Style, deficit or reduction? Analysing the Bioče Micro-Mousterian

Stil, Mangel oder Reduzierung? Die Analyse des Mikro-Mousterien von Bioče

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Abstract - This paper presents the Micro-Mousterian assemblage uncovered during the 2013 excavation at Bioče rock-shelter (Montenegro). Excavations at this site resumed after a long break. In the Eastern Adriatic region this type of assemblage marks the last stage of the Middle Palaeolithic, traditionally regarded as having occurred between 60 and 28 ka BP (OIS 3). A common feature is a toolkit based on small-sized pieces. This article is built on considerations of a toolkit that belongs to the most representative collection of layer 1.4. We argue that the reason for the abundance of small tools lies in the long-term use of the site by its inhabitants, as well as in the re-use of tools. The analysis of the artefact collection shows that the decrease in tool size in major groups is determined by the number of working edge rejuvenation episodes. In parallel with the size decrease due to artefact reduction, there is a change of tool forms from simple to more complex. These results force us to be careful when searching for analogues to the Bioče assemblage in the region, and show that it is problematic to merge the Final Middle Paleolithic assemblages of the region under a single label "Micro-Mousterian".

Zusammenfassung - *Im vorliegenden Artikel wird ein Mikro-Mousterien Komplex vorgestellt, der 2013 am Bioče-Felsdach (Montenegro) erstmals ausgegraben wurde. Die Grabungen wurden nach einer langen Pause erneut aufgenommen. In der ostadriatischen Region kennzeichnet dieser Typ der Mousterien-Komplexe das letzte Stadium des Mittelpaläolitikums (nach traditioneller Sicht datiert zwischen 60 und 28 ka BP, OIS 3). Ein allgemeines Merkmal ist die Präsenz von Kleingeräten im Werkzeug-Inventar. Der Hauptgegenstand dieses Artikels ist die Geräteausstattung, die im repräsentativsten Inventar, der Schicht 1.4, vorliegt. Es werden Gründe gesucht, die den mikrolithischen Charakter dieses Mousterien aus dem Bioče-Feldach erklären. Wir stellen fest, dass die Häufigkeit an Kleingeräten auf die lange Besiedlung des Felsdachs und die mehrfache Nutzung der Geräte zurückgeht. Im Verlauf der Analyse hat sich herausgestellt, dass sich die Verringerung der Größe der meisten Geräte durch die Anzahl der Erneuerung der Arbeitskante erklären lässt. Parallel zu der Verkleinerung der Geräte infolge Reduktion ist auch eine Veränderung in der Form von einfach bis komplex zu beobachten. Diese Ergebnisse raten zur Vorsicht bei der Suche nach vergleichbaren Fundplätzen in der betrachteten Region und zeigen, dass es problematisch ist, die verschiedenen Komplexe des spätesten Mittelpaläolithikums als eine singuläre Einheit des „Mikro-Mousterien" zu betrachten.*

Keywords - eastern Adriatic region, Final Middle Palaeolithic, toolkit, effect of artefact reduction, working edge rejuvenation, Mousterian of Charentian type, microlithic Middle Palaeolithic
Ostadriatische Region, spätes Mittelpaläolithikum, Geräteausstattung, Reduktionseffekt der Artefakte, Erneuerung der Arbeitskante, Mousterien Typ Charentien, mikrolithisches Mousterien

Introduction

In the current state of archaeological research, different approaches are used to identify and interpret the variability of archaeological assemblages in the eastern Adriatic region. The typological method from François Bordes (1961) was preferentially used for a long time (Basler 1975a; Brodar 1958, 1958–1959, 1962, 1965; Đuričić 2006). In south-west France, six major Mousterian facies were described as the "classic Mousterian complex" during the history of Palaeolithic research. However, many attempts to integrate several Middle Palaeolithic assemblages in a single group or facies were unsuccessful. This is due to the lack of a clearly defined set of techno-typological characteristics among the emphasized groups. This statement is also true for Micro-Mousterian assemblages. This type of stone industry was first found in Syria. Alfred Rust described an undated Micro-Mousterian from the Yabroud rock-shelter I, level 5 (Rust 1950). These assemblages are not rare and are known from Armenia, Greece, the Balkans, Italy, central Europe and France, where they occur during OIS 6 - 3 (Stepanchuk & Chabai 1986; Papaconstantinou 1989; Mihailović 2014).

