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II - THE BARADOSTIAN SEQUENCE OF YAFTEH CAVE. A TYPO-TECHNOLOGICAL LITHIC ANALYSIS BASED ON THE HOLE & FLANNERY COLLECTION

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Abstract: A typo-technological analysis of the lithic materials recovered by the excavation of F. Hole and K. Flannery at Yafteh Cave (Khorramabad, Zagros, Iran) leads to a new discussion of the definition of the Baradostian and its relation to contemporary industries in south-west Eurasia. Despite some relatively early dates, these assemblages show no technical proximity with the local Middle Paleolithic or any transitional industry. The debitage, made with an organic soft hammer, is exclusively oriented toward blade and bladelet production. Based essentially on the bladelet productions, it is possible to distinguish two main assemblages clearly organized in a single archeo-sequence. The upper layers contain small twisted bladelets with alternate retouch (Dufour bladelets, Roc-de-Combe sub-type), mostly produced from lateral carinated burins. The base of the sequence contains long bladelets with a curved or rectilinear profile. Most have direct bilateral retouch, convergent (Arjeneh Points), or not ("rods"), but there are also some with alternate retouch (Dufour bladelets, Dufour sub-type). These long bladelets are obtained from prismatic cores on small blocks. Many have impact fractures, indicating their utilization as projectile points.
The general tendency of Yafteh sequence thus follows the same pattern as contemporaneous European and Near Eastern industries.

Résumé: Une analyse typo-technologique du matériel lithique issu des fouilles de F. Hole et K. Flannery à la grotte de Yafteh (Korramabad, Zagros iranien) conduit à rediscuter la définition du Baradostien et ses rapports avec les industries contemporaines du sud-ouest de l'Eurasie. Malgré des dates très anciennes, ces ensembles ne montrent aucune proximité technique avec la Paléolithique moyen local. Le débitage, effectué au percuteur tendre organique, est strictement lamino-lamellaire. Essentiellement à partir des productions lamellaires, il est possible de distinguer deux grands ensembles qui s'organisent très clairement en une archéoséquence. Les niveaux supérieurs livrent des petites lamelles torses à retouche alterne (lamelles Dufour sous-type Roc de Combe), essentiellement produites à partir de burins carénés plans. La base de la séquence montre une production de grandes lamelles courbes ou rectilignes, majoritairement à retouche bilatérale directe convergente (pointes d'Arjeneh) ou non ("rods"), mais aussi à retouche alterne (lamelles Dufour sous type Dufour). Ces grandes lamelles sont obtenues à partir de nucléus prismatiques sur petits blocs. Elles montrent de fréquentes fractures d'impacts, qui permettent de supposer leur usage comme pointes de projectiles. Dans ses grandes lignes, cette séquence est similaire à celles que montrent les industries contemporaines du Proche Orient et de l'Europe.

1. Introduction

In numerous debates and discussions on Middle to Upper Paleolithic transition, the Zagros lithic industries have received relatively less attention compared to Europe and the Levant. Due to many reasons, such as political revolution or war, few Paleolithic excavations have been conducted in the past thirty years and our main information comes from collections from excavations conducted in the 1960s and 1970s using methods that were acceptable at the time but only used partially today.

The Early Upper Paleolithic industry of the Zagros was termed the Baradostian by R.Solecki in 1958 after its recognition in layer C of Shanidar Cave in Baradost Mountain, Iraq. But the major Baradostian sites known are located in the Iranian part of the Zagros, including Warwasi, Yafteh, Pa Sangar, Gar Arjeneh and Ghare Khar, in Kermanshah and Lorestan provinces. Since its definition, the Baradostian technocomplex has been associated with two issues which structure its analysis: the question of its origin and its relevance and resemblance to the Aurignacian.

The dominant hypothesis concerning the origin of the Baradostian is the continuation of the local Middle Paleolithic, based mainly on data derived from the Warwasi assemblages. Warwasi rock-shelter is located in northern Kermanshah and was excavated by Bruce Howe in the late 1950s (Braidwood & Howe 1960; Braidwood *et al.* 1960). The Warwasi excavation yielded a rich sequence containing Middle, Upper and Epi-Paleolithic lithic materials recovered by excavating 10-cm-thick arbitrary horizontal spits (Olszewski & Dibble 1994).

Warwasi's Upper Paleolithic sequence shows a decreasing frequency of elements with Mousterian characteristics from base to top (Levallois cores and products, scrapers and points). However, some doubts were raised about the presence of such components in the Baradostian, due to possible natural mixture of layers or the method of excavation (Olszewski & Dibble 1994). For integration of the Baradostian within a wider geographical context, the same typo-technological study proposed that on the basis of

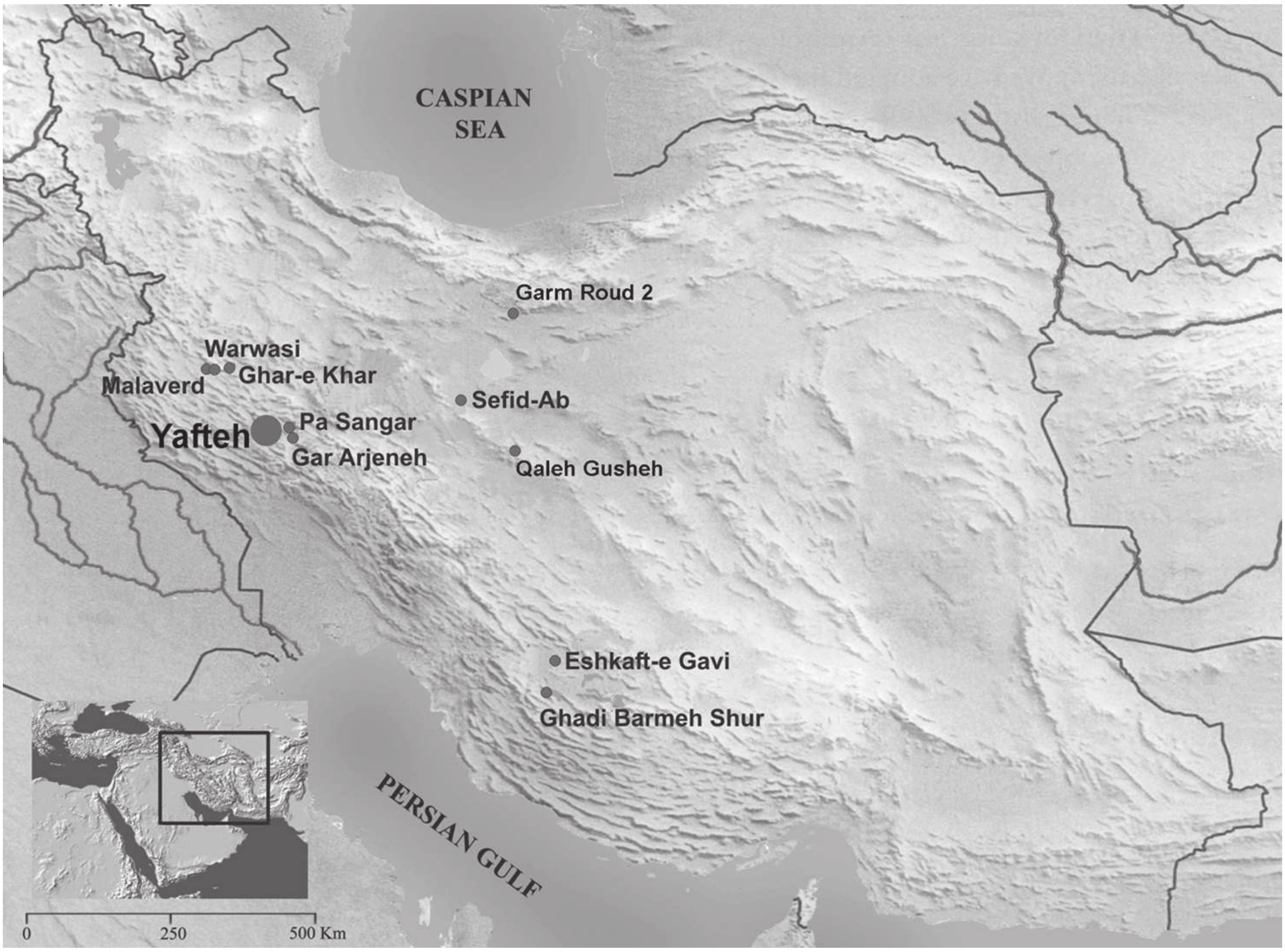

Figure 1 – Distribution of the main known Early Upper Paleolithic sites. After Shidrang 2007, 2009, modified.

