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CONTINUITY AND CHANGE IN THE LATE PLEISTOCENE LITHIC INDUSTRIES OF THE CENTRAL ZAGROS: A TYPO-TECHNOLOGICAL ANALYSIS OF LITHIC ASSEMBLAGES FROM GHAR-E KHAR CAVE, BISOTUN, IRAN

This paper presents a typo-technological analysis of the lithic assemblages from the 1965 test excavation of Khar Cave in Kermanshah region of Central Zagros, Iran. Khar Cave is one of the rare excavated Paleolithic sites in Zagros region with a stratified sequence encompassing archaeological materials from both MIS 2 and MIS 3. The research is based on the typo-technological characteristics of artifacts from both parts of the Khar Cave lithic assemblage, which are stored in the National Museum of Iran and in Montreal University, and have not been properly studied in terms of technology. The paper addresses the issue of the Middle to Upper Paleolithic transition in Zagros; technological characteristics of Baradostian/Zagros Aurignacian industries; and the possibility of industrial evolution from the late Baradostian to the early Zarzian. Despite the small size of the assemblage, the analysis illustrates a sequence of changes and continuity in core-reduction strategies and tool-production in Khar Cave, beginning in the Late Middle Paleolithic to Epipaleolithic. However, from the current state of data, the paper concludes that our technological data supporting the hypothesis of Middle-to-Upper-Paleolithic continuity in Zagros are insufficient, and we can neither confirm nor reject the possibility of a gradual transition in this region.

Keywords: *MP-UP Transition, Zagros Mousterian, Baradostian, Zagros Aurignacian, Zarzian, Central Zagros*

Introduction

During the critical period ca 50,000–35,000 BP, lithic industries went through a major change in Europe and Southwest Asia: Levallois-based technologies were replaced by (or gradually transformed into) more blade-oriented technologies. These changes in lithic technology (or, in a broader sense, the changes in human behavior) are linked to one of the fundamental issues of Paleolithic archaeology and Paleoanthropology: the question of Neanderthal's final replacement by anatomically modern humans. It is not clear where and how the process of change started—whether it was diffusion from a core area, or local adaptation in different regions. East Africa and Southwest Asia (in particular the Levant) are among the key areas that present the best-documented records, and have always been at the center of attention in this regard. In addition to the Levant, which historically has received most attention, other parts of the Middle East (such as Iran), are now receiving increasing research that enables us to compare and reconstruct a more complete image of human evolution history during this period (Shidrang, 2014). Over the past two decades, the subjects of the Middle-to-Upper-Paleolithic transition in Zagros, and identification of Upper Paleolithic entities such as Baradostian and its affinities to Aurignacian, have provided us with valuable information on the Paleolithic sequence of this mountainous region in the west of Iran. During the late 1950s and the 1960s, researchers began focusing on the problem of the shift from Middle Paleolithic to Upper Paleolithic in Zagros. At this time, when major Paleolithic excavations were undertaken, no clear or convincing evidence of industrial continuity between the Zagros Mousterian and the Baradostian was reported in the literature (Hole, Flannery, 1967; Hole, 1967; Smith, 1986). However, in the 1990s, a new detailed study of the Warwasi assemblage by D. Olszewski and H. Dibble proposed a different hypothesis with regard to continuity (Olszewski, Dibble, 1994, 2006; Olszewski, 2007a).

There are very few lithic collections that are large enough to allow a detailed analysis and comparison with other known sites. The assemblages from Warwasi (Olszewski, 1993a, b; Olszewski, Dibble, 1994), layer C of Shanidar in western foothills of Zagros (Solecki, 1958), Pa Sangar (Hole, Flannery, 1967, Minzoni-Deroche, 1993), Gar Arjeneh (Hole, Flannery, 1967), and Yafteh Cave (Ibid.; Bordes, Shidrang, 2009; Jaubert et al., 2006; Otte, Biglari, Flas et al., 2007; Otte, Shidrang, Zwyns et al., 2011) are the main excavated assemblages for studying Zagros Mousterian, Baradostian, and Zarzian lithic industries. The assemblage presented here, Ghar-e Khar (hereinafter referred to as Khar Cave), is among the few assemblages that contain cultural remains attributed to the Zagros Middle Paleolithic, Upper Paleolithic, and Epipaleolithic and still remain to be described in more detail, particularly from the technological standpoint. Therefore, the aims of this paper are twofold. We attempt, firstly, to describe the typo-technological characteristics of this lesser-known assemblage, which is the only lithic assemblage from test excavation of Khar Cave; and secondly, through inter-site comparisons, to provide a synthesis and brief overview of current knowledge concerning the related Paleolithic industries of Zagros.

Regional setting

A few cave and rock-shelter sites in the intermountain valleys of Kermanshah and Khorramabad in West Central Zagros, and some sites in Southern Zagros, are the main sources of our information concerning Paleolithic cultural changes during the Late Pleistocene. Among the different regions of Zagros, Kermanshah has traditionally played an important role in Iranian Paleolithic research, and has contributed significantly to establishing the Paleolithic sequence of Zagros (Fig. 1). Kermanshah Province, in the west of Iran, with its high intermountain river valleys, lies in Central Zagros, and from the west is connected to the lowlands of Mesopotamia. Its relatively Mediterranean environmental conditions, which are considerably influenced by Zagros's mountainous climates and permanent rivers, have formed several ecological niches. Although during Oxygen Isotope Stage 3 (OIS 3) the Late Pleistocene population experienced dryer and relatively colder conditions (Van Zeist, Bottema, 1977; Kehl, 2009), still-reliable water resources and consequently availability of game, high-quality lithic raw materials, and abundant shelters mark Kermanshah as a suitable bio-geographical zone for studying the behavioral patterns of Paleolithic societies. Given the great potential of the region, a considerable number of excavated Paleolithic sites are located in Kermanshah (Biglari, 2012). These tested or excavated sites are Kobeh and Warwasi in the north of modern city of Kermanshah (Braidwood, Howe, 1960; Braidwood, Howe, Reed, 1961); Hunter's Cave; Khar Cave (Ghar-e Khar); and Mar Tarik on southern slopes of Bisotun massif (Biglari, 2001; Coon, 1951; Jaubert et al., 2009; Young, Smith, 1966). The materials from some of these sites, such as the Warwasi rock-shelter, have been intensely studied (Holdaway, 1989; Dibble, 1993; Olszewski, 1993a, b, 2001, 2007a, b; Dibble, Holdaway, 1993; Olszewski, Dibble, 1994). Khar Cave materials have never been studied or published thoroughly, in spite of the Cave's importance as the only known stratified Paleolithic site in the neighborhood of the Warwasi rock-shelter.

