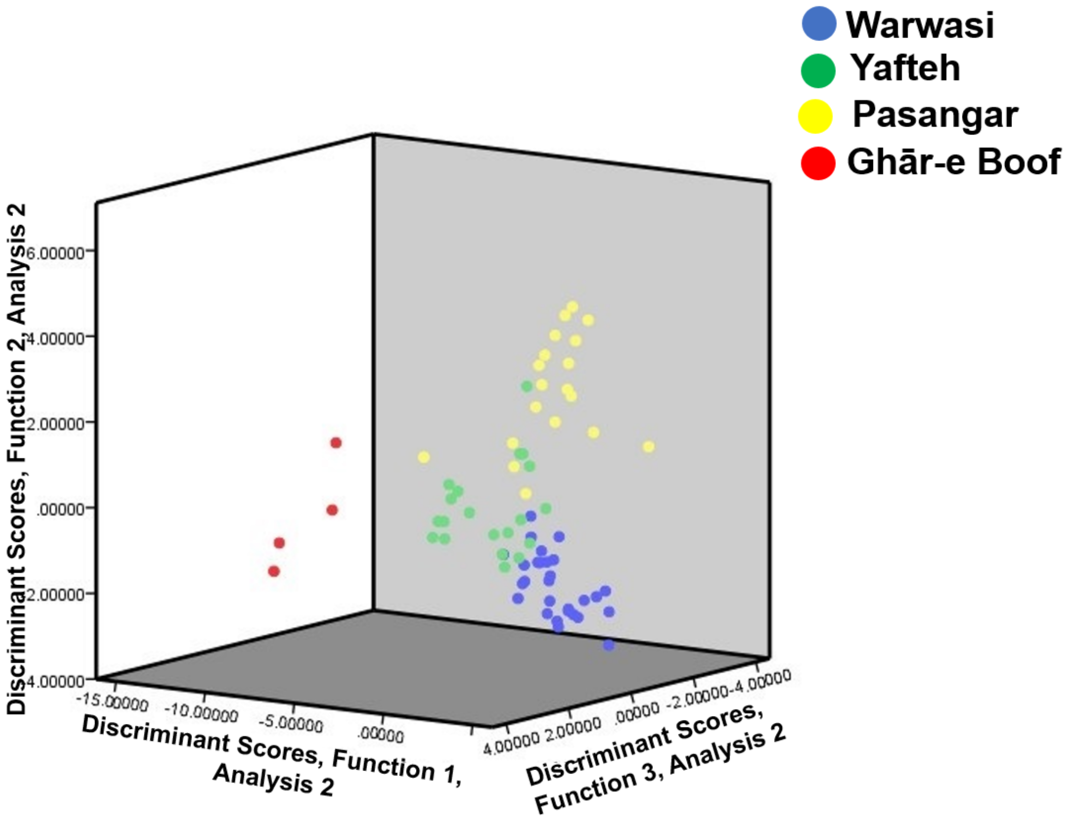


Figure 30. Scatterplot of the three canonical discriminant functions of all archaeological horizons from Warwasi, Yafteh, Pasangar, and Ghār-e Boof.

region of the Zagros.

The techno-typological data on Shanidar documents important differences between the sites. Of particular importance in the typology is the subcategory of "*burins*", "*rabots*" and "*carinated scrapers*" which include both cores and tools in traditional typologies. Many efforts have been made to classify these tools, especially burins in western Europe and the Near East, and to define the boundaries between these tools and cores (Le Brun-Ricalens 2005, de Araujo Igreja et al. 2006 and references therein). Some have proposed the term "core-tools" to deal with the intermediate forms (e.g., the "*nucleiform burin*"/ core-like burin; Solecki 1958). To avoid any problem of mixing tools and cores, all carinated pieces were taken out of the type list entirely and examined according to a set of detailed attributes. Carinated pieces are thus identified on the basis of their technique of manufacture, rather than on the basis of their presumed function. In the typological analysis, the core-like tools were excluded, especially *rabots,* which were described as cores based on the striking platforms and the negative scars of the products. However, concerning burins, in the Shanidar Baradostian the number of 'true' burins was relatively high (36.9%). Compared to the other sites of the Zagros, especially the Southern region, it is striking that carinated scrapers and burins are relatively rare (Ghasidian 2014).

Despite a similar UP chronology for Ghār-e Boof and Shanidar, different types of activities based on local resources available in these two regions imposed different techno-typological characteristics of the lithic assemblages in favor of independent developmental trajectories for early UP in Northern and Southern Zagros.

In sum, techno-typological aspects show that the three UP assemblages of late Warwasi, Yafteh (mostly Y90–Y134), and Pasangar are similar. This may imply that the makers of these assemblages existed as contemporaries with cultural exchanges, since they evidently shared several significant common traits that would otherwise not be realized. Considering lithic technological aspects as cultural factors, at least three cultural groups are recognized in the Zagros Mountains region. These developed in different ecological zones, the Dasht-e Rostam-Basht region in the Southern area, Lorestan (i.e., Khorramabad) and the Kermanshah plains in the West-Central area, and Shanidar in the Northern Zagros Mountains. Based on the techno-typological elements, these cultural groups were independent, but in the later phases of the UP, the techno-complexes of Warwasi, Yafteh, and Pasangar came to somewhat resemble each other. Ghār-e Boof remains apart.

EARLY AND LATE BARADOSTIAN

Hole and Flannery defined the two phases of early and

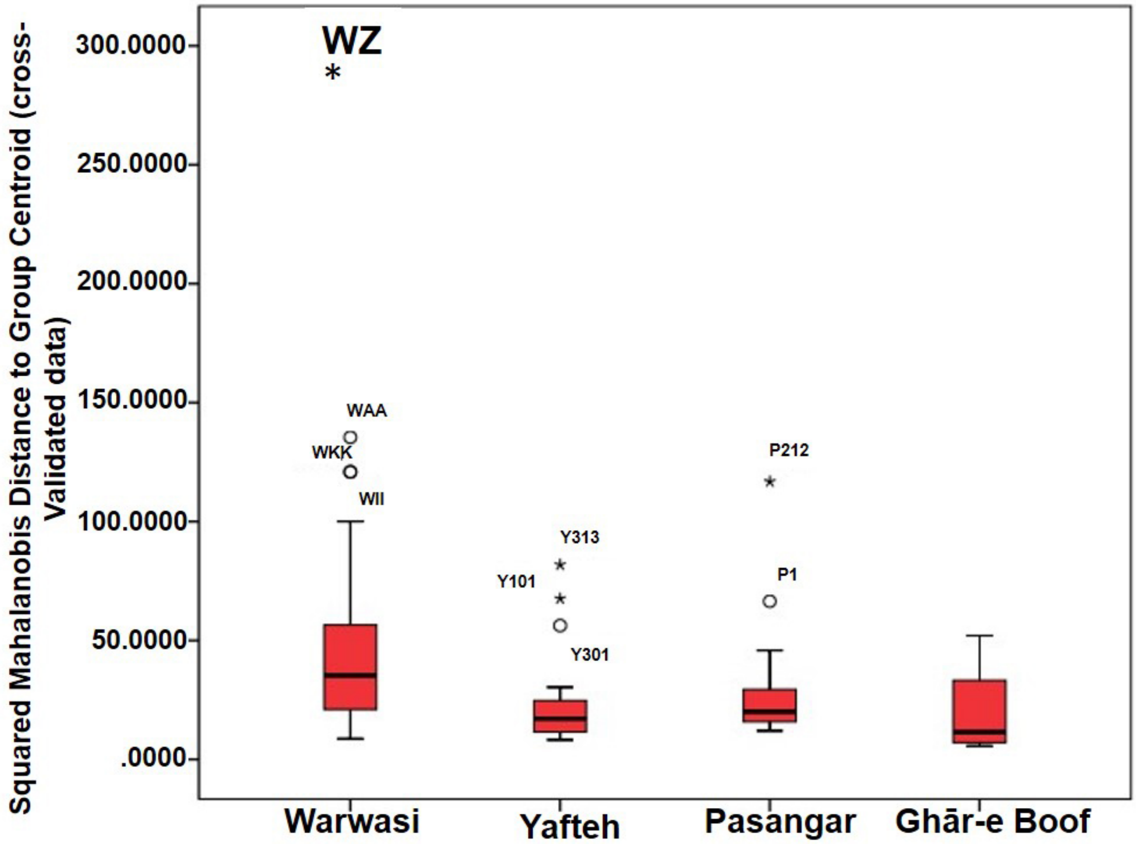


Figure 31. Distribution of Squared Mahalanobis Distance values to each site's group centroid.