similarities in its lithic characteristics, the Baradostian is comparable to the Aurignacian (Zagros Aurignacian) particularly in the Near East and Eastern Europe (Olszewski 1993, 1999, 2001). On the other hand, Yafteh's early radiocarbon dates (Hole & Flannery 1967) also led the debate to consider the Baradostian as one of the earliest facies of the Aurignacian and provided support for the hypothesis of a local origin for the Upper Paleolithic.

A more recent synthesis, based on a number of lithic collections in the Middle East, not only confirmed the hypothesis of attribution of the Baradostian to the Aurignacian, but also considered it as the local origin of this technocomplex (Otte & Kozlowski 2004). In this discussion, Yafteh Cave in particular has played a central role, with a date around 40 ky BP and an industry associated with Levallois elements at the base of the sequence, and including retouched bladelets, a bone industry and ornaments (Otte *et al.* 2007).

Here we present a typo- technological analysis of the collection from the 1965 excavation in Yafteh Cave, conserved at the National Museum of Iran, in order to evaluate the hypothesis of Mousterian components at the base of this important sequence and to discuss the proximity of the industry to what is known as the Aurignacian.

2. Presentation of the site and the collection

The karstic cave of Yafteh opens in the limestone cliffs of Kuh-e-Sefid in the heart of the central Zagros chain that extends through Lorestan province in western Iran (fig. 1). It is located in a region rich in Paleolithic sites along the Khoramabad Valley, some of which were surveyed and excavated in 1963 and 1965 by F. Hole and K. Flannery during their prehistoric project in south western Iran (Hole & Flannery 1967). The excavation of Yafteh in 1965 revealed a Pleistocene sequence over two meters thick, exclusively composed of Baradostian levels overlain by a meter of historical sediments (fig. 2).
The materials were collected from six 1x2m trenches along the North Eastern wall toward the center of the cave and each trench was excavated in 10 cm arbitrary levels. After excavation, the rich collections were separated into two equivalent parts: squares 4e, 6d and 6e remained in Iran while the rest of the collection and most of the fauna, including the bone industry, was transferred to the United States. The results of the 1963-1965 surveys and excavations were published by F. Hole and K. Flannery in a general report covering the Middle Paleolithic to the end of the Ubaid Period about 3700 BP (Hole & Flannery 1967). The collections which are the subject of the present analysis were also studied pre-

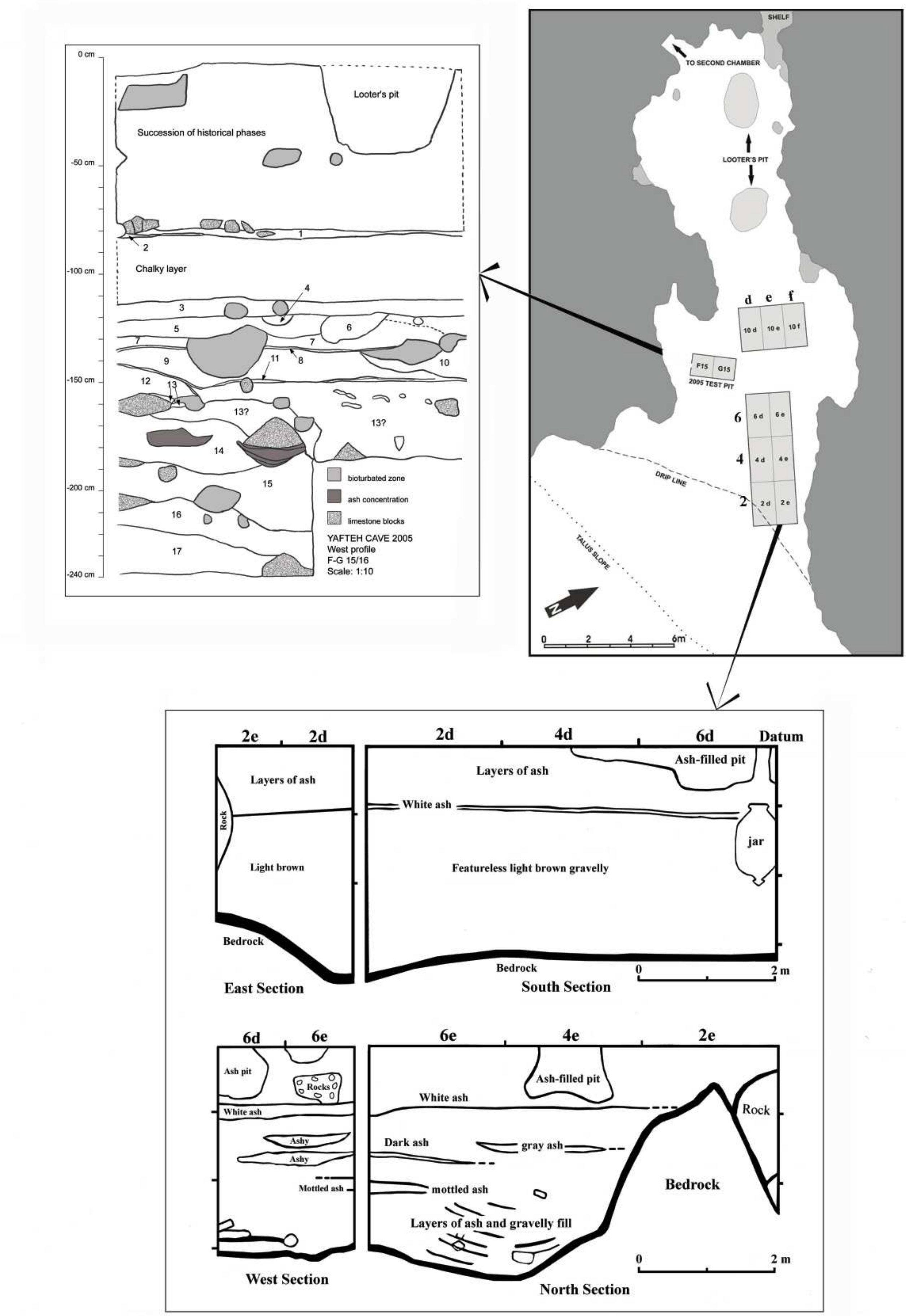

Figure 2 – Yafteh cave, excavation and sequence identified by F. Hole and K. Flannery, courtesy of F. Hole, modified; and 2005 excavation and stratigraphy, after Otte *et al.* 2007.

viously by M. Otte (Kozłowski & Otte 2007). In 2005 and 2008, M. Otte and F. Biglari, and then S. Shidrang conducted a new test excavation at Yafteh, which resulted in the discovery of a new set of ornaments, bone tools and lithic assemblages as well as providing new radiocarbon dates (Otte *et al.* 2007, 2011). The current paper is the result of our study of the collection from squares 4e, 6d and 6e, carried out in 2004 as a part of a cooperative project on the Paleolithic between Iran and France, directed by J. Jaubert and F. Biglari.