The site and its research background

Khar Cave is situated in the southeastern ridge of Bisotun Mountain (34° 24′00.52″ N, 47°26′27.41″ E) and developed in this limestone zone of Central Zagros in Kermanshah Province (Fig. 2). It is located at an elevation of 1420 m a.s.l., opens southwards, and faces the green corridor of the Gamasiab river valley. The Cave is long and relatively narrow, about 27 m in length and with an average width of 6 m (Fig. 3), as recorded for the first time by Carleton S. Coon in 1949 during his "cave exploration" project in Iran. Between 1964 and 1965, in the context of a prehistoric survey extending from Kermanshah to Azerbaijan in the west of Iran, Philip E.L. Smith and T. Cuyler Young selected the Gamasiab River valley in Kermanshah for their research. In 1965, they excavated a 1 × 2 m test-trench near the

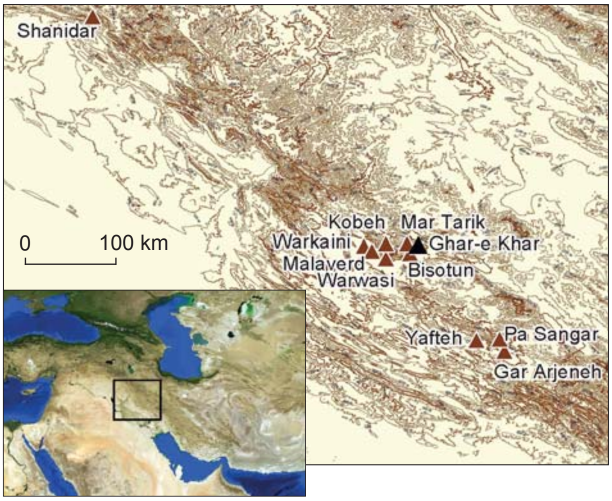


Fig. 1. Map showing the location of some of the main Paleolithic sites in the intermountain valleys of Kermanshah and Khorramabad in West Central Zagros.

entrance of Khar Cave, which proceeded in 10-to-30-cm arbitrary levels, and reached a depth of 5 m below the current surface of the cave (Fig. 4). This trial-trench did not reach bedrock, but revealed the promising potential of the site by uncovering a sequence beginning from the Late Middle Paleolithic and through the Epipaleolithic and later periods (Smith, 1986; Young, Smith; 1966). At the base of the test-pit, a Middle Paleolithic level was reached, but remained unexcavated except for a small part that yielded a few Mousterian artifacts. According to the excavators' notes, no clear stratigraphic break could be observed between the Zagros Mousterian and Baradostian levels, nor between the Baradostian and Zarzian levels (Young, Smith, 1966; Smith, 1986). However, the major part of the Baradostian deposits (about 1 meter) contains a less clayey reddish-brown soil, with occasional charcoal flecks and some rockfall at the top; and angular limestone at the bottom, where the Baradostian is mixed with Mousterian elements. The Zarzian artifacts have come from ca 1 meter of stiff medium-brown clay and occasional charcoal flecks (more descriptions of stratigraphy are provided in the caption of Fig. 4). The archaeological materials retained from 1965's test-pit were divided in two parts: one remained at the National Museum of Iran, and the other was sent to Montreal University. The current paper provides a detailed study of lithic materials from both assemblages in Tehran and Montreal, and attempts