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Practically the only feature that links the Old World's Micro-Mousterian assemblages together is the presence of a toolkit with small-sized pieces.

On the east coast of the Adriatic Sea Micro-Mousterian assemblages are known from Middle Palaeolithic sites of Dalmatia (Croatia) and Montenegro. They mark the last stage of the Middle Palaeolithic (according to the traditional view about 60 to 28 ka BP, OIS 3). This stage is characterized by a warm and humid climate, when the spread of forest vegetation is documented for the region (Panagiotopoulos et al. 2014). In this period, serious changes occur in the subsistence strategies of the region's inhabitants, and entirely new technical solutions were applied in stone tool production (Mihailović 2014). Most sites in Dalmatia are surface collections (Karavanić 2009; Vujević 2009; Karavanić & Smith 2014; Karavanić et al. 2014), while stratified Micro-Mousterian assemblages have been recorded only in the sequence of the Mujina Pecina site (Karavanić 2000). Here, the cultural layers accumulated in a very short period during OIS 3. This is confirmed by the dates obtained for the site which vary between 45 - 39 ka BP (Rink et al. 2002). A common feature of surface complexes and the stratified Middle Palaeolithic sites of this area is the toolkit with small-sized pieces (Basler 1983; Karavanić 2000; Karavanić et al. 2014). The tools are dominated by denticulated and notched items, although retouched flakes and blades and different side-scrapers are also quite numerous. The flakes and occasional blades used as blanks for tools were periodically produced with the Levallois method.

Micro-Mousterian assemblages are present in layers XVI - XII of Crvena Stijena rock-shelter, located near the border of Montenegro and Bosnia-Herzegovina (Brodar 1958, 1958-1959, 1962, 1965; Basler 1975a, 1979; Basler 1975b; Bakovic et al. 2008). 30 cultural layers were distinguished at this site with archaeological material ranging from the Lower Palaeolithic to the Bronze Age.

Apparently, the time depth of the Micro-Mousterian complexes falls into the range of OIS stages 4 - 3 (layers XVI - XII). Most probably, layer XVI belongs to OIS 4 as shown by geological observations (Brunnacker 1975; Morley & Woodward 2011). Layer XII has a yielded a calibrated (OxCal 4.3 with IntCal 13) radiocarbon date on charcoal of 46'020-42'906 calBP (95.4 %; 40'777 ± 900 BP; GrN-6083) (Vogel & Waterbolk 1972) and therefore belongs to the middle stage of OIS 3.

Primary reduction involved mainly radial and discoid methods accompanied by the Levallois method. Several cores were used for blade production. The composition of the toolkit is similar between all layers. The tools consist of side-scrapers, notched and denticulated tools. Layers XIII and XIV contain numerous atypical end-scrapers, and all layers have a few blades with an abrupt retouch. Mousterian points are poorly represented. Based on the small size of the artefacts, some researchers compared the assemblages of layers XVI - XII of Crvena Stijena with the Micro-Mousterian complexes in Syria and Italy (Brodar 1962, 1965; Basler 1975a, 1979). They emphasized that "the microlithic" character of the toolkit is mainly caused by the cultural preference of the makers.

The second Middle Palaeolithic key-site in Montenegro is the Bioče rock-shelter which is the focus of this article. According to L. Đuričić (2006), who started research at this site, the stone industries of all layers do not show any significant differences in technology or typology. The majority of flakes were produced with the Levallois method. Most of the tools (side-scrapers, small Mousterian points, raclettes and others) range in size from 2 to 4 cm.

A brief overview shows the main problems related to the Micro-Mousterian phenomenon in the eastern Adriatic region

- criteria that are applied to unite the Middle Palaeolithic sites in the same group. In most cases, tool size is the decisive attribute that accounts for a Micro-Mousterian affiliation. Differences in the techno-typological characteristics of the assemblages are usually not taken into consideration;
- chronological variability between sites; there is a significant absence of evolutionary change over time in most of the sites; nonetheless, an opposite pattern is observed in some cases (see below);
- lack of explanations of the causes that generated "the microlithic" character of the toolkit. There are three main points of view on this issue. L. Đuričić (2006) indicates that the small size of retouched artefacts is not caused by a deficiency of large-sized blanks; instead, it is the result of a deliberate microlithization. I. Karavanić (2007), who studied the Micro-Mousterian assemblages of Croatia, considers that the small size is generated by the initial size or the low quality of the raw material used. D. Mihailović (2014), a Serbian specialist, describes the main feature of Micro-Mousterian industries as an "ad hoc technology in core exploitation" in order to reduce it to its maximum.