3. The value of the collection, preliminary considerations

One glance at the Hole and Flannery stratigraphic description is enough to follow the depositional sequence of Yafteh; a concentration of archaeological material, quite horizontal ash and charcoal lines, separated in part by probable sterile levels as well as evidence of some bioturbation. The 2005-2008 small test excavation in Yafteh confirmed the accuracy of this description in the zone along the western wall of the cave with more detail (Otte *et al.* 2007). The Hole and Flannery lithic collection is clearly sorted, with most of the assemblage represented by tools, lamellar blanks, large blade/bladelets and bladelet cores. But sorting of small objects by the excavator was also done, seen particularly by the large number of unretouched bladelets which are very small in size, indicating the high accuracy and resolution of the excavator. However, we do not know much about the sieving method or whether it was systematic; this factor can significantly influence the industry's composition (Bordes & Lenoble 2001). In our preliminary analysis, we therefore consider that this collection cannot address economic issues and we remain cautious about the quantitative aspect of the different types of artifacts. However, as we will see in the analysis, the large number of available artifacts and consistency of their stratigraphic distribution allow us to consider the Yafteh sequence as a valuable source of information. It is clear that further excavations conducted by modern methods will reveal the full extent of these deposits which seems to have great informative potential.

	6e	4e	6d	total
Retouched bladelets	376	212	318	906
Non-retouched bladelets	992	910	993	2895
Bladelets cores	155	179	263	597
Tools on blades and flakes	102	142	111	355
Blades and flakes with some retouch	57	45	114	216
Non-retouched blades and flakes	10	7	23	22
Undetermined blanks, retouched or not	102	145	91	338
Total	**1853**	**1744**	**1943**	**5538**

Table 1 – Yafteh, Hole and Flannery excavation, collection held in National Museum of Iran, Inventory of the entire lithic collection.

4. Analysis

4.1. Preliminary statements and observations

Table.1 shows a clear consistency in the different artifact categories counted by square and indicates that we probably do not have a differential distribution of lithic industries within the excavated area. As a result, we base most of our analysis on the richest, square 6d, since the results for other squares did not differ significantly. The assemblages are dominated by bladelet production which on average represents more than 82% of the collected artifacts. It is difficult to determine whether the very low number of blades and non-retouched flakes corresponds to an economic factor (no on site reduction, except bladelets, which have a significant raw frequency).

Consequently, retouched tools represent about 25% of the assemblage or nearly 40% if we include pieces that are slightly retouched and some bladelet cores which were previously counted as tools. Considering, firstly, the significant scale of production and utilization of bladelets and secondly, the fact that these artifacts have already been noted as the best marker of the chronological sequence for the Early Upper Paleolithic (e.g. Le Brun-Ricalens 2005), we concentrate our initial sorting efforts on bladelets. It then becomes evident to observe two main patterns in the whole assemblage: one leading to the production of small twisted bladelets, especially from burins or nosed scraper core types, the other in the manufacture of large curved or straight bladelets from prismatic cores on blocks.

4.2. Demonstration of an archaeological sequence:

The central role of bladelets

According to observations of the excavators, the Paleolithic sequence of Yafteh is about two meters thick and many lenticular levels have been identified. Although no layer name was assigned during the excavation (1965 excavation), the depth of each piece was documented on its ventral face. Thus, a piece marked as 167 was actually between 160 and 170 cm below 0 (1965 absolute datum), pieces marked as 223 are between 220 and 230 cm in depth, etc. On the drawing plates, we cited the first two digits only. For example, an item recorded as 13 was between a depth of 130 and 140 cm. The distribution of the different types of retouched bladelets strongly depends on the depth: in the lower part (over 200 cm in depth), we found rather large bladelets, straight or slightly curved in profile and in the upper part (less than 170 cm in depth) small twisted bladelets (fig. 3). Pieces with bladelet removal scars follow the same trend, confirming their status as cores and showing the technical coherency of the sets and individuals (fig. 4). Between 170 and 200 cm, both types of production exist, but taking into account the imprecision of the available data, we have chosen to exclude this middle part from our analysis. Although our study is preliminary and depends only on one part of the 1965 lithic collection and without precise contextual data, we prefer to discuss the definite techno-typological characteristics of the assemblages and do not interpret the origin of this co-occurrence (natural mixture, caused by excavation or coexistence of two productions?).

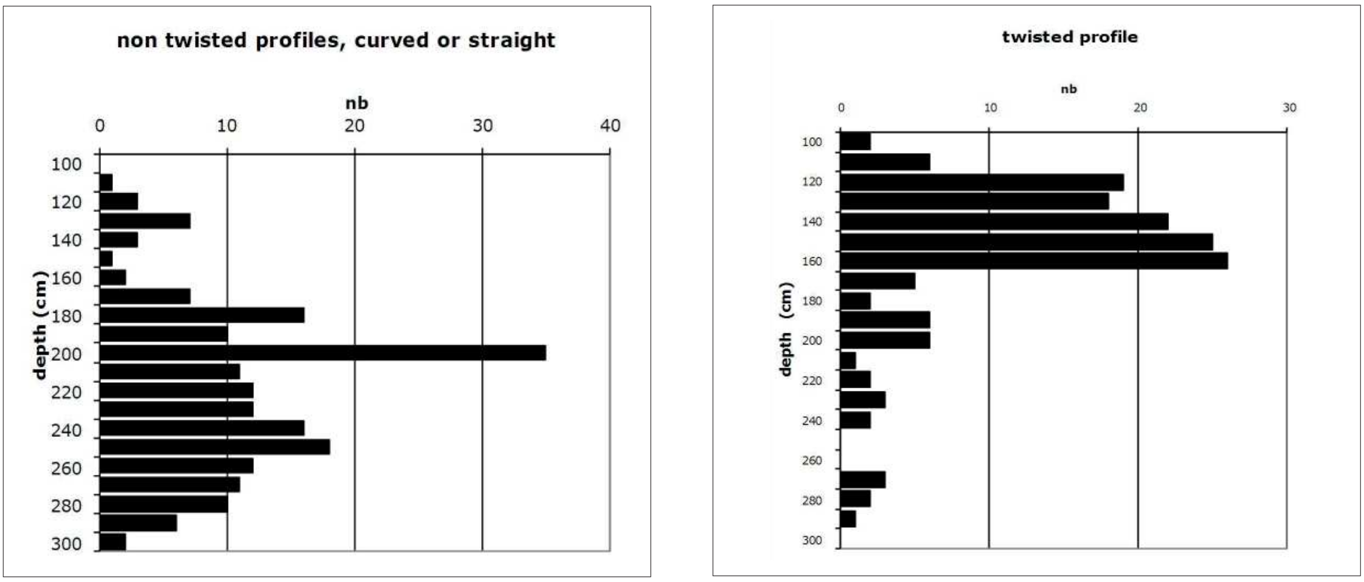

Figure 3 – Distribution of bladelets according to their depth and profile. We clearly distinguish a sequence with two subdivisions: at the base: bladelets with rectilinear or slightly curved profile, at the top: bladelets with a twisted profile.