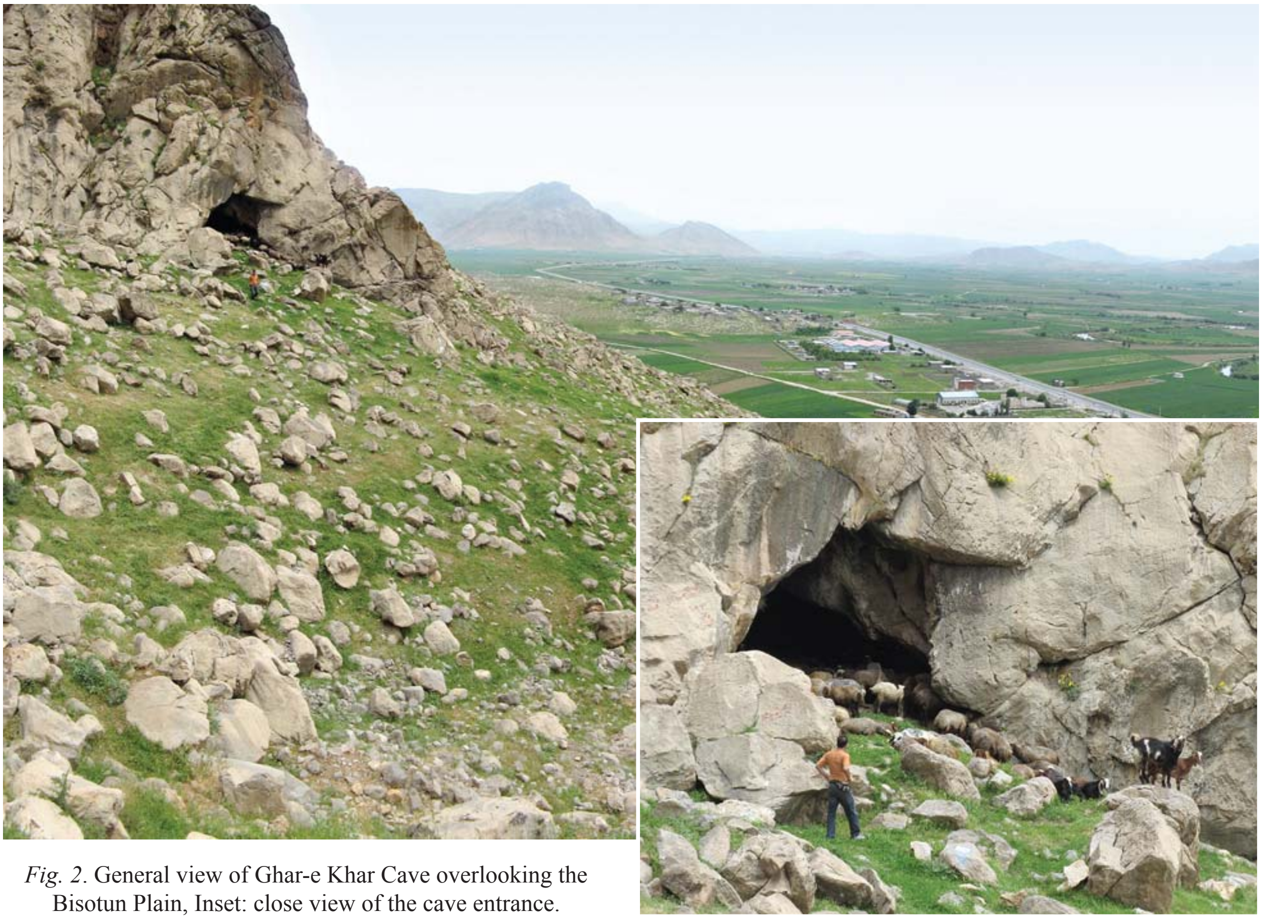


Fig. 2. General view of Ghar-e Khar Cave overlooking the Bisotun Plain, Inset: close view of the cave entrance.

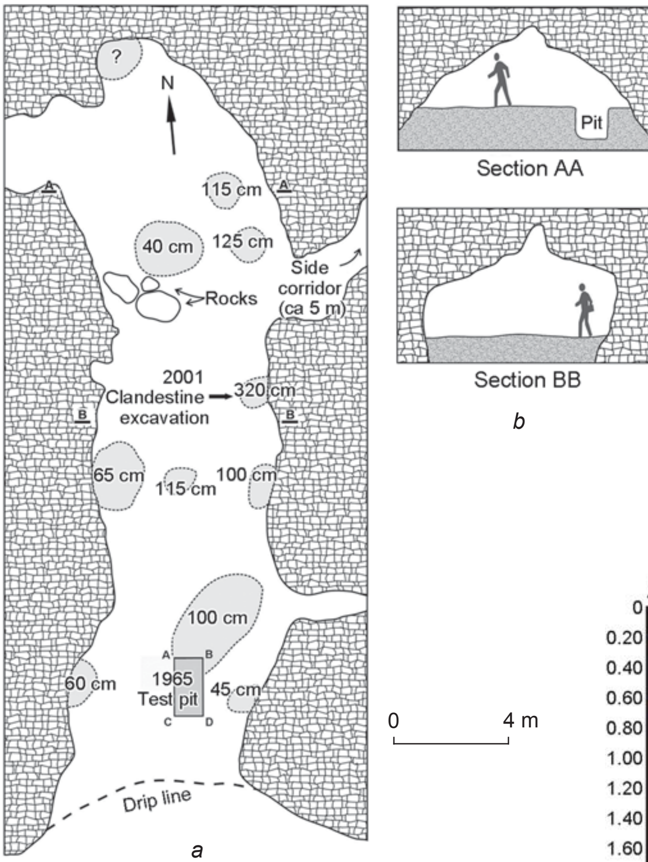


Fig. 3. Plan (*a*) and the cross section (*b*) of Khar Cave (depth from cave floor). *Drawing by F. Biglari*.

to describe the diachronic technological changes and continuities beginning from the late Zagros Mousterian to the Zarzian.

Materials and methods

This assemblage is composed of 285 lithic artifacts, of which 256 pieces can be assigned to Zagros Late Pleistocene cultures and are the subject of this study. The excluded 29 remaining lithic artifacts are attributed to the Neolithic, and were discovered in Holocene deposits with small sherds of pottery difficult to diagnose (Young, Smith, 1966). In view of the small area of the test-pit and the limited information on its depositional history and site-formation process, information derived from statistical analysis should be viewed with caution; since it may not accurately reflect the real state of archaeological materials. Thus, this study relies mainly on the techno-typological characteristics of the lithic artifacts to trace the industrial evolution of the Khar Cave Late Pleistocene sequence. Methodologically, the assemblage was subjected to preliminary analysis of the raw material and reading of its technological attributes in order to address specific questions concerning techno-typological changes in the sequence. Types of raw material were identified by means of macroscopic characteristics; fine distinctions do not appear to be possible, but some differences between various types of rock can be traced. In order to monitor technological changes of the lithic artifacts, the technological and typological attributes of each were examined; while each assemblage was divided into the three categories of tools, debitage, and cores. The emphasis was on recognition of blank-types and scar-patterns, and also metric measurements of various characteristics and