late Baradostian and documented them in the three shelter sites of Gar Arjeneh, Yafteh, and Pasangar. The production of flakes was dominant in the early phase of Baradostian and bladelet production, despite its appearance in Early Baradostian, only became frequent in Late Baradostian. In all, the size of the artifacts became smaller (Hole and Flannery 1967: 157: Figure 5). As Figure 32 shows, the changes mostly appeared in the abundance of each tool instead of new types. This division was not documented at a single site in Khorramabad. In defining the Baradostian early and late phases, Hole (Hole and Flannery 1967) put several assemblages including Gar Arjeneh, Yafteh, and Pasangar together with Kunji and Ghamari in order to reconstruct the changes from the MP Zagros Mousterian through the

TABLE 33. THE MISCLASSIFIED NINE ARCHAEOLOGICAL HORIZONS IN CROSS-VALIDATED ANALYSIS.

Archaeological Horizon	Actual Site	Predicted Site of Origin*
WGG	Warwasi	Yafteh
Y101	Yafteh	Warwasi
Y112	Yafteh	Pasangar
Y190	Yafteh	Warwasi
P178	Pasangar	Yafteh
P189	Pasangar	Yafteh
P201	Pasangar	Yafteh
P212	Pasangar	Warwasi
GBIV	Ghār-e Boof	Warwasi

*on the basis of 20 techno-typological attributes.

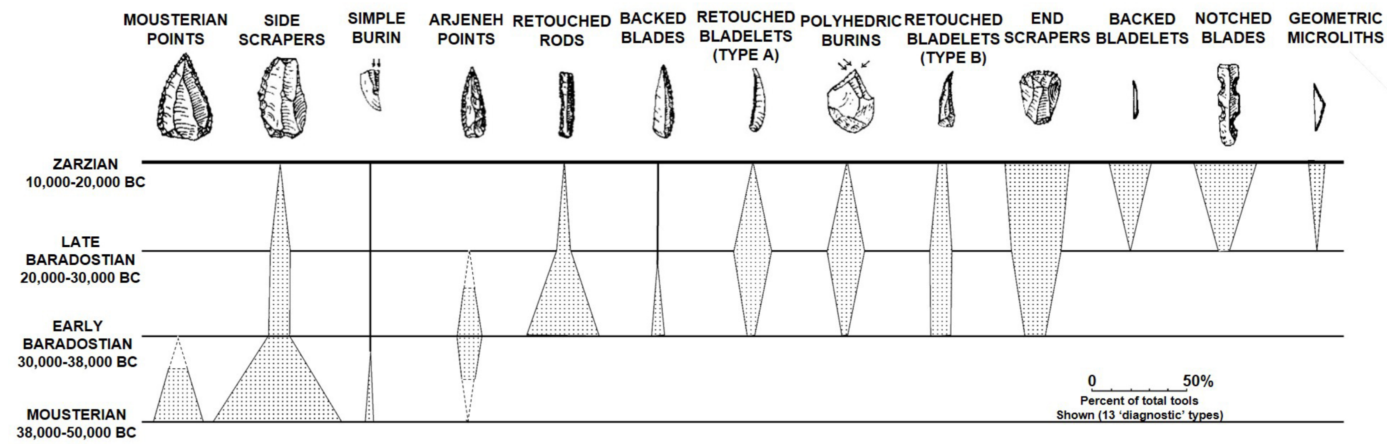


Figure 32. Different tools during the MP, UP, and Epipaleolithic of the Khorramabad sites (after Hole and Flannery 1967).

Epipaleolithic Zarzian, since no site provided Paleolithic sequences of the MP to Epipaleolithic. Each site rather represented a single occupation.

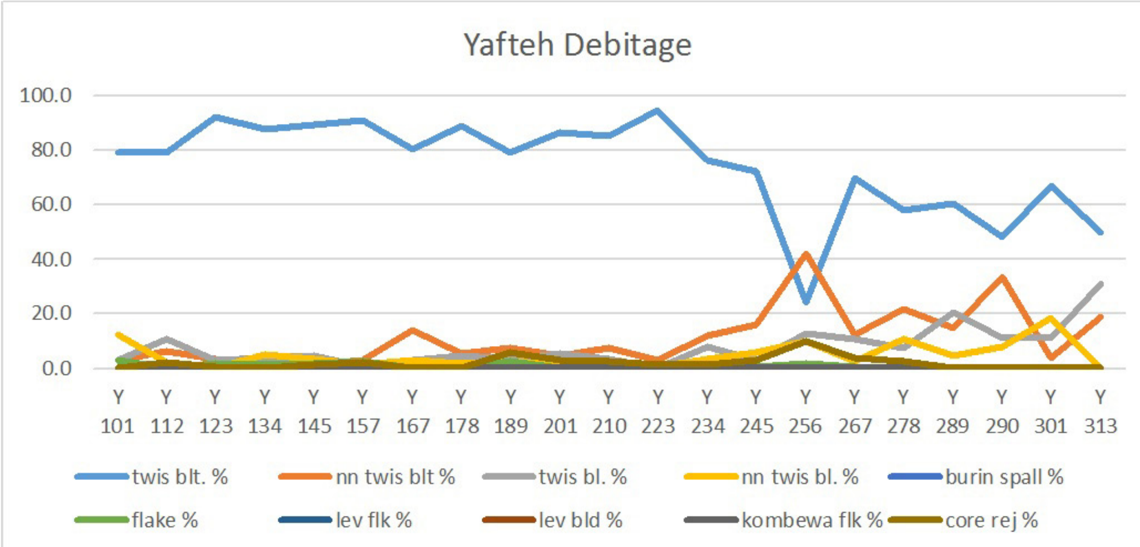
The most striking point of the Yafteh lithics is the homogeneity of bladelet production. Previous analysis of Yafteh documents the division between the early and late phase, being reflected mainly in the size of the bladelets (Bordes and Shidrang 2012; Hole and Flannery 1967; Tsanova 2013). This decrease towards the upper parts of the deposits and the production of bladelets from cores on flake blanks (= burins; Tsanova 2013) increases. However, the present analysis shows that using flakes as cores for bladelet production, as proposed in previous research, to obtain smaller twisted and standardized bladelets (Bordes and Shidrang 2012) occurs throughout the sequence. Both phases showed the same scheme of blank production, as bladelets remained the main product, even among the débitage, throughout the sequence. The change occurred gradually without any sharp breaks in certain tool blanks or débitage. The notable change among the débitage is in the number of twisted bladelets versus non-twisted ones in Level 256. Comparing the débitage and tool blanks with the core blanks diagram shows no direct relationship between the core types and the end products (twisted vs non-twisted bladelets) (Figure 33).

The situation among the tool types is rather different. Tsanova suggested that the points (including Arjeneh) are domestic tools of the Early Baradostian at Yafteh which disappear during late Baradostian (Tsanova 2013: 58). The production of Arjeneh points as one of the main tools at Yafteh decreases dramatically at Level 223. This pattern was observed only for this tool type. Other tools fluctuated in number throughout the levels but were not replaced completely. In general, the tools at Yafteh do not show a bimodal pattern, but change rather gradually. These changes are considered an adaptation mode rather than stemming from chronological origin, since the dating of Yafteh levels 150 and 210–245 are dated to the same phase at ca. 38 ka (Otte et al. 2011), possibly due to taphonomic reasons.