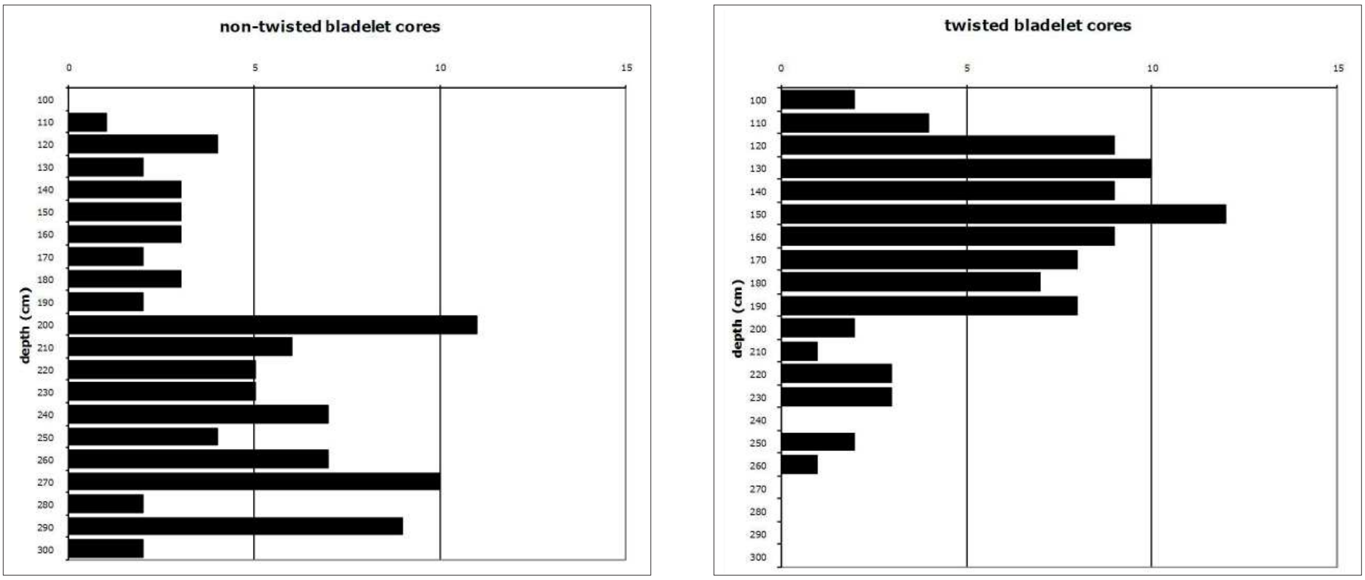

Figure 4 – Distribution of pieces with bladelet removal negatives (cores) according to their depth and the morphology of the last successful removals: twisted (top) or not (base of the sequence).

5. The Example of Square 6d

In order to refine these observations, we have taken into account the assemblage from square 6d, the frequency and structure of which is given in Table 2.

5.1. Common Elements in the Entire Sequence

Debitage Technique

For all blade and bladelet products, the only diagnostic detachment technique is organic soft hammer used for direct percussion. On thicker blades, the proximal part is prepared and faceted slightly and then carefully abraded on the dorsal face (Fig. 9d and 12f), quite similar to such procedures observed for the European Upper Paleolithic, particularly during the Aurignacian (Bon 2002, Bordes & Tixier 2002). There are also a few fragments in the assemblage that show traces of direct percussion knapping by hammer stone. These few pieces are mostly flakes which are usually potential blanks for bladelet cores and burins, and in some cases scrapers.

Raw Material

A few products have cortical margins, while bladelet cores in particular show the reduction of small rounded nodules most likely from river terraces. Larger products, however, show no trace of rounded cortex. Due to the lack of regional survey, the source(s) of these high quality materials, which vary in color, remains unknown.

Scrapers and Burins: Tools or Cores?

As always it is not easy to determine the technological status of the “scrapers” and “burins”., We counted all pieces showing the or-

Scraper on blade	31
Scraper on flake*	13
Total of scrapers	**44**
Burin with only one removal	15
Burin with multiple removal*	15
Total of burins	71
Scrapers / burins	2
Retouched blades	30
Retouched flakes	4
Total of tools on blade or flake	**111**
Arjeneh Points	42
Retouched bladelets with curved or straight profile	213
Retouched bladelets with twisted profile	69
Total of retouched bladelets	**318**
Total of tools	**586**
Flakes without retouch or with some retouch	45
Blades or Bladelets without retouch or with some retouch	91
Total of pieces without retouch or with some retouch	**137**
Non-retouched twisted bladelets	167
Large bladelets without retouch, not twisted	688
Small bladelets without retouch, not twisted	138
Total of non-retouched bladelets	**993**
Cores without noticeable organization and preparation	21
Prismatic cores	52
Twisted bladelet cores	48
« carinated scraper » core type	83
« carinated burin » core type	52
Abandoned cores at the stage of bifacial shape	7
Total of cores	**263**
Total	**1979**

Table 2 – Yafteh, excavation by Hole and Flannery, collection conserved in Tehran. Inventory of the lithic assemblage of square 6d.

ganized arrangements of bladelet production as cores and pieces with one bladelet scar as comparable to definite cores; pieces with no clear organization of different scars from bladelet production were counted as probable tools (name followed by an asterisk in table 2) and other retouched pieces as tools. This uncertainty prevents us from discussing the scraper versus burin part of the assemblage, which are the only types of tools on non-bladelet blanks in this assemblage.

In all cases and the structure of the collection in general, the assemblage is dominated by elements linked to bladelet production: retouched products, unretouched bladelets and potential cores.

General Information on Blade Production

The rest of the tools are mostly on blades. Based on the dorsal removal scars, blade production appears to be unidirectional. The absence of blade cores and the extreme rarity of its technical by-products (core tablets, rejuvenation flakes, etc.), prevent us from further discussing blade production techniques.

Flake Production?

The flakes in this assemblage have three characteristics:
- The vast majority is composed of "burin" or "scraper" bladelet core types.
- There is no preferential type of tool on flakes; most are classified as "flakes with some retouch". None are related to any production method known for the Middle Paleolithic. In particular, the few flakes which have a "carefully prepared butt" are in fact rejuvenation tablets from the striking platform of blade or bladelet cores, usually identified as core tablets. The "faceting" is actually formed by the proximal scars of blades or bladelets removed by detachment from the core tablet (fig. 5). - Furthermore, a few "bifacial pieces" are present, which are actually bladelet cores abandoned in their shaping stage. We reconstruct all the stages of this production method to the exhausted core (see below).

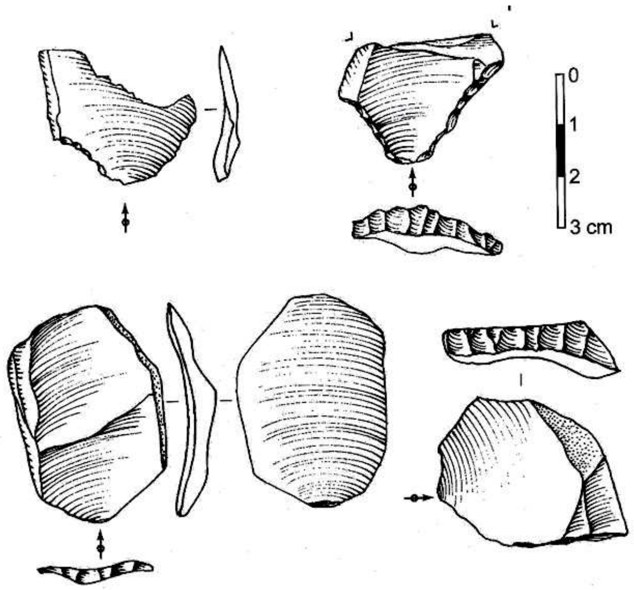

Figure 5 – Yafteh, flakes with a facetted butt (after fig. 6, Otte *et al.* 2007, modified) or rejuvenation flakes of the bladelet striking platform?