Determining the causes of this "microlithization" during the Late Mousterian period will provide new data for interpreting the behaviour of the last Neanderthals in the Mediterranean region. Recent studies show that almost all Late Middle Palaeolithic sites contain only small assemblages (Mihailović 2014; Karavanić & Smith 2014; Dogandžić et al. 2014). This makes a holistic determination of the stone industries impossible. The study of Bioče rock-shelter resumed after a long break (Derevianko et al. 2012, 2014, 2016) and uses modern standards of stone artefact excavation and analysis. This allows for an identification of the specific features of lithic artefact production in different cultural layers (see next paragraph). This article deals with the toolkit of the most representative collection of layer 1.4 to

determine the causes that triggered the "microlithic" character of the Micro-Mousterian assemblages of the Bioče rock-shelter.

Bioče rock-shelter: General information

The Bioče site can be clearly seen as one of the most informative Middle Palaeolithic sites in the east Adriatic region (Derevianko et al. 2012, 2014, 2016). The small village of Bioče, which gave the name to the site, is located in a small valley surrounded by mountains, at the confluence of the Morača and Mala Rivers (Fig. 1: A). The Bioče rock-shelter is situated on the left side of the Morača valley, at the base of the limestone massif, at an altitude of about 40 m above the modern-day river level. The rock-shelter is oriented to the south-west and measures 9 m in depth (from the drip line) and 11 m in width.

The first excavation area was opened in 1986 followed by periodical investigations until 1997. The sequence of Pleistocene sediments was divided into three series (I - III) by L. Đuričić, who started research at the site (Đuričić 2006).

Between 2010 and 2015, new excavations of undisturbed deposits started inside the rock-shelter. The excavated section has a thickness exceeding 5 m (Fig. 1: B) and reveals four main lithological units (Derevianko et al. 2015).

Deposits comprising layers 3 and 4 (sublayers 4.1 and 4.2), which form the lower part of the section, consist of heavy reddish-brown loamy sediments, with debris of medium and large size, and small blocks showing different degrees of weathering. The former occur sporadically or are part of the subhorizontal horizons. Raw material was taken as pebbles for stone knapping using simple parallel, orthogonal and centripetal reduction methods. However, there is also clear evidence of the Levallois technology. The most numerous tool categories are side-scrapers (Fig. 1: C).

The deposits of layer 2, composing the middle part of the section, are divided into three sublayers (2.1 - 2.3). The sediment includes mainly grey-coloured sandy loams and sands of various grain sizes in the upper and middle part of the layer, whereas the near-bottom part is composed of light coloured loams. An intensive development of secondary carbonates is the marker-attribute of layer 2. The lithic industry recovered in this layer reveals a frequent use of the radial reduction method. This industry is characterized by the production of medium-sized blades and elongated Mousterian points made on blades, as well as side-scrapers and atypical knives. It is likely that these blades are the result of an off-site raw material reduction (Fig. 1: D).

Four sublayers (1.1 - 1.4) were recognized in the sediments comprising layer 1. They include loams of different shades (from reddish to black), containing debris and humic material at varying degrees. Radiocarbon dating of bone and charcoal samples collected from layer 1 indicates that sediment accumulation occurred in a time span ranging from 40 to 32 ka BP or 48 ka to 39 calBP calibrated with OxCal 4.3 using IntCal 13: 38'926 – 33'853 calBP (95.4 %; 31'765 ± 1'143 BP; NskA-00380), 39'132 – 34'219 calBP (95.4 %; 32'158 ± 1'084 BP; NskA-00380), 42'130 – 37'653 calBP (95.4 %; 35'257 ± 1'068 BP; NskA-00381) and 48'089 – 42'304 calBP (95.4 %; 40'787 ± 1'511 BP; NskA-00381) (Derevianko et al. 2014).

The major part of the site's archaeological material (about 90 % of all assemblages from the site) was documented within layer 1. In comparison with the other layers, the layer 1 assemblage most closely matches the characteristics of the Micro-Mousterian (Fig. 1: E), as discussed in detail below.