Reviewing part of the Yafteh materials from the excavation in 1965, which are stored in the National Museum of Iran, shows a different pattern (Bordes and Shidrang 2012). Despite the lack of clear stratification, Bordes and Shidrang propose two main assemblages, as '*the upper layers*' contain small twisted bladelets with alternate retouch (Dufour bladelets, *Roc-de-Combe* sub-type), mostly produced from lateral carinated burins, while the '*base of the sequence*' contains long bladelets with a curved or rectilinear profile. Based on these traits and some special tools at Yafteh including Arjeneh points, '*retouched rods*,' and Dufour bladelets, the authors document similarities between the Yafteh UP and contemporary industries in the Near East and Europe (Bordes and Shidrang 2012). However, in the present analysis on all levels, no changes in the lithics that could be assigned to chronology were observed. Bladelet production (including Dufour) occurs throughout the sequence, and, in fact, the whole industry was always bladelet oriented. The twisted bladelet production among the débitage comprises the majority throughout the sequence and flakes were not significant, even in the early phases, and showed no significant break dividing two early and late phases.

The recently excavated site of Kaldar in the Khorramabad Plain provided both MP and UP lithic assemblages. Techno-typological analysis of the UP lithic industry documented no change in the UP sequence and no division between early and late phases was mentioned (Bazgir et al. 2017).

The situation at Warwasi is rather different. The diagram plotting the Warwasi débitage shows that there is a correlation between flake and bladelet production (Figure 34). At ca. Level AA-Z where the production of flakes is at a minimum, bladelets as well as core rejuvenation elements increase. Almost all of these bladelets are twisted in profile. The situation is different concerning the typology. The use of flake blanks decreases upwards in the stratigraphy, while bladelets and blades increase. Among the tools, the significant replacement of retouched flakes with retouched bladelets (Dufour) occurs ca. at Levels BB-Z. Arjeneh points, as a significant marker of the early UP phase in Yafteh, are less important at Warwasi, the same happening with end



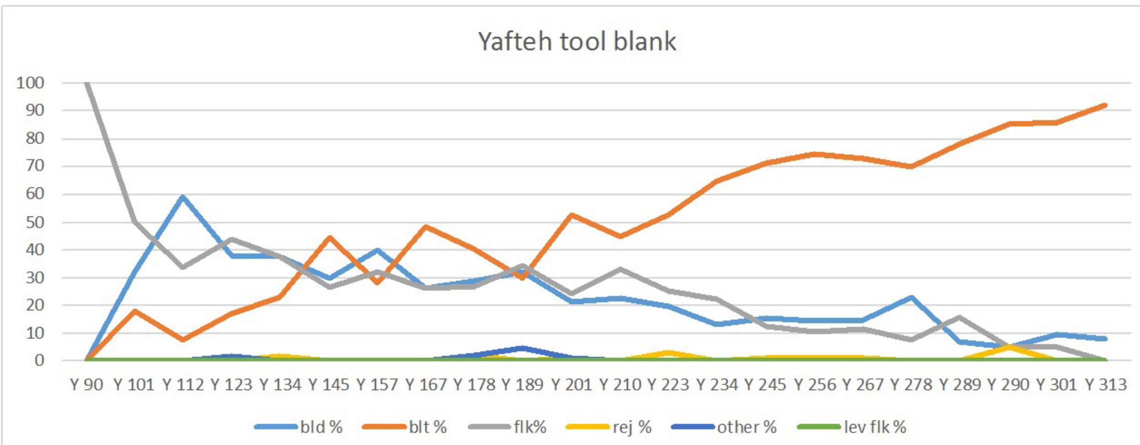


Figure 33. Yafteh débitage and tool blanks comparisons.

scrapers. The Warwasi lithics confidently demonstrate the abrupt changes in the UP sequence that could be related to chronological changes through time as proposed by Olszewski (1993a, 1999).

For Shanidar Layer C, Solecki did not recognize early and late phases in either tool blanks or tool types. However, the tools made on flakes appear to be less frequent in upper Layer C. Despite blade blanks being more frequent throughout the stratigraphy, they increase at the end of the UP phase. The distribution of the tool types does not show a significant pattern indicating change through time. Certain tool types, including nosed, carinated, and thumbnail scrapers are more frequent at the top of Layer C. In the lower levels (ca. Levels 10–11 to 15–16), points (including Mousterian and Font-Yves points) are more abundant than in other levels. Looking at the cores' negative scars throughout Layer C documents that laminar production (blades/bladelets) remained the most important element, however, at Levels 8–9 to 11–12, flakes are as equally important as blades and bladelets. In general, no clear pattern showing early and late Baradostian phases can be seen based on the Shanidar lithic artifacts.

In the Ghār-e Boof case, despite the high homogeneity of the artifacts, the sequence shows minor changes, especially Layer IIIa and above compared to Levels III and IIIb, a pattern seen only among the tool blanks. Overall, techno-typological characteristics show high homogeneity in the Rostamian lithics (Ghasidian 2014).

CHRONOLOGICAL RELATIONS AMONG THE ZAGROS UP SITES

A relatively good chronological frame work is available for the Zagros UP (Beccerra-Valdivia et al. 2017) based on the dates available from Shanidar in the Northern (Solecki 1958, 1963), Yafteh in the West-Central (Hole and Flannery 1967, Otte et al. 2011, Zwyns et al. 2012) and Ghār-e Boof in the Southern Zagros (Ghasidian 2014) (Table 34). Dates are also available for the other UP sites of the Zagros, namely Eshkaft-e Gavi and Kaldar. The dating from Eshkaft-e Gavi in the Southern Zagros is considered less valid due to its reverse chronology (Rosenberg 1985). Additionally, due to the small number of reliable dates (three), the dating of Kaldar in the West-Central Zagros was not considered in UP dating modelling (Becera-Valdivia et al. 2017: 63).

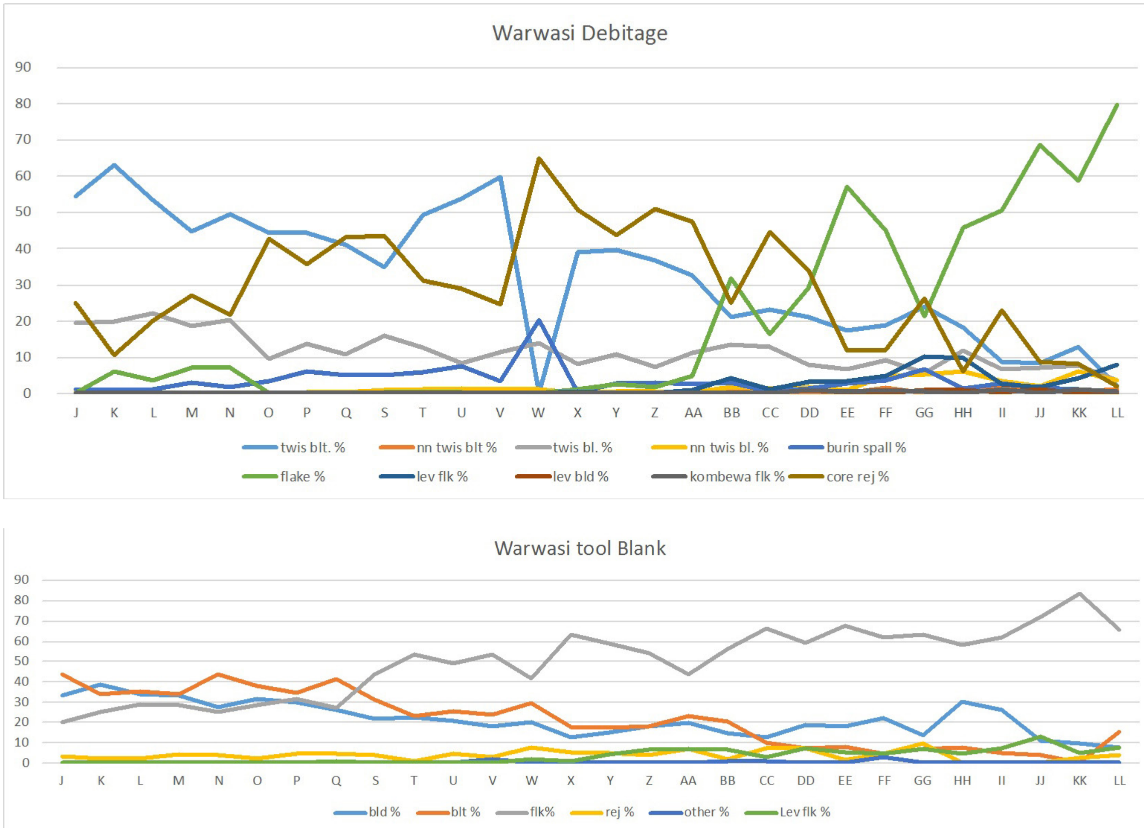


Figure 34. Warwasi débitage and tool blanks comparisons.