5.2. Upper Part of the Sequence

Bladelet

Retouched bladelets have very standardized typological and morphometric characteristics: length between 16 and 26 mm, width between 4 and 6 mm. The twisted profile is systematically counter-clockwise. Inverse retouch is found on the concave right edge and direct retouch is sometimes presents on the convex left edge (fig. 6). The morphology of these blanks is linked to cores present in the assemblage (fig. 7): a very narrow debitage surface, bladelet removals for which the point of percussion is off centered on the left flank of the debitage surface (if we place the striking platform on top of the drawing). The bladelet cores are blocks or flakes. Nothing seems to help distinguish the patterns of removals on both types of blanks. Formatting and shaping of the cores are quite variable: from none (regular shape flake with a steep edge) to complete. In the latter case (fig. 8), the shaped core takes the form of a bifacial piece with a rather acute angle at the point of its equator. an initial knapped bladelet is detached from this point: its negative forms a striking platform for rapid production of twisted bladelets. It is possible to detect this type of management on bifacial crests, more and less peripheral, on many twisted bladelet cores in this assemblage. All of these characteristics, particularly the retouched products, strongly resemble those described for the late (recent) southwestern European Aurignacian (Dufour bladelet- Roc-de-Combe subtype; Demars & Laurent 1990).

Blades

The rare blade products in the assemblage show two groups: large size blades (Fig. 9), thick, with scaly retouch (scraper, retouched blade and pointed pieces) and smaller size blades without lateral retouch, retouched on the end as scrapers, discrete, dihedral burins or burins on truncation (Fig.9h). A significant part of bladelet production on very small nodules or flakes is independent of other production patterns. For the rest, it has not been possible to determine to what extent the production of these different types of blanks was nested.

5.3. Lower Part of the Sequence

Bladelet

Both in terms of blank and retouch, variability of retouched bladelets is higher than in the upper assemblages. However, one characteristic of all these blanks which differentiates them significantly from those found in the upper levels of the sequence is to be slightly curved or straight, but never twisted in profile. The desired blanks are generally larger (often up to 40 mm) and wider (often 10 to 12 mm) than in the upper levels. In this preliminary analysis, we have identified three main groups of artifacts based on retouch:

- Bladelets with bilateral direct retouch are by far the most abundant. Two types are distinguished according to the retouch which creates a pointed tip or not.

- The clearly pointed bladelets ("Arjeneh points") are more numerous (N=33 in 6d), and seem to be made on the most consistent blank (fig. 10). The retouch is always marginal and semi abrupt, sometimes only on the tip but often involving the entire blank, although less developed in its medial part. The cross-section is mostly symmetrical, but there are exceptions (Fig. 10b and h).

- Many bladelets (N=29 in 6d) have a convergent edge after retouching the end, without being really pointed. Are these pieces being manufactured where the tip did not have to be vulnerant or is this merely the consequence of edge management?

- The bladelets with parallel edges along their length ("rods") are actually quite rare (N= 8 in 6d). The shape of these items is rectangular and retouch is nearly abrupt (fig. 10k and i). Bladelets with inverse or alternate semi abrupt retouch (Dufour) are also rare (N=8 in 6d) but distinguishable and are mostly fragmented in the sample under consideration (fig. 10).

Traces of impact

Nearly 10% of large retouched bladelets in the lower levels show characteristic fractures typically attributed to projectile point use (fig. 11). Some objects also have a large skimming removal on their ventral face, which we believe should be distinguished from simple retouching (fig. 11). All the bladelets showing a complex type of fracture have direct bilateral retouch. It would be necessary to complete this simple observation by a thorough study of these objects.

Blades

Just as in the upper levels, the blade blanks are mostly long, wide and thick and have scaly retouch (scarpers and mainly retouched blades, fig. 12). There is also a smaller size group of blanks but

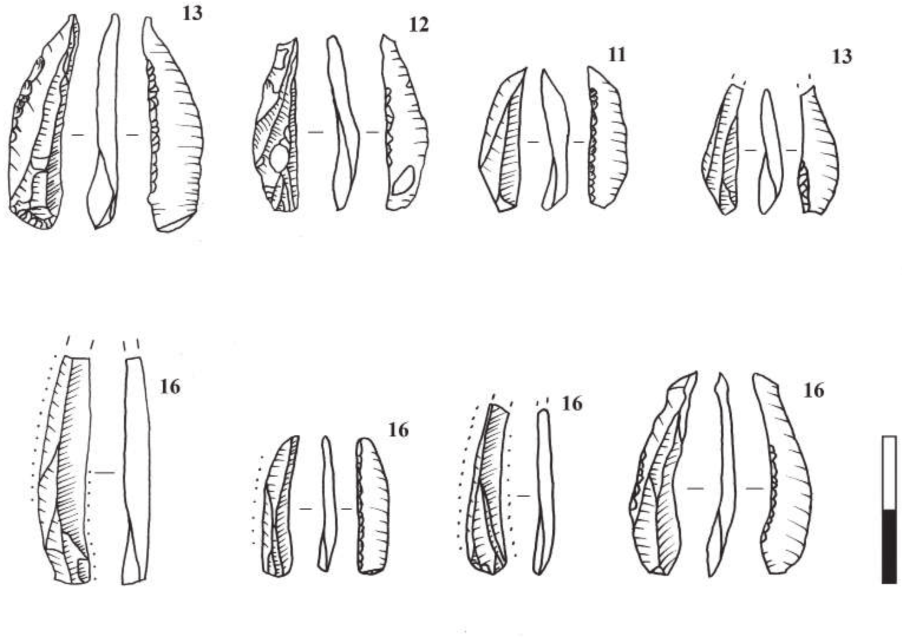

Figure 6 – Yafteh, excavation by Hole and Flannery, twisted bladelets with inverse or alternate retouch, Dufour bladelets, Roc-de- Combe subtype. The numbers indicate the depth in tens of centimeters.