The lithological specifics of the layers evidence that the rock-shelter was filled with deposits under different depositional conditions during a long time span. The dynamics revealed by the Bioče industry (in conjunction with stratigraphic observations) provide a basis for recognizing several techno-complexes at the site which reflect occupation episodes by human groups with different lithic technologies (Derevianko et al. 2016). This article examines the largest collection of sublayer 1.4 (excavations of 2013) that gives a complete picture of the specific features of lithic production in layer 1.

Lithic collection sublayer 1.4

Chipped stone artefacts were made of locally obtained flint, predominantly chocolate-brown or grey in colour. In addition to flint, varieties of carbonated rock and fine-grained sandstone with good conchoidal fracturing properties were also used (Đuričić 2006). Core preforms, which show the preparation of the nucleus before blank removal, provide an idea about the size of individual raw material pieces selected for knapping. These are river pebbles with a size of 60 to 110 mm maximum.

The collection from the excavation area (excluding water screened material) consists of 4'563 stone artefacts (Fig. 2). 952 pieces (20.9 %) are classified as debris (less than 10 mm in size and chunks).

Core-like pieces, including split pebbles and cobbles, account for 320 items (7 % of the total number of artefacts in the assemblage) (Fig. 3).

Centripetal, discoid unifacial, and discoid bifacial cores (Fig. 4: 1, 3) used for the production of small flakes are the most frequent types of nuclei. Orthogonal cores (Fig. 4: 2, 4) are morphologically close to them. Parallel cores, including rare items with a volumetric working surface (sub-cylindric, conoid, sub-conoid) (Fig. 4: 5, 6, 9) are more numerous than parallel transverse cores. Rare narrow-faceted cores (Fig. 4: 7) and Levallois cores (Fig. 4: 8) for flakes also exist. The rare Levallois cores exhibit a protruding shape of the working surface that was formed by the removal of small centripetal chips. These chips, usually not exceeding 1 cm in length, were not removed over the entire working surface. In all cases, the striking platform