The absolute chronology provided for the Paleolithic layers of Yafteh, from both old (Hole and Flannery 1967) and new excavations (Zwyns et al. 2012), shows that the cave was occupied over a long time from at least 34 to 24 ka BP and associated with homogenous techno-typological lithic artifacts through time. The main occupation at Yafteh occurred in the Early Baradostian, which was dated approximately between 34 to 33 ka (uncal. BP). However, recent Bayesian modeling of the Yafteh radiocarbon dates documents a duration of occupation of ca. 4000 years between 39 and 36 ka (Beccera-Valdivia et al. 2017).

The 5 absolute dates available from Ghār-e Boof place the UP occupation in this cave between 36 and 31 ka (uncal. BP). Layer C at Shanidar Cave is dated between 35 and 28 ka (uncal. BP) (Solecki 1958, Vogel and Waterbolk, 1963).

Recently, in an attempt to provide a chronology on MP-UP transitional layers, Becerra-Valdivia et al. (2017) put together the published data on the chronology of the dated UP sites of the Zagros. They provided calibration and Bayesian modelling of radiocarbon determinations using the OxCal 4.3 and the IntCal13 calibration curve. This model is mostly based on the data from Ghār-e Boof, Shanidar, and Yafteh caves. In addition to the published data (Ghasidian, 2014), the model includes two new dates from Ghār-e Boof. This model places the start of the UP in this cave at 41,950–39,850 cal. BP (68.2% probability). Based on the published radiocarbon data at Yafteh (Otte et al. 2011), a date boundary for the beginning of the UP in this cave is at 38,850–38,000 cal. BP (68.3% probability) (Becera-Valdivia et al. 2017). Since the majority of the artifacts come from the middle and lower parts of the UP occupation, the major UP occupation at Shanidar dates to the time frame between ca. 43–38 ka BP, which is roughly contemporaneous with Ghār-e Boof. Bringing these data together with a statistical analysis of previously published radiocarbon determinations of Shanidar Cave in UP-age modelling shows the start boundary for the UP in the Zagros Mountains (45,250–40,000 cal BP at 68.2% confidence) (Figure 35). This age estimation does not significantly predate, but is more or less at the same estimated date range of the beginning of the UP in the Levant and Europe (Alex et al. 2017; Becera-Valdivia et al. 2017), indicating simultaneous occurrence of the UP in Iran and adjacent regions. These results neither confirm the idea of the Zagros as the birthplace of the Aurignacian as proposed (Otte and Kozlowski 2004) nor its origin from a local MP (Otte et al. 2007).

PHYSIOGEOGRAPHICAL VARIABILITIES: NORTHERN, WEST-CENTRAL AND SOUTHERN ZAGROS AND THE GEOGRAPHICAL DISTRIBUTION OF THE BARADOSTIAN

Geographic positions and the environmental contexts of each site have a direct effect on the distribution of resources. This information could provide explanations for the cultural changes and/or differences, ones that are directly

TABLE 34. DATING AVAILABLE ON THE UP SITES OF THE ZAGROS.*

Site	Layer/Depth From Surface	Paleolithic Period	Radiocarbon Date BP	Calibrated Date
Yafteh Cave	125cm	UP/Zagros Aurignacian	24470±280	29252±374
Yafteh Cave	150cm	UP/Zagros Aurignacian	33400±840	38300±1049
Yafteh Cave	Y6e 200	UP/Baradostian	34800+2900/-4500	
Yafteh Cave	Y4e 201	UP/Baradostian	32500+2400/-3400	
Yafteh Cave	Y4e 201	UP/Baradostian	29410±1150	
Yafteh Cave	210.5cm	UP/Zagros Aurignacian	33800±330	38629±528
Yafteh Cave	Y6e 212	UP/Baradostian	30860±3000	
Yafteh Cave	213cm	UP/Zagros Aurignacian	32190±290	36755±384
Yafteh Cave	213.5	UP/Zagros Aurignacian	33160±240	37879±450
Yafteh Cave	226.5cm	UP/Zagros Aurignacian	32900±290	37584±501
Yafteh Cave	234cm	UP/Zagros Aurignacian	33260±300	37957±473
Yafteh Cave	236cm	UP/Zagros Aurignacian	33430±310	38118±471
Yafteh Cave	240cm	UP/Zagros Aurignacian	35450±600	40510±672
Yafteh Cave	245cm	UP/Zagros Aurignacian	33330±310	38020±474
Yafteh Cave	Y4e 250	UP/Baradostian	21000±800	
Yafteh Cave	251	UP/Zagros Aurignacian	31120±240	35696±388
Yafteh Cave	258.5	UP/Zagros Aurignacian	34360±340	39437±479
Yafteh Cave	260	UP/Zagros Aurignacian	32770±290	37435±491
Yafteh Cave	Y6e 260	UP/Baradostian	38000+3400/-7500	
Yafteh Cave	266.5	UP/Zagros Aurignacian	33520±330	38212±495
Yafteh Cave	273	UP/Baradostian	34160±360	39220±518
Yafteh Cave	Y6e 280	UP/Baradostian	31760±3000	
Yafteh Cave	Y4e 278	UP/Baradostian	>36000	
Yafteh Cave	Y4e 280	UP/Baradostian	34300±2100/-3500	
Yafteh Cave	Y4e 285	UP/Baradostian	>40000	
Yafteh Cave	Y4e 290	UP/Baradostian	>35600	
Eshkaft-e Gavi	P-2861 spit 12/16	UP/Baradostian	27640	
Eshkaft-e Gavi	P-2862 spit 12/16	UP/Baradostian	28000	
Eshkaft-e Gavi	P-2863 spit 18	UP/Baradostian	24240+3110/-2180	
Eshkaft-e Gavi	P-2864 spit 17	UP/Baradostian	18150±1500	
Eshkaft-e Gavi	P-2865 spit 19	UP/Baradostian	19230+4310/-1340	
Eshkaft-e Gavi	P-2866 spit 24	UP/Baradostian	27300	
Shanidar	C	UP/Baradostian	28700±700	32148-29353
Shanidar	C (ca. 304.8cm)	UP/Baradostian	29500±1500	35908-29048
Shanidar	C (ca. 457.2cm)	UP/Baradostian	<34000	
Shanidar	C	UP/Baradostian	33300±1000	38196-33476
Shanidar	C	UP/Baradostian	33900±900	38566-34256
Shanidar	C	UP/Baradostian	34000±420	37600-35218
Shanidar	C	UP/Baradostian	35440±600	39386-36856
Shanidar	C	UP/Baradostian	34540±500	38390-36079

TABLE 34. DATING AVAILABLE ON THE UP SITES OF THE ZAGROS (continued).*

Site	Layer/Depth From Surface	Paleolithic Period	Radiocarbon Date BP	Calibrated Date
Ghār-e Boof	III	UP/Rostamian	31150+250/-240	35152±368
Ghār-e Boof	IV	UP/Rostamian	33060+270/-260	37529±682
Ghār-e Boof	IV	UP/Rostamian	36030+390/-370	41355±326
Ghār-e Boof	IIIb	UP/Rostamian	33850±650	38994±1419
Ghār-e Boof	IIIb	UP/Rostamian	34900±600	39949±921
Ghār-e Boof	III	UP/Rostamian	35950±800	42050-38950
Ghār-e Boof	IV	UP/Rostamian	31620±180	36000-35000
Kaldar	Layer 4, Sub-Layer 5, Z: 110	UP/Baradostian	33480±320	38650-36750
Kaldar	Layer 4, Sub-Layer 5, Z: 85	UP/Baradostian	39300±550	44200-42350
Kaldar	Layer 4, Sub-Layer 5II, Z: 125	UP/Baradostian	49200±1800	54400-46050

*After Bazgir et al. 2017; Beccera-Valdivia et al. 2017; Ghasidian 2014; Hole and Flannery 1967; Otte et al. 2011; Rosenberg 1985; Solecki 1958.

influenced by ecological resources. Different resources led to the separation of different population groups and resulted in the formation of somewhat isolated populations and new group identities (Foley and Mirazón Lahr 2011).