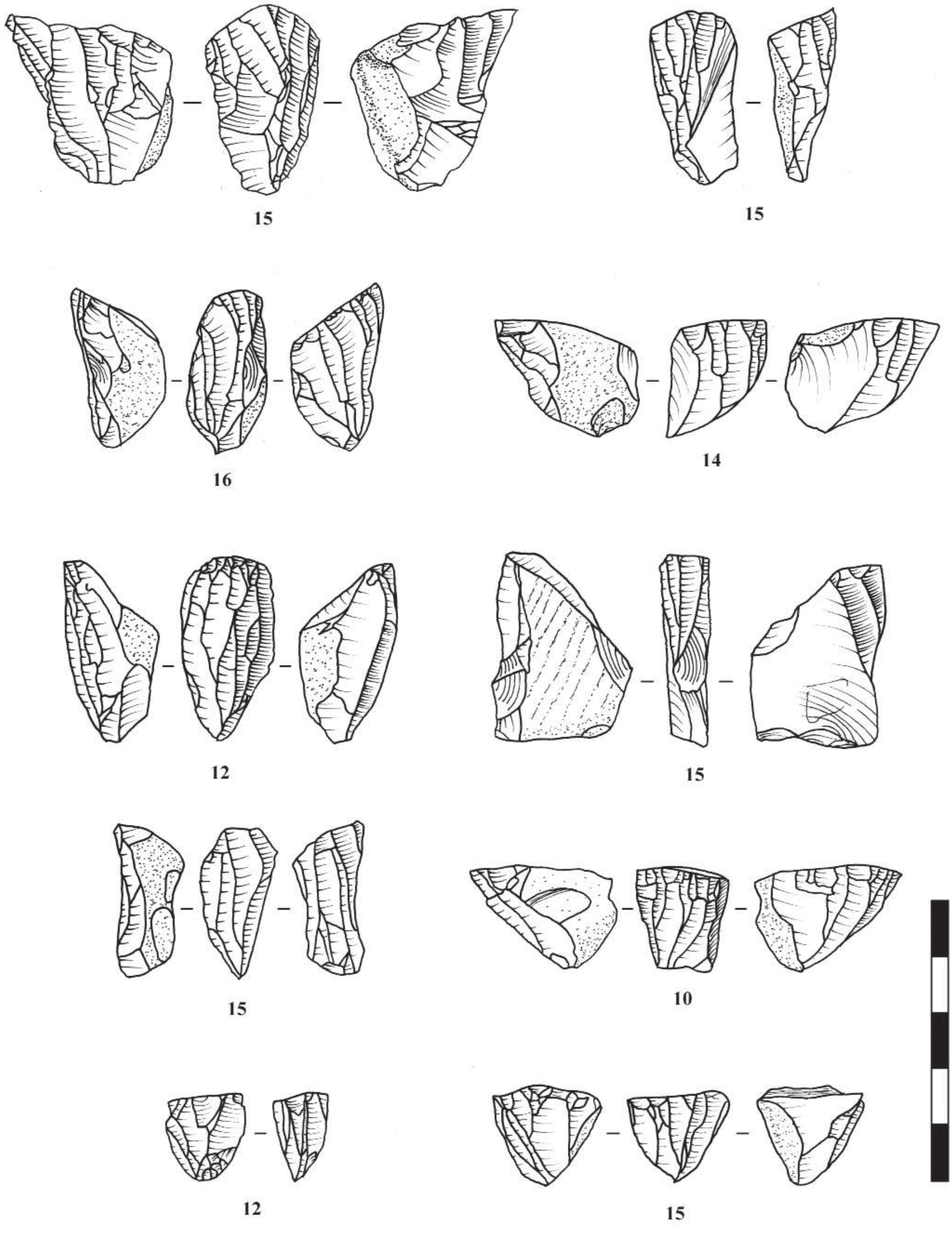

Figure 7 – Yafteh, excavations by Hole and Flannery, twisted bladelet cores.

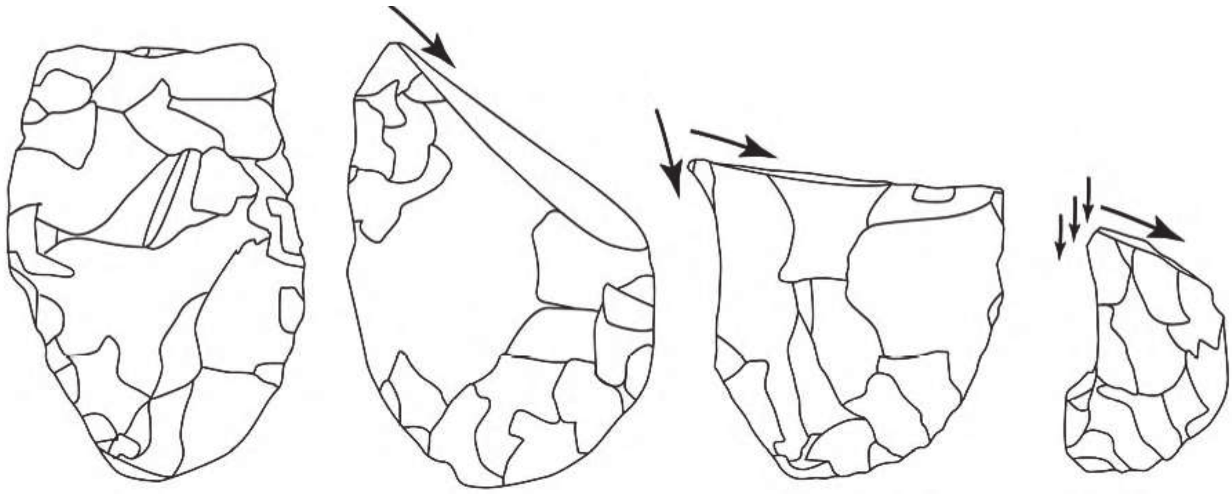

Figure 8 – Yafteh, excavations by Hole and Flannery, different stages of abandon of bladelet cores prepared by bifacial shaping. From left to right: abandon during or at the end of bifacial shaping; after the detachment of a bladelet serving as a striking platform; after the detachment of a twisted bladelet; after the detachment of several bladelets. On this latter piece, we clearly distinguish the traces of the bifacial preparation (right bottom).

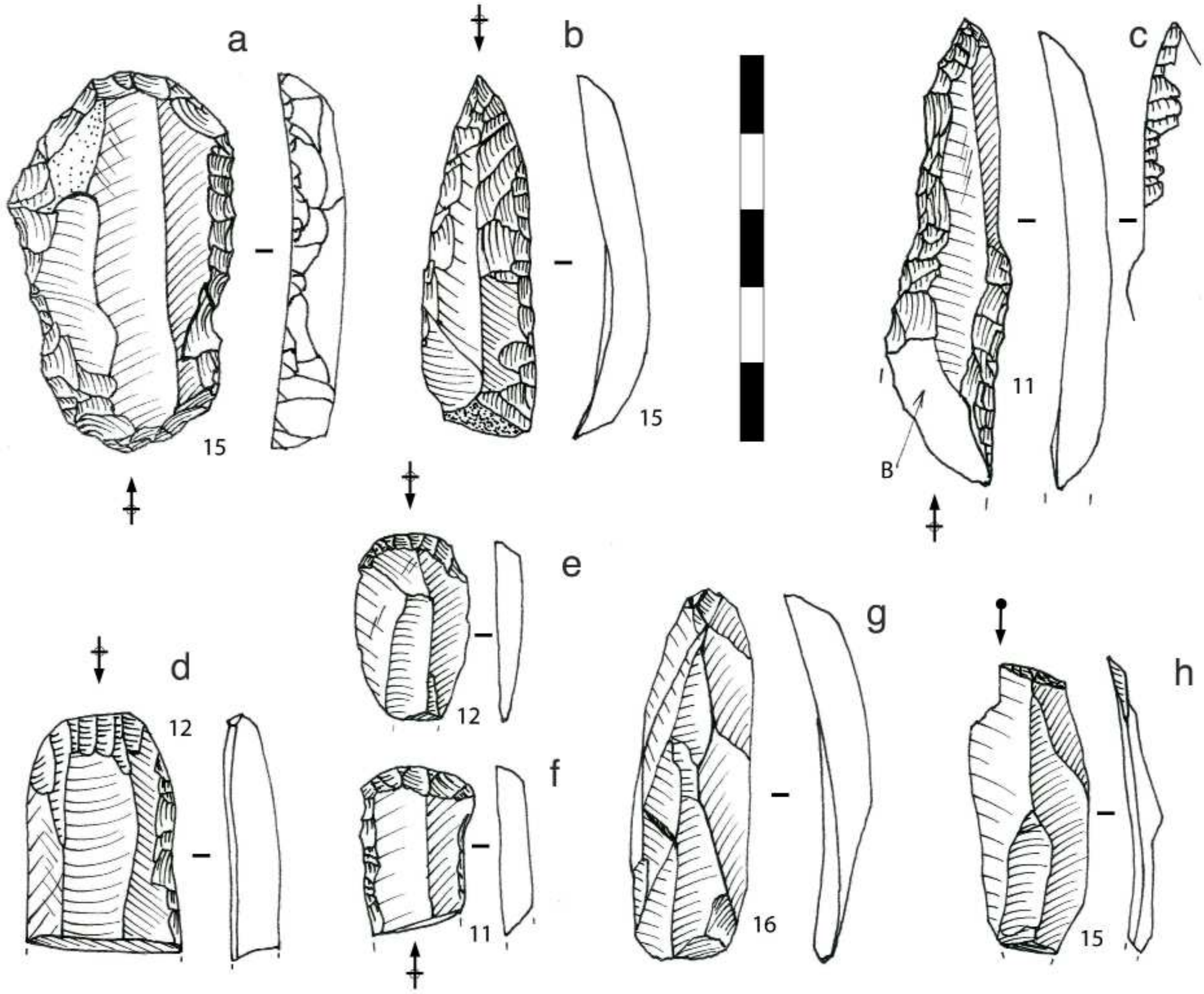

Figure 9 – Yafteh, excavations by Hole and Flannery, blade tools from the upper part of the sequence. a: double scraper on a robust retouched blade; b: pointed blade with bilateral retouch; c: blade retouched on both edges, with flat inverse retouch; d: proximal fragment of a blade with one retouched edge (note the detachment preparation); e and f: end scrapers on small blades; g: unretouched blade showing unipolar convergent debitage; h: truncation burin on a small blade.