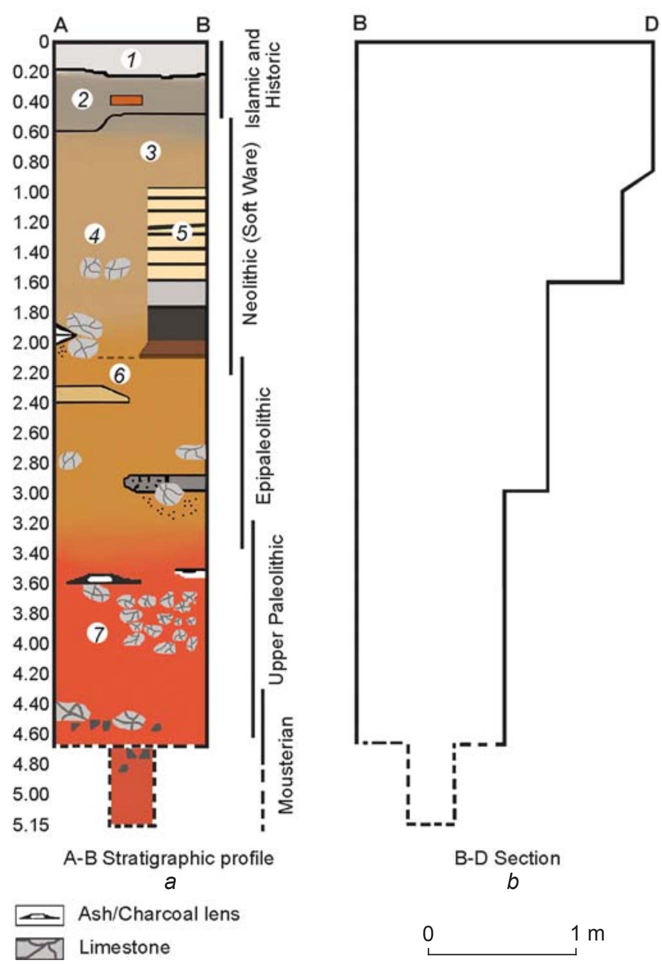
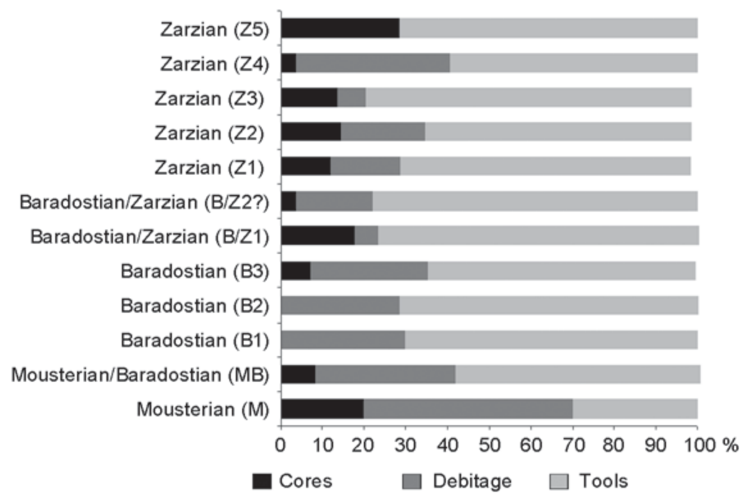


Fig. 4. Khar Cave A-B stratigraphic profile (*a*) and B-D section (*b*) (after (Smith, 1986)).
1 – loose gray-brown soil; *2* – black-streaked clayey soil with brick in the middle; *3* –looser brown soil, with little charcoal; *4* – intrusive pit?; *5* – alternating ash-earth levels; *6* – stiff brown clay and occasional charcoal flecks; *7* – reddish-brown soil, less clayey, with occasional charcoal flecks and traces of rock fall at the top, and angular limestone at the bottom.



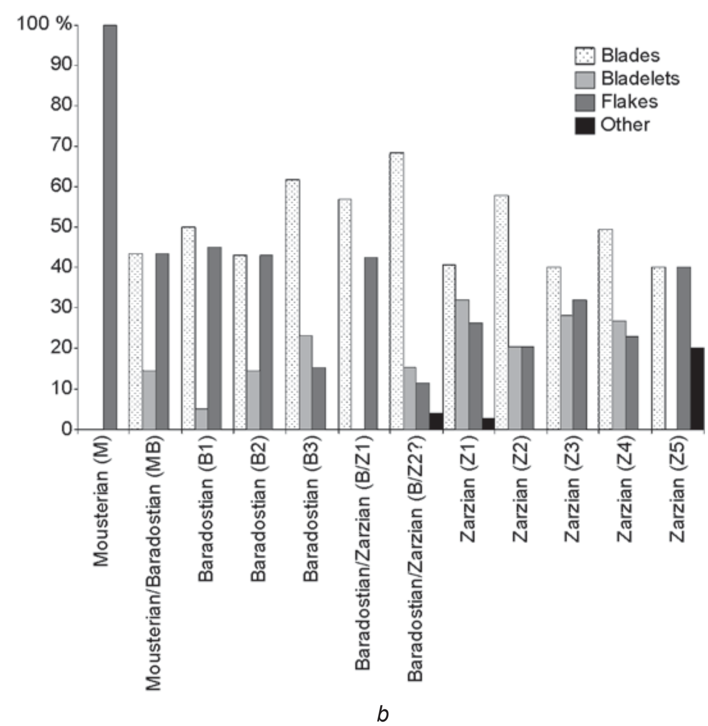


Fig. 5. Plot of the main composition (*a*) and blank types (*b*) of Khar Cave lithic assemblage, subdivided by arbitrary levels and cultural attributions.

attributes (Fig. 5). Following the initial sorting and counting of the materials (according to the aforementioned categories), they were grouped into their original arbitrary levels, and then divided into three cultural categories and their transitional parts. A proper refitting analysis was not possible because of the small quantity of the Khar Cave assemblage, and the fact that it had been divided into two parts and kept in two distant museums.

Raw materials

The most exploited raw material in all levels of Khar Cave is radiolarian chert (in different textures, colors, and silicifications) that mainly belongs to the Radiolarit Belt of Kermanshah. This belt is situated 10 to 15 kilometers south of the site, and extends from Borujerd at the southeast to Paveh in the northwest. Some of its outcrops (called Gakia-Harsin outcrops) yield nodules and tabular forms of good quality radiolarian chert: on a hilly area to the southeast of Kermanshah, and northwest of Harsin, at a distance of about 12 kilometers to the south and southwest of Khar Cave (Biglari, 2001, 2004, 2007; Heydari, 2004; Jaubert et al., 2009). The Late Pleistocene occupants of Khar Cave seem to have preferred the Gakia-Harsin outcrops with better-silicified cherts to the lower-quality cherts of tectonic origin in the vicinity of the site. As indicated by the retained fresh cortices of the pieces, procurement of raw materials from secondary sources like fluvial context was very rare. Despite the surveys by Biglari and Heydari in the region (Biglari, 2004; Heydari, 2004), which resulted in locating a number of major and minor sources of radiolarian cherts, the definitive source of several groups of raw materials in the Khar Cave assemblage has remained unknown. So far, the most common type of raw material in the entire assemblage is an opaque reddish-brown/brown group of cherts (Harsin type) that usually present a fresh cortex, indicating procurement from a primary source. The other frequent type is a grayish-green group, followed by other smaller groups such as cream, yellowish, and pinkish cherts.