The Iranian Plateau is a large geological feature in southwestern Asia characterized by marked topographical and ecological diversity (Heydari-Guran 2014). The Zagros Mountains which form the western boundaries of the plateau constitutes a land bridge between west and east and is located on the dispersal route from Africa to Europe and eastern Asia (e.g., Bailey et al. 2007; Bar-Yosef 1994; Bar-Yosef and Belfer-Cohen 2001; Dennell and Roebroeks 2005; Flemming et al. 2003; Petraglia 2005). The Zagros stretches ca. 1800km from north-western Iran and northern Iraq to the Hormuz strait, separating the interior Iranian Plateau from the eastern Mesopotamian Plain and is the largest mountain chain in the Middle East (Heydari-Guran 2014). Averaging 300km wide, this mountain chain has numerous intermountain valleys with contrasting ecological and geographical conditions.

The physiogeographical data for the studied sites includes the geographic positions of each site in the Zagros, latitudinal sections for both low and high geographical resolution analyses, strong seasonality, internal geomorphological barriers, and rainfall data from each area. The latter indicate a close relationship with primary production

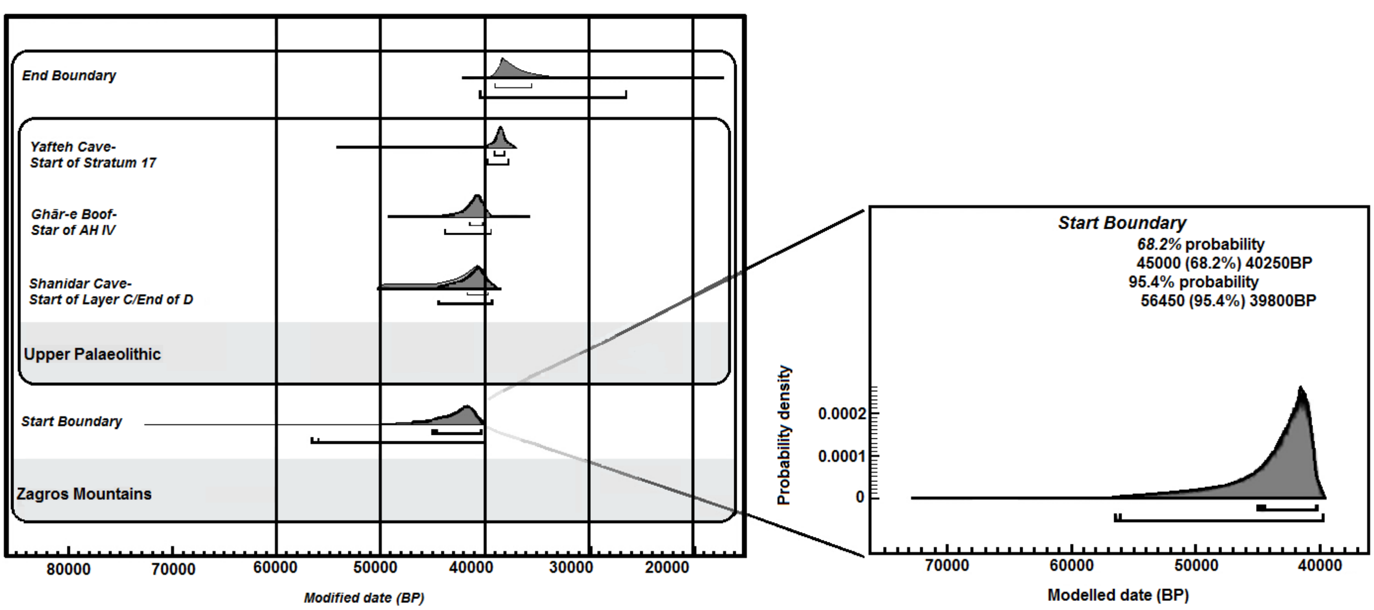


Figure 35. Age modelling of the Zagros UP (after Becerra-Valdivia et al. 2017).

and biomass and, therefore, are considered as one of the most important determinants of cultural diversity (Collard and Foley 2002: 377). The Southern Zagros is characterized by broad intermountain plains with gentle topography, in extreme contrast to the Central and West-Central Zagros Mountains, with deep valleys and plains surrounded by high mountains (Ghasidian 2014; Heydari-Guran 2014). The high mountains of the Central Zagros create a natural barrier between the West-Central and Southern Zagros, making access to these areas difficult (Heydari-Guran 2014: 62). This topographical variety supports the hypothesis of diversity among the UP lithic assemblages from this region and also, at a larger scale, with sites throughout the Iranian Plateau.

The Southern Zagros consists of well-connected habitat areas such as the Dasht-e Rostam, Marvdasht, and Arsanjan. Here a system of natural passes and rivers allows easy transitions between these areas (Heydari-Guran 2014: 140).

The West-Central Zagros is separated from the Southern Zagros by the ecozone of the Central Zagros where no large intermountain valleys developed and the mountains are high and compact, forming a natural barrier for human and animal migration north-southwards and east-westwards. This makes exchange and communication difficult between West-Central and Southern Zagros UP populations (Heydari-Guran 2014: 62). Here, the most possible way of accessibility between the Southern and West-Central Zagros is via the western piedmonts of the Zagros, imposing a longer distance. Paleoclimatic data derived from Lakes Zeribar and Mirabad in the West-Central Zagros Mountains indicate a dry and cold steppic environment with an additional decrease in temperatures of 4–7 centigrade degrees during mid-MIS 3 due to the presence of glaciers (Van Zeist and Bottema 1977). Brooks (1989) indicates dramatic climatological fluctuations between warm, cold, humid, and dry conditions between ca. 39–33 kya BP for the Kermanshah Region and, in general, the West-Central Zagros Mountains. Data from Lake Urmia, located in the north western Zagros, indicates winter temperatures for the region lower than today and intense erosion by high fluvial activities due to the absence of a well-developed vegetation cover during the last glacial period (Djamali et al. 2008: 418). In contrast, the Dasht-e Rostam-Basht Region is located at a lower geographical latitude with a higher mean annual temperature of 15–25°C (Ganji 1968), providing a prolific biome.

The valleys embracing Warwasi, Yafteh, and Pasangar are located at relatively the same elevation (Pasangar: 1240masl, Yafteh: 1278masl, and Warwasi: 1350masl) and *a latitude of 36 degrees north,* but Ghār-e Boof is located at 905masl and *at a latitude of 34 degrees north.* The difference of 2 degrees had a large impact on climatic conditions, being less affected by the late glacial maximum than the Kermanshah and Khorramabad plains. This climatic situation imposed significant differences in the ecological context and the subsistence strategy of the Southern compared to the West-Central Zagros and resulted in cultural variability as a reflection of adaptations to different biogeography. In addition to these different environments, the factor of distance between the Southern and West-Central Zagros should be taken into account as a potential factor for isolation of a cultural group (Foley and Lahr 2011:1088).

All these techno-typological, chronological, and physiogeographical data lead us to the question that Smith once correctly raised: '*why the Baradostian failed to diffuse as widely in Iran as did the Mousterian*[3]?' (Smith 1986: 29). To this end, regarding the geographical distribution of the Baradostian, Solecki believed that it was restricted to the Zagros Mountains, while Hole notes that the Baradostian of the Khorramabad Valley, which is better manifested at Yafteh Cave, has many typological analogies with the UP assemblages of the Southern Caucasus (Hole 1970). He mentioned that the Baradostian has more common characteristics with these sites and with the sites in the Levant rather than the Aurignacian in Europe (*ibid*). Smith proposed that the geographical distribution of the Baradostian appears to be restricted to Iran and especially to the west of the country (Smith 1986). There are two main reasons for this restriction; firstly, the environmental conditions of the Zagros and its slopes hindered expansion of settlement; and, secondly, climate during the Baradostian period was too severe for the occupants to spread (Smith 1986: 28).