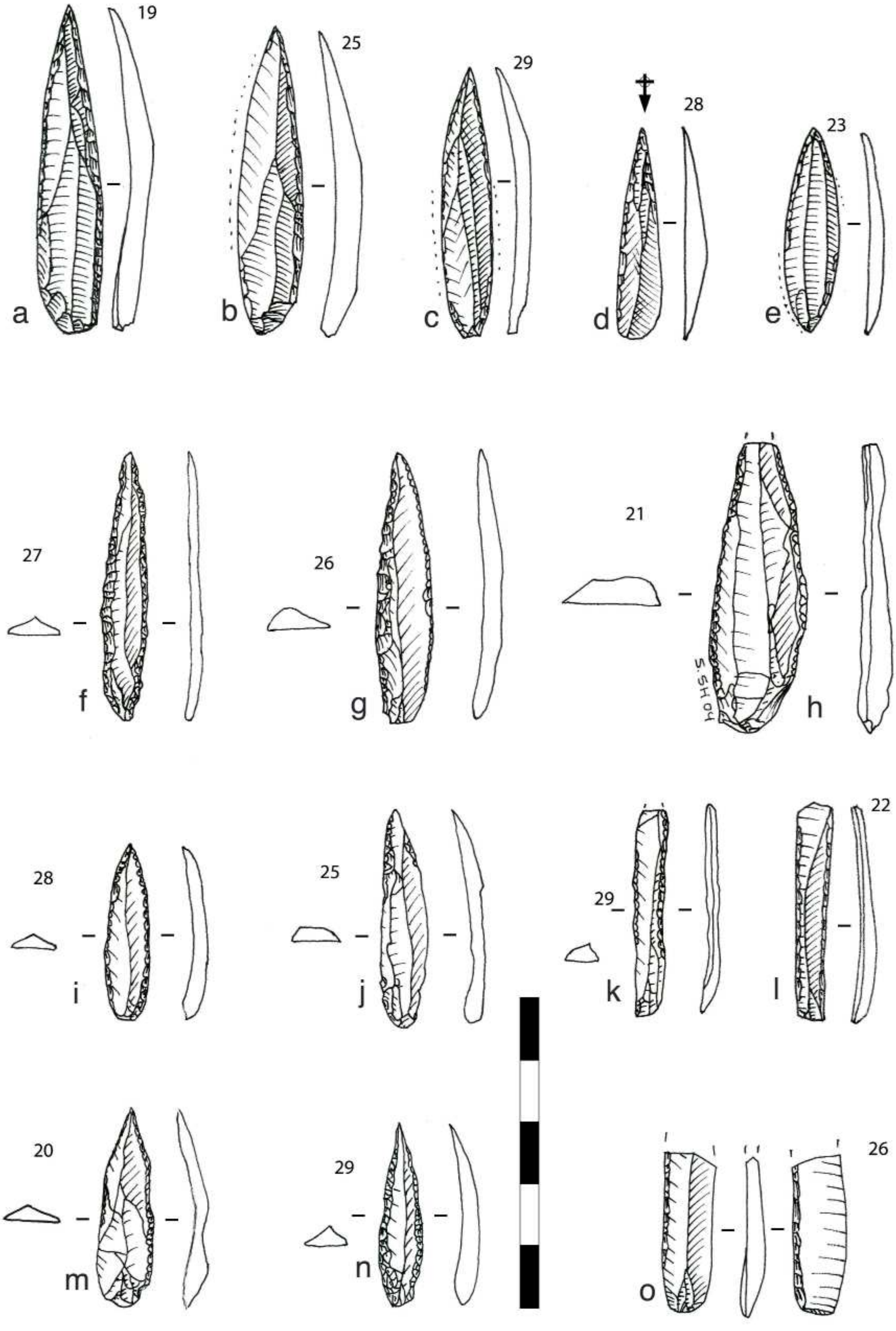

Figure 10 – Yafteh, excavations by Hole and Flannery, retouched blades from the lower part of the sequence. a to j: Arjeneh Points; k and l: "rods"; o: proximal fragment of a long, non-twisted bladelet.

unlike in the higher levels, such blanks are not often retouched (fig. 13a, b and c); however, the edges are polished (traces of use?). In addition, some blade blanks have dorsal bladelet scars (fig. 12e). However, this assemblage does not allow specification of size and characteristics, but we point out intercalated blade and bladelet production in the lower part which does not seem to exist in the upper levels.

6. Conclusions and Perspectives

Given the quality of excavations, the richness of available collections and the consistency of its sequence, Yafteh Cave provides an important reference for the Early Upper Paleolithic of the Zagros and also across the Middle East. The upper levels show the production of small twisted bladelets coming in particular from burin core types. These bladelets usually have inverse retouch on their concave edge which is often associated with direct retouch on their convex edge.

The base of the sequence yielded an industry dominated by the production of rather large, straight or generally curved bladelets. Pointed bladelets are dominant and Dufour bladelets are also present in lower frequency. The industry is free of any Mousterian influence. The Yafteh sequence is quite similar to those known at some sites in the Near East, in particular assemblages belonging to the lower levels (Early Baradostian) that can be compared to the Ahmarian in the Levant, while the upper level assemblages (Late Baradostian) are similar to the Levantine Aurignacian (see Goring-Morris & Belfer-Cohen 2003 for an overview). Apart from the Levant, this sequence is also similar to the Western European Aurignacian, except that here the "Early Aurignacien" is not present (Bordes 2006). We stop the comparisons at this level, since it would be necessary to confirm and describe the sequence characteristics by more precise studies of collections, new systematic excavations and eventually test and demonstrate its regional value in other nearby sites. We believe, however, with current data, proposing an Iranian origin for Aurignacian is quite difficult, given the absence of a transitional industry, but considering the small number of sites studied so far, this remains an open issue for further research.

Although unable to provide us with information on population movement, these common tendencies may at minimum indicate the fluid circulation of ideas in terms of technical equipment between Early Upper Paleolithic groups at a large geographical scale, throughout Baradostian, Ahmarian and Aurignacian groups. This overall unity obviously should not obscure the regional variability of the lithic industries, the characterization of which remains to be explored, particularly in the Zagros region. It is obvious that these data should be complemented with those obtained from other disciplines before proposing any definitive cultural process interpretations.