The Zagros Mousterian assemblage

The earliest assemblage of this test-pit comes from a very small hole at the base of the excavated area. The pit was dug to a depth of 5.15 m under the cave-floor; and tested briefly to 5.30 m, in order to locate the bedrock and determine the depth of the deposits, which still remains unknown. According to Smith and Young, on the basis of the typological attributes of the recovered artifacts from the deepest level of the test-pit, a Middle Paleolithic layer contained typical Mousterian artifacts resembling materials from nearby Bisotun Cave, excavated by C. Coon (Young, Smith, 1966; Smith, 1986; Coon, 1951, 1957). So far, no Levallois elements have been reported by Smith in the Mousterian artifacts of the Khar Cave assemblage, and their absence was considered to be related to the small size of the sample (Smith, 1986). However, according to the present study, the small assemblage of the lowermost layer represents a flake-based industry using hard-hammer percussion, which is also known in other nearby Mousterian sites in the region. The Levallois method has been used to produce blanks, as evidenced by the presence of a typical Mousterian point on a Levallois flake in the base of the test-pit (Fig. 6). The Levallois flaking-method is now relatively well documented from the nearby Middle Paleolithic sites of Mar-Tarik (Jaubert et al., 2009) and Bisotun Cave (Dibble, 1984). The presence of the Levallois flaking method in Khar Cave will add to this database, and reinforce the fact that the Zagros Mousterian encompasses higher frequencies of Levallois elements than previously assumed (Ibid., Dibble, Holdaway, 1993). Of particular importance among the 11 Mousterian pieces are two small cores on flake with relatively the same size and similar technological characteristics (Fig. 6). In both pieces, a flake with general dimensions of approximately 3.5 × 2.5 × 1 cm has been chosen, and an edge around the surface with suitable convexity (whether the dorsal or ventral surface) has been prepared to reach a convenient striking platform angle; and then small flakes were produced from these cores centripetally. Apparently, different methods were applied and caused some degree of variation in core reduction strategy. A combination of Levallois method, the Kombewa method, and the method used in manufacturing truncated-faceted pieces, individually or together contributed to the procedure of debitage. Truncated-faceted pieces or cores (we use the term "core" cautiously, since the resulting flakes are too small, and it is difficult to determine their function) represent the highest level of variation, and cause difficulties relating to their classification as cores, tools, or parts of a hafting-modification procedure. Dibble and McPherron's studies on the truncated-faceted pieces of the Middle Paleolithic assemblages of Bisotun, Warwasi, and Pech de l'Aze IV (Dibble, McPherron, 2007) suggested that interpreting these pieces as cores is more credible than as products of a thinning technique or functional edges of tools. Examination of some of these pieces in several Zagros Mousterian assemblages leads us to consider truncated-faceting as a method which, apart from producing flakes in small-core categories, has often been used in thinning for hafting purposes, especially on pointed tools such as Mousterian points (Solecki R.S., Solecki R.L., 1993). In some cases, they resemble a specific functional edge of a tool; but no microwear-analysis study has yet analyzed these pieces to define their function. Such small cores are reported from several sites in the Kermanshah region, such as Warwasi, Bisotun, Warkaini, and Do-Ashkaft. Interestingly, all these cores display similar size and techno-typological characteristics, which persuades us to consider them as indicators of the Zagros Mousterian (Dibble, 1984; Dibble, Holdaway, 1993; Biglari, 2001; Shidrang, 2006).

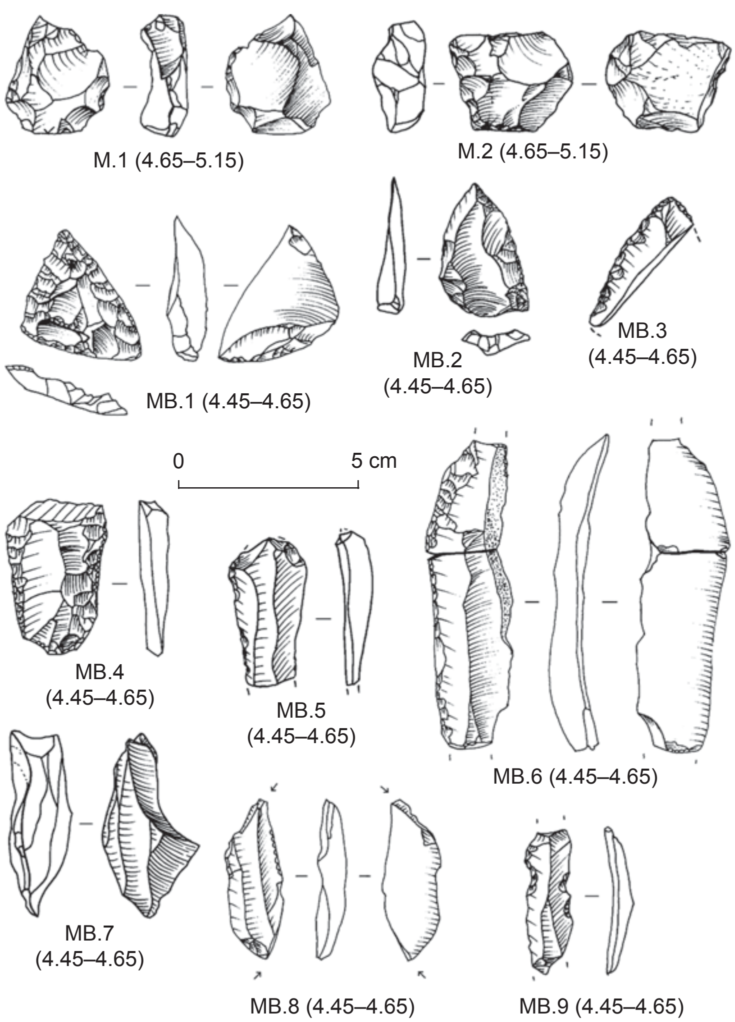


Fig. 6. Artifacts from Mousterian (M.1, 2) and intermediate Mousterian/Baradostian (MB.1–9) levels of Khar Cave (figures in parentheses indicate the depths of artifacts' discovery). *Drawing by S. Shidrang*.