The study of raw material economy for each of these studied sites could bring more clues about the nature of interaction between the different zones of the Zagros Mountains. The Zagros is characterized by tectonic slices that are comprised of Cretaceous to Tertiary limestones, radiolarites, and ophiolite remnants (Heydari-Guran 2014: 40) indicating the local availability of the raw material for the UP sites in the different zones of the Zagros. The pattern of raw material use in the Southern Zagros UP shows an absolute dependence on local resources (Ghasidian and Heydari-Guran 2018). The same pattern is observed in the West-Central Zagros UP sites (Shidrang 2015; personal observation). This localized pattern of raw material use influenced the degree of isolation of the UP populations in the different zones of the Zagros, supporting cultural diversity. However, at Shanidar, the presence of obsidian in the UP assemblage is interesting (Solecki 1958). While this raw material is totally absent in UP artifacts from the West-Central and Southern Zagros sites, its presence at Shanidar may indicate the interaction of the Shanidar occupants with sites located northward, since the sources are, so far, distinguished around Lake Van in Anatolia, towards Taurus (Solecki 1958: 105).

CONCLUSION

The techno-typological analysis presented here proposes that the UP lithic industries from three regions of the Zagros reflect cultural diversity and shows that different UP groups employed different strategies of adaptation and responses to the environment and available resources. This result challenges the previous ideas which proposed that the Zagros was a single cultural unit with the inclusive Baradostian culture from north to south and also into the steppe/desert areas of the Central Plateau (Shidrang 2018).

In fact, the definition of Baradostian in this approach is too generalized to exclude any UP assemblage. In this scenario, the UP (i.e.= Baradostian) of different zones of the Zagros share a striking techno-typological similarity. These similarities are interpreted as the indication of a high degree of interaction and communication between the UP populations in different zones of the Zagros. These interactions resulted in many exchanges of different aspects of technology and typology which formed the same cultural tradition. Based on this scenario, the Zagros microhabitat zones and further regions of the interior Iranian Plateau were easily accessible to UP populations. Consequently, the entire Zagros Mountains and even the Plateau served as a vast but homogeneous habitat area.

A different approach is the idea of the diversity of culture among the UP populations in the Zagros and in the Iranian Plateau (Ghasidian 2014; Ghasidian et al. in press). This approach is based on techno-typological analysis, physiogeographical studies, and the temporal scale of the Iranian UP sites in order to better understand innovations and regional characteristics. No cultural differences among the UP assemblages are ignored, but instead are interpreted as identification hallmarks of different population groups dispersed throughout the Zagros. The variability observed among the UP throughout the Zagros questions a unilinear pathway from the late MP Zagros Mousterian to the UP Baradostian. It is seen mostly as a result of a series of distinct dispersal events at various geographical routes into the Iranian Plateau occurring within a limited time span of ca. 8 kya (ca. 42–34 kya; Beccerra-Valdivia et al. 2017). Considering physiogeographical and absolute dating data helps us to better understand the nature of innovation and dynamism of AMH during the UP in the Iranian Plateau. This issue is often ignored and results in a superficial consideration of the UP sites, as well as prevents testing hypotheses regarding the dispersal and expansion of AMH.

This approach has been supported by the ecological model presented by Heydari-Guran (2014). Based on environmental, geomorphological, and topographical aspects, he divided the macrozone of the Zagros Mountains into several zones with different environmental characteristics (Heydari-Guran and Ghasidian 2017). These characteristics imposed different ecological patterns resulting in different cultural traditions (see the Structural Landscape Model presented by Heydari-Guran 2014).

The combination of these data made it possible to understand whether we are dealing with several techno-typologically different assemblages as various cultural units, not all of them falling under the umbrella of the Baradostian. Answering this question provides information on understanding the spatial distribution of the Baradostian in the Iranian Plateau and yields important clues for tracking AMHs' expansions into the Iranian Plateau during MIS 4 and 3. The variability observed among the UP assemblages was already noted by the scholars who worked in different parts of the Zagros as a reflection of ecological adaptations manifested in adopting different lithic reductions (Hole and Flannery 1967: 160; Smith 1986: 26). In light of new research and data from the Zagros (Olszewski 1993, Ghasidian 2014, Shidrang 2015), now is the time to learn '*how much more complex the UP is than we used to think*' (Smith 1986: 26).

Investigating lithic assemblages and the geographical distribution of each lithic industry from three UP core areas of the Zagros hypothesizes that the diversity between the Early UP groups is related to different ethnic identities in a specific period of time when neighbors were more numerous than before, and human groups affected each other and reproduced themselves over generations (Foley and Mirazón Lahr 2011; Smith 1986). The results of this study stand in contrast to the original and inclusive idea of considering every UP industry bearing bladelets as Baradostian (Bazgir et al. 2014; Berillon et al. 2009; Hole and Flannery 1967; Shidrang 2009, 2015, 2018; Rosenberg 1985, 1988).

The level of technological variability among the UP of the Zagros hypothesizes the dispersal of more than a single group, using different routes, each bearing particular technological traditions into the Zagros. Each tradition had a high degree of localization resulting from the large distances between the different zones of the Zagros and isolation from each other, with fewer interactions and a consequent hindering of easy cultural transmission. The present state of the data indicates that the less pronounced analogies between the Zagros UP industries are the result of '*homoplasy*' rather than '*homologie*s' (Kuhn and Zwyns 2014: 8) and suggests three cultural groups of Baradostian—the Northern, LaK (Lorestan and Kermanshah UP) in the West-Central, and the Rostamian in the Southern Zagros. The local innovations of Baradostian, LaK, and Rostamian UP more likely reflect a high speed of cultural and demographic dynamics caused by physiogeographical conditions and socio-cultural and demographic domains and is seen as a combination of environmental and socio-cultural phenomenon.

Patterns of techno-typological similarity and difference among the three regions in the Northern, West-Central, and Southern Zagros imply relatively closed population groups in far afield areas in the Zagros and suggests abrupt shifts in technology in stratigraphic sequences that were formerly thought to represent continuous regional transitions. So far, no clear MP-UP technological transitions have been documented among the Early UP assemblages in the Zagros except the MP-UP gradual shift at Warwasi (Olszewski and Dibble 1994, 2006). However, the latter is not based on technology and may indicate the contemporary occurrence of MP and UP traits (Ghasidian et al. in press; Olszewski 2007). The data presented from the Zagros appears more to support McBurney's idea proposing Iran as a corridor of population movement from west to east rather than a birthplace of the earliest UP (McBurney 1964: 398). However, more data from other parts of the plateau are needed to reconstruct cultural dynamics of the late Pleistocene in the Iranian Plateau.

ENDNOTES

[1]However, the new excavations at the site questioned this supposition, as no gap was visible (personal communications with G. Barker, 2018). Firm conclusions await the completion of the data analysis at this

site.

[2]Ghar-e Khar is excluded due to the high rate of disturbance in the Paleolithic sequence and a very small lithic collection for the MP-UP transition (see Shidrang et al. 2016).

[3]Although recent studies by the author have challenged the latter: '*diffusion of Mousterian*' (Ghasidian and Heydari-Guran in prep.).

ACKNOWLEDGEMENTS

The author thanks the people who allowed the work with the lithics in their care: Becky DeAngelo, Maureen White and Roger Colten from the Yale Peabody Museum of Natural History, the late Harold Dibble from the Department of Anthropology, University of Pennsylvania, and Xiuqin Zhou from the University of Pennsylvania Museum of Archaeology and Anthropology. Special thanks to Frank Hole from the Department of Anthropology, Yale University, for his support and his kind permission to access his unpublished field notes and pictures of his excavations in Yafteh and Pasangar. I am grateful to Marta Mirazon Lahr, Robert Foley, and Saman Heydari-Guran for the helpful suggestions and discussions. Especial gratitude to Deborah Olszewski for her constructive criticism and comments. This research was funded by German Academic Exchange Service (DAAD).