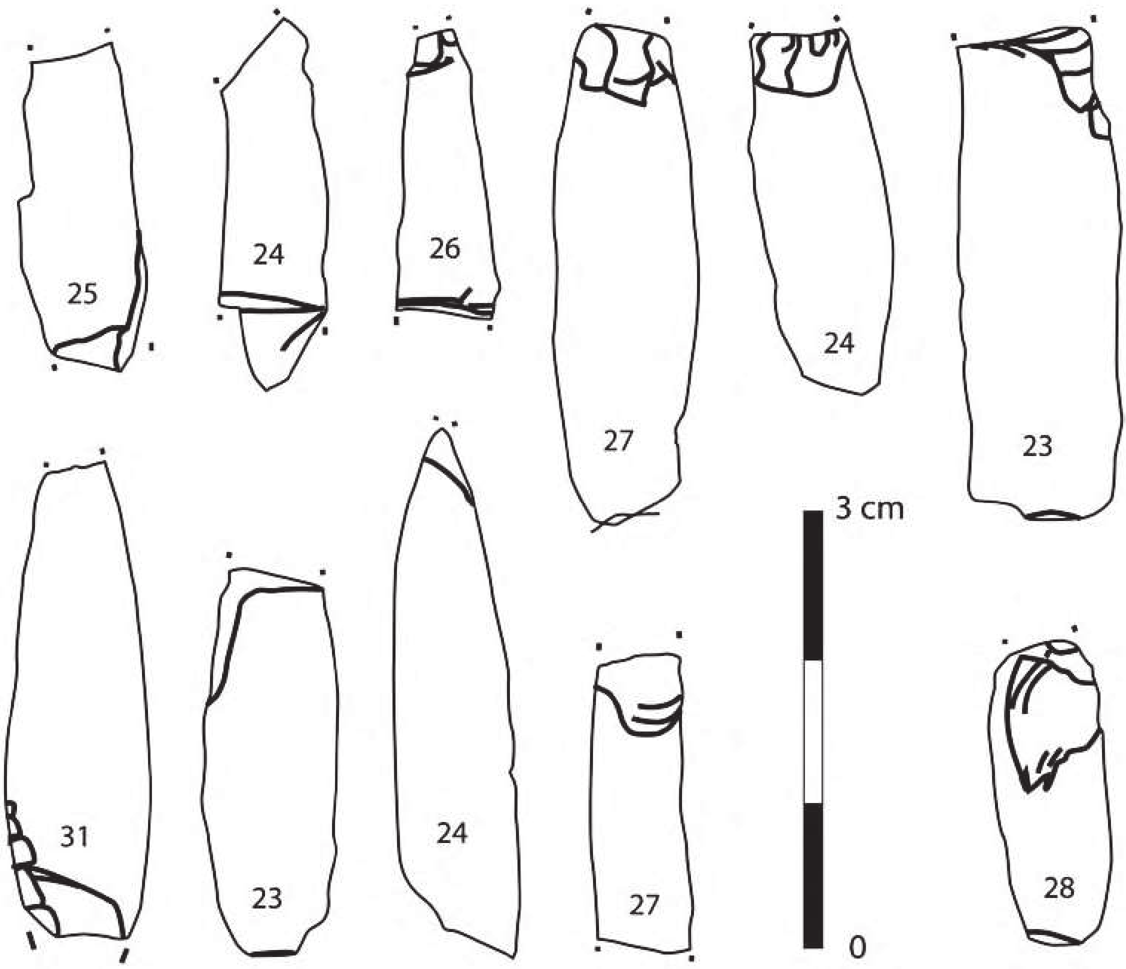

Figure 11 – Yafteh, excavations by Hole and Flannery, lower part of the sequence, retouched bladelets with complex fractures indicating use as projectile point elements.

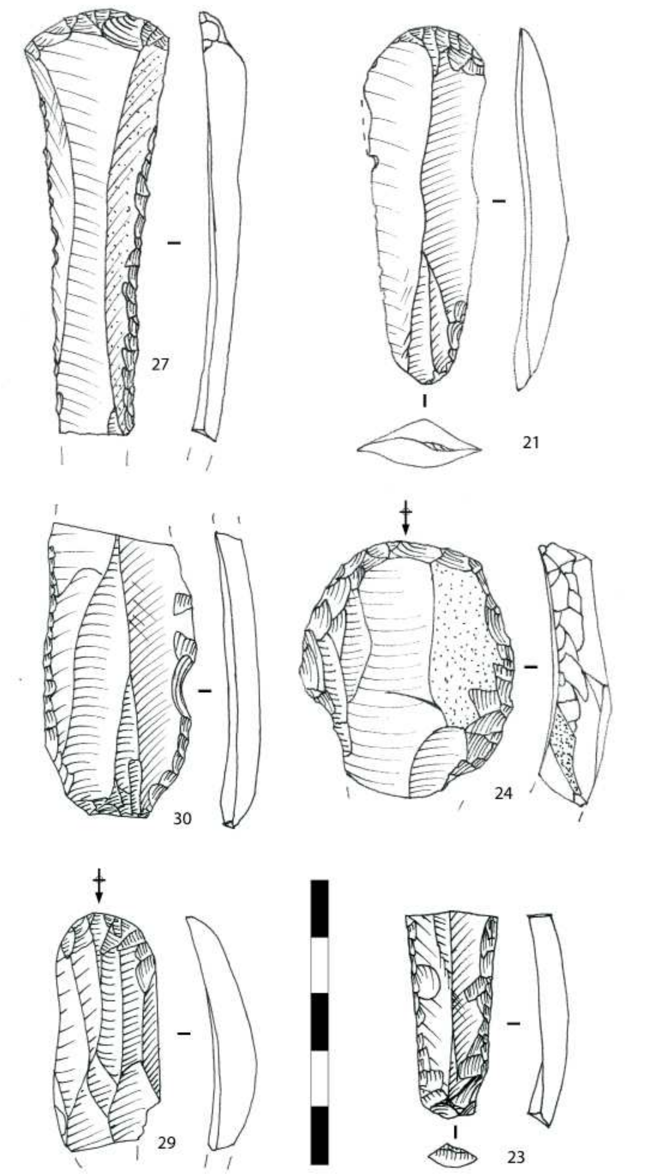

Figure 12 – Yafteh, excavations by Hole and Flannery, lower part of the sequence, blade tools

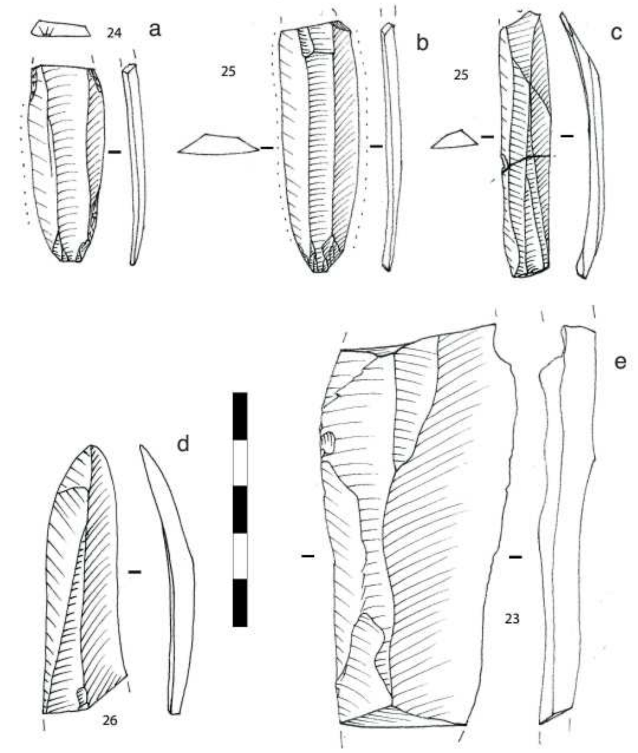

Figure 13 – Yafteh, excavations by Hole and Flannery, lower part of the sequence, blades unretouched or with slightly crushed edges (use traces?)

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