M.1, 2 – small radial cores on flakes; MB.1 – convergent scraper with truncated-faceting; MB.2 – Mousterian point on Levallois flake; MB.3 – broken edge of a convergent scraper?; MB.4 – double scraper; MB.5 – broken end-scraper on blade; MB.6 – retouched blade/side-scraper; MB.7 – blade core fragment; MB.8 – opposite double burin; MB.9 – blade with double notches on opposite edges.

The assemblage from intermediate layers of the Zagros Mousterian and Baradostian

The deposits between the depths of 4.45 and 4.65 m under the cave floor have yielded 24 lithic artifacts presenting both Mousterian and Baradostian elements (Fig. 7, B1–B6). While most of the Baradostian elements are quite distinguishable on the basis of their choices of raw material (in particular, increasing use of medium-grained chert in variable colors), Mousterian pieces display the same frequent use of high-quality Gakia and Harsin chert (Biglari, 2007). Apart from choice of raw material, several artifacts can be attributed to the Baradostian technologically. The presence of a fragment of a single-platform blade-core with well-established volume, and some characteristic blades detached by a soft hammer, provide some evidence for this observation. Besides double scrapers on flake-blanks, two typical Mousterian points on relatively short flakes with faceted platforms signal the presence of the Zagros Mousterian in this layer. Apparently one is manufactured on a Levallois blank, and the other has truncated-faceting modification on its proximal end and both faces—presumably for hafting purposes.

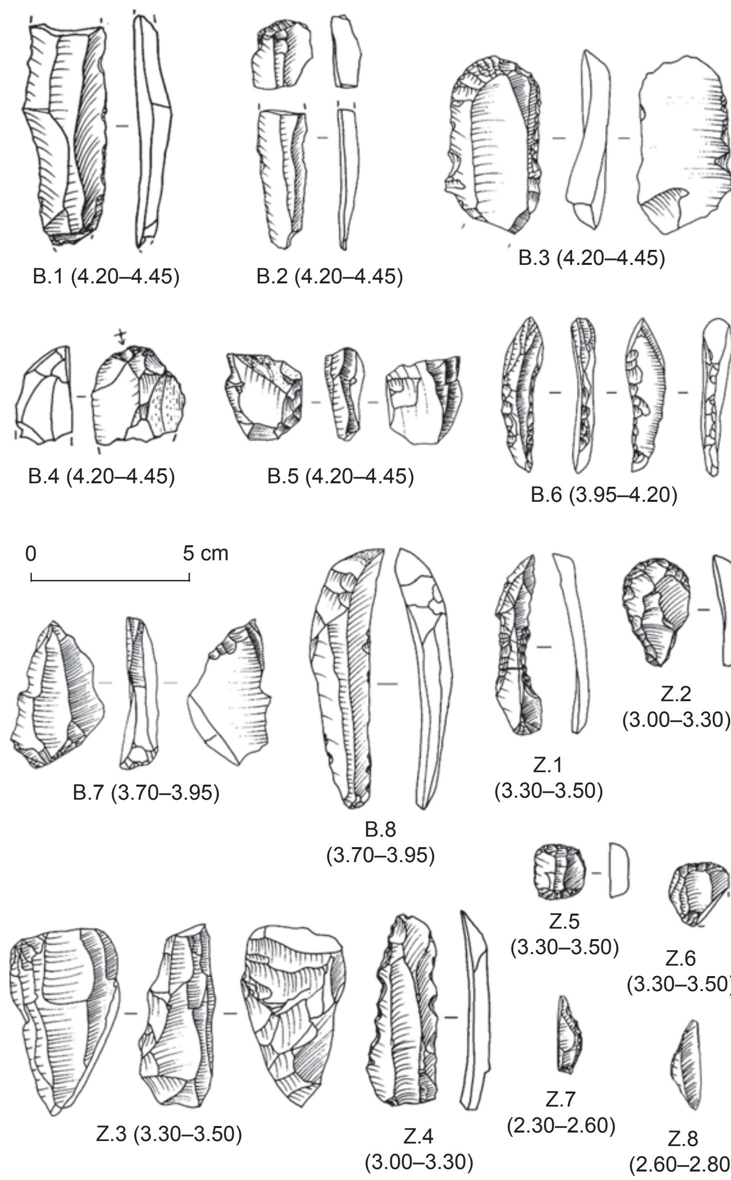


Fig. 7. Artifacts from Baradostian (B) and Zarzian (Z) levels of Khar Cave (figures in parentheses indicate the depths of artifacts' discovery). *Drawing by S. Shidrang*.

B.1 – broken blade; B.2 – end-scraper refitted with its blade handle; B.3 – end-scraper on flake/blade; B.4 – broken end-scraper; B.5–7 – carinated burins; B.8 – partial crested blade; Z.1 – double-notched blade; Z.2 – fan-shaped scraper; Z.3 – single-platform blade core; Z.4 – denticulate blade; Z.5–6 – small double scrapers (thumbnail scrapers); Z.7–8 – geometric microliths.

The Baradostian assemblage

The depth of 4.45 m under the cave's floor is the uppermost level where Mousterian artifacts can be observed, and the following deposits (to a depth of about 3.50 m) yielded typical Zagros Early Upper Paleolithic or Baradostian elements. The main reduction strategy at the beginning of genuine Early Upper Paleolithic materials or pure Baradostian levels manifests as the production of true blades, or in fact blanks for manufacturing typical Baradostian end-scrapers. Refitting of a broken end-scraper to its proximal blade (handle) led us to see the homogenous fracture-patterns of several pieces (Fig. 7). In all cases, the fractures occurred at distal part of the blade, probably owing to the accumulation of pressure on the other end of the tool during its use. The production of these standardized blades and the aforementioned typical end-scrapers can be observed in the lowest part of the Early Upper Paleolithic deposits. The materials from the uppermost levels of the Baradostian display a tendency towards production of bladelets, burins, and end-scrapers on short and smaller blades or flakes. However, flakes also exist, and were transformed into tool-types such as simple end-scrapers or burins (particularly carinated burins). The slender middle-sized blades that may belong to another reduction strategy were usually retouched abruptly (non-scalar retouch) on both lateral edges, and even on their distal ends. The final role of some of these slender retouched blades was to become carinated burins—presumably to produce twisted bladelets.