REFERENCES

Alex, B., Barzilai, O., Hershkovitz, I., Marder, O., Berna, F., Caracuta, V., Abulafia, T., Davis, L., Goder-Goldberger, M., Lavi, R., Mintz, E., Regev, L., Bar-Yosef Mayer, D., Tejero, J-M., Yeshurun, R., Ayalon, A., Bar-Matthews, M., Yasur, G., Frumkin, A., Latimer, B., Hans, M.G., and Boaretto, E. 2017. Radiocarbon chronology of Manot Cave, Israel and Upper Paleolithic dispersals. *Science Advances* 3 (11), e1701450.

Bailey, G.N., Flemming, N.C., King, G.C.P., Lambeck, K., Momber, G., Moran, L.J., Al-Sharekh, A., and Vita-Finzi, C. 2007. Coastlines, submerged landscapes, and human evolution: the Red Sea Basin and the Farasan Islands. *The Journal of Island and Coastal Archaeology* 2:2, 127–160.

Bar-Yosef, O. 1994. The contributions of southwest Asia to the study of the origin of modern humans. In *Origins of Anatomically Modern Humans*, M.H. Nitecki and D.V. Nitecki (eds.). Plenum, New York (NY), pp. 23–66.

Bar-Yosef, O. and Belfer-Cohen, A. 2001. From Africa to Eurasia—early dispersals. *Quaternary International* 75, pp. 19–28.

Bazgir, B., Ollé, A., Tumung, L., Becerra-Valdivia, L., Douka, K., Higham, T.F.G., van der Made, J., Picin, A., Saladié, P., López-García, J.M., Blain, H-A., Allué, E., Fernández-García, M., Rey-Rodríguez, I., Arceredillo, D., Bahrololoumi, F., Azimi, M., Otte, M., and Carbonell, E. 2017. Understanding the emergence of modern humans and the disappearance of Neanderthals: insights from Kaldar Cave (Khorramabad Valley, Western Iran). *Scientific Reports* 7, 43460.

Bazgir, B., Otte, M., Tumung, L., Ollé, A., Deo, S.G., Joglekar, P., López-García, J.M., Picin, A., Davoudi, D., van der Made, J. 2014. Test excavations and initial results at the Middle and Upper Paleolithic sites of Gilvaran, Kaldar, Ghamari caves and Gar Arjene Rockshelter, Khorramabad Valley, western Iran. *Comptes Rendus Palevol* 13, 511–525.

Becerra-Valdivia, L, Douka, K, Comeskey, D., Bazgir, B., Conard, N.J., Marean, C.W., Ollé, A., Otte, M., Tumung, L., Zeidi, M. and Higham, T.F.G. 2017. Chronometric investigations of the Middle to Upper Paleolithic transition in the Zagros Mountains using AMS radiocarbon dating and Bayesian age modelling. *Journal of Human Evolution* 109, 57–69.

Bee, R.L. 1974. *Patterns and Progress, an Introduction to Anthropological Strategies for the Study of Sociocultural Change*. The Free Press, New York.

Berrillon, J, Asgari Khanghah, A., Antoine, P., Bahain, J-J., Chevrier, B., Zeitoun, V., Aminzadeh, N., Beheshti, M., Ebadollahi Chanzanagh, H., and Nochadi, S., 2007. Discovery of new open-air Paleolithic localities in Central Alborz, Northern Iran. *Journal of Human Evolution* 52(4), 380–387.

Bordes, J-G. and Shidrang, S. 2012. The Baradostian sequence of Yafteh Cave. A typo-technological lithic analysis based on the Hole and Flannery collection. In *L'Aurignacien de la Grotte Yafteh et son Context (Fouilles 2005–2008)*, Otte, M., Shidrang, S., and Flas, D. (eds.). Presses Universitaires de Liège, Liège, pp. 27–39.

Brookes, I.A. 1989. *The Physical Geography, Geomorphology and Late Quaternary History of the Mahidasht Project Area, Qara Su Basin, Central West Zagros*. *ROM Mahidasht Project, Vol. 1*. Royal Ontario Museum, Toronto.

Collard, I.F. and Foley, R.A. 2002. Latitudinal patterns and environmental determinants of recent human cultural diversity: do humans follow biogeographical rules? *Evolutionary Ecology Research* 4, 371–383.

de Araujo Igreja, M., Bracco, J-P., and Le Brun-Ricalens, F. 2006. *Burins Préhistoriques: Formes, Fonctionnements, Fonctions*. Musée National d'Histoire et d'Art, Luxemburg.

Dennell, R.W. and Roebroeks, W. 2005. An Asian perspective on early human dispersal from Africa. *Nature* 438, pp. 1099–1104.

Djamali, M., de Beaulieu, J-L., Shah-hosseini, M., Andrieu-Ponel, V., Ponel, P., Amini, A., Akhani, H., Leroy, S.A.G., Stevens, L., Lahijani, H., and Brewer, S. 2008. A late Pleistocene long pollen record from Lake Urmia, NW Iran. *Quaternary Research* 69, 413–420.

Dibble, H.L. and Holdaway, S.J. 1993. The Middle Paleolithic Industries of Warwasi. In *The Paleolithic Prehistory of the Zagros-Taurus*, Olszewski, D.I. and Dibble, H.L. (eds.), University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, pp. 75–99.

Flemming, N., Bailey, G., Courtillot, V., King, G., Lambeck, K., Ryerson, F., and Vita-Finzi, C. 2003. Coastal and marine palaeo-environments and human dispersal points across the Africa-Eurasia boundary. In *The Maritime and Underwater Heritage*, C.A. Brebbia, and T. Gambin (eds.). Wessex Institute of Technology, Southampton, pp. 61–74.

Foley, R.A. and Mirazón Lahr, M. 2011. The evolution of the diversity of cultures. *Philosophical Transactions of the Royal Society B* 366, pp. 1080–1089.

Ganji, M.H. 1968. Climate. In *The Cambridge History of Iran*, Vol. 1: *The Land of Iran*, W.B. Fisher (ed.). Cambridge University Press, Cambridge, pp. 212–249.

Ghasidian, E. 2014. *Early Upper Palaeolithic Occupation at Ghār-e Boof Cave: A Reconstruction of Cultural Traditions in the Southern Zagros Mountains of Iran*. Kerns Verlag, Tübingen.

Ghasidian, E. and Heydari-Guran, S. 2018. Upper Palaeolithic Raw Material Economy in the Southern Zagros Mountains of Iran. In *The Middle and Upper Paleolithic Archaeology of the Levant and Beyond*, Nishiaki, Y. and Akazawa, T. (eds.). Springer International Publishing, Singapore, pp. 157–174.

Ghasidian, E., Bretzke, K., and Conard, N.J. 2017. Excavations at Ghār-e Boof in the Fars Province of Iran and its bearing on models for the evolution of the Upper Palaeolithic in the Zagros Mountains. *Journal of Anthropological Archaeology* 47, 33–49.

Ghasidian, E., Heydari-Guran, S. and Mirazón Lahr, M. *in press*. Upper Palaeolithic cultural diversity in the Zagros Mountains and the expansion of modern humans into Eurasia. Submitted to *Science Advances*.

Heydari-Guran, S. 2014. *Paleolithic Landscapes of Iran*. British Archaeological Reports International Series 2586, Oxford.

Heydari-Guran, S. and Ghasidian, E. 2017. The MUP Zagros Project: tracking the Middle–Upper Palaeolithic transition in the Kermanshah region, West-Central Zagros, Iran. *Antiquity* 91(355). https://doi.org/10.15184/aqy.2016.261.

Hole, F. 1970. The Paleolithic culture sequence in western Iran. In *Actes du II congres international des sciences préhistoriques et protohistoriques*, Filip, J. (ed.). Institut d archéologie de l Académie tchécoslovaque des sciences, Prague, pp. 286–292.

Hole, F. 2012. The 1960s excavations at Yafteh Cave. In *L'Aurignacien de la Grotte Yafteh et son Context (Fouilles 2005-2008)*, Otte, M., Shidrang, S., and Flas, D. (eds.). Presses Universitaires de Liège, Liège, pp. 11–25.

Hole, F. and K. Flannery 1967. The Prehistory of southwestern Iran: a preliminary report. *Proceedings of the Prehistoric Society* 33, 147–206.

Ikeda, J. 1979. *Preliminary Report of an Archaeological Survey in Arsanjan Area, Fars Province, Iran, 1977*. Kyoto University, Kyoto.