The Zarzian assemblage

The attributes of the artifacts found at a depth of about 3.50 m under the current floor of Khar Cave present characteristics of the "Zarzian", an Epipaleolithic industry known from a number of sites in Central Zagros (Olszewski, 1993; Hole, Flannery, 1967). More blades and bladelets that have been produced from single-platform cores (as well as from opposed-bladelet cores), and a relative absence of carinated pieces, are the main technological changes as compared with the Late Baradostian industry. The blades and bladelets, which resulted from the aforementioned core-reduction strategies, were used to produce backed, notched, and denticulate tools. Another marker of the Zarzian, particularly in its initial phase, is a group of small end-scrapers on flakes (or on small blades) which, with more extended retouching around the blank, were reduced in size and rounded in shape, and then became transformed into thumbnail scrapers. After Hole and Flannery's suggestion, Olszewski also suggested that the initial phase of the Zarzian evolved out of the Late Baradostian (Hole, Flannery, 1967; Smith, 1986). The study of more than 17,000 Zarzian lithic artifacts from the Epipaleolithic layers of Warwasi indicates that Dufour bladelets of the early phase of Zarzian (Unit 1) were replaced by scalene triangles in later units (Olszewski, 1993b). We do not intend to compare these two assemblages statistically or analytically, since the Zarzian assemblage from Khar Cave consists of only about 150 pieces. However, among a few geometrics, triangles and irregular trapezoid-shaped tools that seem to be a variant of triangles are dominant in the Khar Cave assemblage.

Discussion

Adding these data from Khar Cave to the Zagros database, we now have six sites with stratified sequences covering the shift from the Middle Paleolithic into Early Upper Paleolithic. One of these, Gar Arjeneh, should be excluded owing to the serious disturbance of its deposits; and other two, Gilvaran and Kaldar, were excavated just recently and yielded similar mixtures of MP/EUP elements (Hole, Flannery, 1967; Bazgir et al., 2014). Excavation in Eshkaft-e Gavi in 1978 also yielded a sequence with a Middle Paleolithic layer at the base that (according to the excavator, M. Rosenberg) contained typical Mousterian lithic artifacts, and was free of Early Upper Paleolithic elements (Rosenberg, 1988). At the end, we were left again with the Warwasi rock-shelter that is our main reference site. On the basis of its lithic assemblage, Olszewski and Dibble proposed a high probability of continuity between the Zagros Mousterian and Early Upper Paleolithic industries of Zagros (Olszewski, Dibble, 1994, 2006; Olszewski, 2001, 2007a, b). They have divided the 2.2 m Early Upper Paleolithic sequence of Warwasi into two phases, whereby the Khar Cave Mousterian/Baradostian intermediate level may correspond to its first phase, or the beginning of the Early Zagros Aurignacian. This "transitional" phase has been considered a developmental sequence from Mousterian into evolved Zagros Aurignacian. It contains both Mousterian elements (such as side-scrapers and truncated-faceted pieces) and Early Upper Paleolithic forms (end-scrapers on blades, burins, Dufour bladelets, and Arjeneh points). A quick look at an Early Zagros Aurignacian tool-types table is enough to notice the high frequencies of side-scrapers and notched-denticulates, as is common in the Late Middle Paleolithic of Zagros, which may indicate the dominant role of Mousterian tradition in the transitional phase of Warwasi assemblages (Olszewski, Dibble, 1994, 2006). The presence of Early Upper Paleolithic tool-types, particularly burins and end-scrapers associated with Levallois points (morphologically or genuine), and production of hard-hammer non-Levallois blades, represent the transitional phases of several sequences in the Levant. These transitional industries present two main variants: one with the characteristic index fossil of the Emireh point, and the other with the chanfrein pieces (Belfer-Cohen, Goring-Morris, 2013). As in the Levant, the Levallois blades and elongated points are common; small numbers of chanfreins pieces, along with the higher frequency of end-scrapers, are the dominant retouched-tool forms in the Initial Upper Paleolithic of Anatolia (Kuhn et al., 2009). Leaving the Levant behind, towards the north, reassessment of old excavations and new research in some of the southern Caucasian sites in Georgia and Armenia have provided evidence in favor of discontinuity and the presence of a relatively Late Upper Paleolithic without local precedent (Adler et al., 2006; Bar-Yosef et al., 2006; Golovanova et al., 1999; Tushabramishvili et al., 2012). In Ortvale Klde, the Late Middle Paleolithic sequence is overlaid by a genuine Early Upper Paleolithic occupation with unidirectional blade-cores, end-scrapers on blades, rounded-flake scrapers, burins on truncation, retouched bladelets, and backed bladelets (Adler et al., 2006). In Dzudzuana, the Early Upper Paleolithic industry is characterized by the production of short blades and small bladelets from unidirectional blade/bladelet cores with many microliths and typical burins and end-scrapers. The later Upper Paleolithic layer in Dzudzuana contains an industry dominated by the production of small blades and bladelets detached predominantly from carinated cores (Bar-Yosef et al., 2011). Taking into account all known characteristics of transitional industries (which represent local technological modification of lithic industries from Late Mousterian into Initial and Early Upper Paleolithic traditions), the MP-UP transitional phenomenon of Central Zagros is rather a mixture of Zagros Mousterian and Early

Upper Paleolithic components than a technologically modified Late Middle Paleolithic industry into Early-Upper Paleolithic. Towards the northeast of Iran, there are suggestions that the transition from Middle Paleolithic to Initial Upper Paleolithic has gradually taken place in Kara-Bom sequence, of which the Levallois-Mousterian collection resembles Boker Tachtit layer 1 (Derevianko 2011a, b; Rybin, 2004). However, a recent study has expressed skepticism of a gradual transition of Middle Paleolithic industries into Early Upper Paleolithic in this region, and describes an Initial Upper Paleolithic bidirectional blade-technology (accompanied by a core-burin technology for smaller laminar production) that appears above the local Middle Paleolithic (Zwyns et al., 2012). The Early Upper Paleolithic of this region is characterized by genuine volumetric bladelet cores (mostly unidirectional) made of medium-sized blocks or pebbles, with plain-platform bladelet products, all bearing signs of a soft hammer (Ibid.; Rybin, 2004). The early phase of the Baradostian in Zagros represents almost the same characteristics; the difference lies in the less-dominant role of carinated scrapers in Zagros.