Kozlowski, J. 2014. Warwasi: Geography and Culture. In *Encyclopedia of Global Archaeology*, C. Smith (ed.). Springer Science+Business Media, New York, pp. 7689–7694.

Kuhn, S.L. and Zwyns, N. 2014. Rethinking the initial Upper Paleolithic. *Quaternary International* 347(1), 29–38.

Le Brun-Ricalens, F., Bordes, J.G., and Bon, F. 2005. *Productions Lamellaires Attribuées à l'Aurignacien: Chaînes Opératoires et Perspectives Technoculturelles*. Musée National d'Histoire et d'Art, Luxemburg.

Marks, A.E. 1981. The Upper Paleolithic of the Levant. In *Préhistoire du Levant*, Cauvin, J. and Sanlaville, P. (eds.). Centre National de la Recherche Scientifique, Paris, pp. 369–374.

McBurney, C.B.M. 1964. Preliminary report on Stone Age reconnaissance in North-Eastern Iran. *Proceedings of the Prehistoric Society* 30, 382–399.

Olszewski, D.I. 1993a. The Late Baradostian occupation at Warwasi rockshelter, Iran. In *The Paleolithic Prehistory of the Zagros-Taurus*, Olszewski, D. and Dibble, H. (eds.), University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, pp. 186–206.

Olszewski, D.I., 1993b. The Zarzian occupation at Warwasi rockshelter, Iran. In *The Paleolithic Prehistory of the Zagros-Taurus*, Olszewski, D. and Dibble, H. (eds.), University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, pp. 207–236.

Olszewski, D.I., 1999. The early Upper Paleolithic in the Zagros Mountains. In *Dorothy Garrod and the Progress of the Palaeolithic*, Davies, W. and Charles, R. (eds.). Oxbow, Oxford, pp. 167–180.

Olszewski, D.I., 2007a. Carinated tools, cores and mobility: the Zagros Aurignacian example. In *Tools Versus Cores: Alternative Approaches to Stone Tool Analysis*, S.P. McPherron (ed.). Cambridge Scholars Publishing, New Castle, UK, pp. 91–106.

Olszewski, D.I. 2007b. Issues in the development of the Early Upper Paleolithic, and a 'transitional' industry from the Zagros region. In *New Approaches to the Study of Early Upper Paleolithic 'Transitional' Industries in Western Eurasia: Transitions Great and Small*, Riel-Salvatore, J. and Clark, G.A. (eds.). British Archaeological Reports International Series 1620, Oxford, pp. 131–142.

Olszewski, D.I. 2017. Assessing patterning in the Upper Paleolithic and Epipaleolithic at Warwasi, Iran. *International Journal of the Society of Iranian Archaeologists* 3 (5), 1–12.

Olszewski, D.I. and Dibble, H.L. 1994. The Zagros Aurignacian. *Current Anthropology* 35, 68–75.

Otte, M., Shidrang, S., Zwyns, N., and Flas, D. 2011. New radiocarbon dates for the Zagros Aurignacian from Yafteh cave, Iran. *Journal of Human Evolution* 61(3), 340–346.

Otte, M., Biglari, F., Flas, D., Shidrang, S., Zwyns, N., Mashkour, M., Naderi, R., Mohaseb, A., Hashemi, N., J., D., and Radu, V. 2007. The Aurignacian in the Zagros region: new research at Yafteh Cave, Lorestan, Iran. *Antiquity* 81, 82–96.

Otte, M. and Kozłowski, J.K. 2004. La place du Baradostien dans l'origine du Paléolithique supérieur d'Eurasie. *L'Anthropologie* 108, 395–406.

Otte, M. and Kozłowski, J.K. 2007. *L'Aurignacien du Zagros*. Presses Universitaires de Liège, Liège.

Otte, M. and Kozłowskǐ, J. 2009. Origines du Paléolithique supérieur en Asie occidentale. In *Iran Palaeolithic*, Otte, M., Biglari, F., and Jaubert, J. (eds.). British Archaeological Reports International Series 1968, Oxford, pp. 57–72.

Petraglia, M.D. 2005. Hominin responses to Pleistocene environmental change in Arabia and South Asia. *Geological Society, London, Special Publications* 247(1), 305–319.

Reynolds, T., Farr, L., Hill, E., Hunt, C., Jones, S., Gratuze, B., Nymark, A., Abdulmutalb, D., and Barker, G. 2018. Shanidar Cave and the Baradostian, a Zagros Aurignacian industry. *L'Anthropologie* 122, 737–748.

Rosenberg, M.S. 1985. Report on the 1978 sondage at Eshkaft-e Gavi. Iran. *The Journal of the British Institute of Persian Studies* 23, 51–62.

Rosenberg, M. 1988. *Paleolithic Settlement Pattern in the Marv Dasht, Fars Province, Iran*. Unpublished Ph.D. dissertation. University of Pennsylvania. USA.

Roustaei, K., Vahdati Nasab, H., Biglari, F., Heydari, S., Clark, G.A., and Lindly, J.M. 2004. Recent Paleolithic surveys in Lurestan. *Current Anthropology* 45, 692–707.

Shea, J.J. 2013, *Stone Tools in the Paleolithic and Neolithic of the Near East: A Guide*. Cambridge University Press, New York.

Shea, J.J. 2014, Sink the Mousterian? Named stone tool industries (NASTIES) as obstacles to investigating hominin evolutionary relationships in the Later Middle Paleolithic Levant. *Quaternary International* 350, 169–179.

Shidrang, S. 2009. A typo-technological study of an Upper Paleolithic collection from Sefid-Ab, Central Iran. In *Iran Paleolithic / Le Paléolithique d'Iran*, Otte, M., Biglari, F., and Jaubert, J. (eds.). British Archaeological Reports International Series 1968, Oxford, pp. 47–56.

Shidrang, S. 2015. *The Early Paleolithic of Zagros: Techno-Typoloical Assessment of Three Baradostian Lithic Assemblages from Ghare Khar, Yafteh and Pa-Sangar in the Central Zagros, Iran*. Unpublished doctoral thesis. Université Bordeaux 1, France.

Shidrang, S. 2018. The Middle to Upper Paleolithic transition in the Zagros: the appearance and evolution of the Baradostian. In *The Middle and Upper Paleolithic Archeology of the Levant and Beyond*, Nishiaki, Y. and Akazawa, T. (eds.). Springer International Publishing AG, Singapore, pp. 133–156.

Smith, P.E.L. 1986. *Paleolithic Archaeology in Iran.* The University of Pennsylvania Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia.

Solecki, R.S. 1955. Shanidar Cave, a Paleolithic site in Northern Iraq. *Annual Report of the Smithsonian Institution* 1954, 389-425;

Solecki, R.S. 1958. *The Baradostian Industry and the Upper Palaeolithic in the Near East*. Unpublished Ph.D. dissertation, Colombia University, USA.

Solecki, R.S., 1963. Prehistory in Shanidar Valley Northern Iraq. *Science* 139(1551), 179–193.

Spratt, D.A. 1982. The analysis of innovation process. *Journal of Archaeological Science* 9, 79–94.

Tostevin, G.B. 2012. *Seeing Lithics: A Middle-Range Theory for Testing for Cultural Transmission in the Pleistocene*. Oxbow, Oakville, CT.

Tsanova, T. 2013. The beginning of the Upper Paleolithic in the Iranian Zagros. A taphonomic approach and techno-economic comparison of Early Baradostian assemblages from Warwasi and Yafteh (Iran). *Journal of Human Evolution* 65, 39–64.

van Zeist, W. and Bottema, S. 1977. Palynological investigations in western Iran. *Palaeohistoria* 19, 19–85.

Vogel, J.C. and H.T. Waterbolk. 1967. Groningen radiocarbon dates IV. *Radiocarbon* 5, 163–202.

Zwyns, N., Flas, D., Shidrang, S., and Otte, M. 2012. In *L'Aurignacien de la Grotte Yafteh et son Context (Fouilles 2005–2008)*, Otte, M., Shidrang, S., and Flas, D. (eds.). Presses Universitaires de Liège, Liège, pp. 41–49.