Returning to the Khar Cave sequence, the beginning of the full Early Upper Paleolithic or Baradostian presents an industry with production of moderate-sized blades and tools made from them (i.e. end-scrapers). However, in later units of the Baradostian, the standardized blades are replaced by burins, particularly carinated types that are attributed to the production of small twisted bladelets. On the basis of recent studies of lithic assemblages from Yafteh Cave in Lorestan, the existence of two main typo-technological phases is described for the Baradostian (Bordes, Shidrang, 2009). The first, or older, phase is associated with an assemblage mainly oriented towards the production of Arjeneh points; and relatively large, straight or slightly curved, Dufour bladelets. In the upper part or the later phase of the Yafteh sequence, carinated burins are dominant, and small twisted bladelets were detached from them and subsequently transformed into small twisted Dufour bladelets by inverse or alternate retouch (Ibid.). The new chronological data obtained from the Yafteh sequence suggest the attribution of these phases to the interval of 24,500 and 36,000 ^{14}C BP, with a single chronological signal of approximately 33,500 ^{14}C BP (Otte et al., 2011). We do not intend to compare the rich Baradostian assemblages of Yafteh Cave with the few related artifacts of Khar Cave: we only highlight the presence of carinated burins in the latter's late-Baradostian levels, and moderate-sized blades as blanks for typical end-scrapers in its early-Baradostian levels. At the end of the Baradostian (or in fact the transitional phase of Baradostian to Zarzian), blade-production increased again as blanks for manufacturing notched and denticulate or backed-tool types (such as Gravette point), and blades become dominant in the beginning of the Zarzian. The blades and bladelets are mainly detached from single-platform cores, and both are the result of one reduction strategy. Geometrics, particularly triangles/trapezoids, can be observed in very small number at the beginning of the Zarzian levels, and persist in later units as well. As is attested by the analysis of this assemblage (Fig. 5), the most distinctive aspect of this small sample is the high percentage of tools in almost all cultural levels. Given the non-selective composition of the assemblage, which even includes some un-worked materials retained from the 1967 test-excavation, the high frequency of tools cannot be related to any selective procedure in the recovery methods of the excavation. Particular site-function is a more credible interpretation, since Hesse's studies on the faunal remains of the site demonstrated a different pattern of Paleolithic subsistence strategies in Khar Cave than that of the adjacent known site of Bisotun Cave, or the Warwasi rock-shelter (Hesse, 1989). On the basis of Hesse's study, the exploitation pattern of Upper/Epipaleolithic occupants of the Khar Cave indicates a higher frequency of goat/sheep (*Capra aegagrus/ Ovis orientalis*) than at other Middle/Upper Paleolithic sites in the Kermanshah region. He discussed the site as a highland hunting camp that, according to its exploitation pattern, may be placed into the model "game specialization based on site-location in Khorramabad Valley" proposed by Hole and Flannery (Ibid.; Hole, Flannery, 1967). In such a site, hunters were presumably specialized in chasing vertical game migrations while they stalked for horizontally-migrating, plains-dwelling herbivores such as gazelle (*Gazella subgutturosa*) or onager (*Equus hemionus*). Given the site's location (that is, about 30 m above the floor of the plain, at the base of Bisotun Rock, which is a natural goat habitat), the higher percentage of goat-remains in the faunal assemblage is as expected. The presence of large herbivore species such as deer (*Cervus elaphus*) or aurochs in later units (Zarzian/Baradostian), and their absence in earlier phases, lead Hesse to consider the higher possibility of some post-depositional processes from early units to later ones (Hesse, 1989). This assumption can be supported by the presence of a few diagnostic twisted bladelets in quite homogenous Zarzian levels; whereas a refitting of two bone fragments linked the materials of the late Baradostian into Zarzian units (Ibid.).

Conclusion

In addition to possible post-depositional disturbance of sediments through some part of the sequence (particularly between the Baradostian and Zarzian levels) the techno-typological studies of the Khar Cave lithic artifacts revealed another mixture of Mousterian and Baradostian elements at the very beginning of the Baradostian levels.

Recovery of the Levallois elements (particularly a Mousterian point made on a Levallois blank), which are associated with typical Mousterian flake-based industry and Baradostian elements, indicates an intermediate phase from Middle to Upper Paleolithic in Khar Cave, without confirming any sort of technological continuity between the two lithic industries. The improving current state of knowledge on the crucial shift between the Middle and Upper Paleolithic in Zagros still faces fundamental problems. The first is that our knowledge is limited mainly to one site, "the Warwasi rock-shelter"; second is the lack of detailed stratigraphic and chronological information; and third is the fact that technologically we cannot trace the evolution of late Zagros Mousterian industries into the earliest Baradostian, and all we have is based on typology. The Zarzian occupation of Khar Cave displays stronger evidence of on-site activities, which may indicate longer occupations or more frequent visits to the cave. However, the cave is relatively small and dark for use as a base camp; and the overall density and composition of the remains of cultural material in the studied sample make a very long-term intense occupation at the site unlikely. This occupation manifested itself in on-site production of blades and bladelets from semi-pyramidal cores for the manufacture of backed bladelets, notches, and denticulate tools, and then for secondary production of geometric tools. It has been suggested by Hole and then Olszewski that the Zarzian has evolved out of the Baradostian, on the basis of the Khorramabad sites and Warwasi rock-shelter in Kermanshah (Hole, Flannery, 1967; Olszewski, 1993a). Undoubtedly, more reliable stratified sequences are needed to establish an accepted regional sequence in which either replacement or coexistence of different chronological phases and cultural traditions in the Late Pleistocene of Zagros could be verified.

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