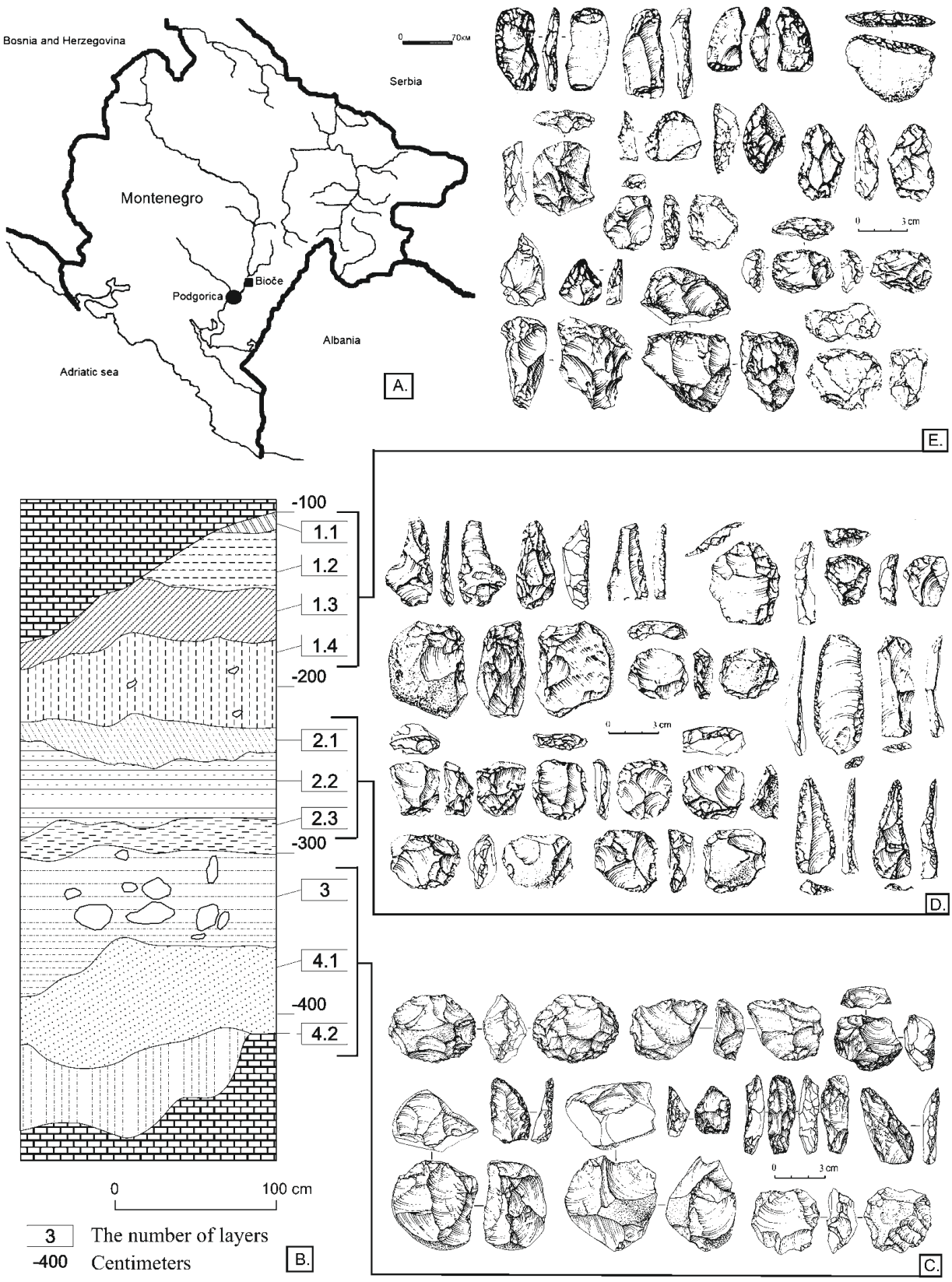

Fig. 1. A – Map showing the location of the Bioče rock-shelter; B – Profile of the Bioče rock-shelter sequence in the Northern part of the excavation; C – Stone artefacts uncovered in layers 3 - 4.1; D – Stone artefacts uncovered in layers 2.1 - 2.3; E – Stone artefacts uncovered in layers 1.1 - 1.4.

Abb. 1. *A – Karte mit der Lage des Bioče-Felsdaches; B – Profil der Sequenz des Bioče-Felsdaches im nördlichen Teil der Ausgrabung; C – Die Steinartefakte aus den Schichten 3 - 4.1; D – Die Steinartefakte aus den Schichten 2.1 - 2.3; E – Die Steinartefakte aus den Schichten 1.1 - 1.4.*

		N	%
Cores		**218**	***4.8***
Fragments of cores		**76**	***1.7***
Split pebbles		**22**	***0.5***
Split cobbles		**4**	***0.1***
Decortication flakes (including fragments)		**359**	***7.9***
	large (mo than 50 mm)	103	
	middle (from 20 to 50 mm)	218	
	small (less than 20 mm)	38	
Core trimming elements		**68**	***1.5***
	working surface preparation	35	
	working surface rejuvination	2	
	crested	4	
	semi-crested	9	
	striking platform preparation	18	
Flakes (including fragments)		**2'295**	***50.3***
	large (mo than 50 mm)	138	
	middle (from 20 to 50 mm)	795	
	small (less than 20 mm)	1'362	
Blades		**32**	***0.7***
	not fragmented	23	
	proximal	2	
	medial	4	
	distal	3	
Bladelets		**4**	***0.1***
	not fragmented	1	
	proximal	2	
	distal	1	
Tools		**533**	***11.7***
Chunks		**904**	***19.8***
Chips (less than 10 mm)		**48**	***1.1***
All		**4'563**	***100***

Fig. 2. Bioče rock-shelter. Layer 1.4. Composition of the lithic assemblage.
Abb. 2. *Bioče-Felsdach.. Schicht 1.4. Zusammensetzung des Artefaktinvetars.*

of the cores is strongly convex and well prepared. It was removed only one predeterminated flake.

The collection contains numerous decortication flakes (359 pieces, 7.9 %) of which more than half are entirely covered with cortex. This indicates that the first steps of stone knapping (decortication, core preparation) were performed at the site.

The largest group of blanks comprises flakes, blades and bladelets (2'295 pieces, (51.1 %). Flakes are most numerous, of which the majority (59.4 %) is of small size (less than 20 mm). Medium sized flakes (20 to 50 mm) comprise 34.6 % of the group, whereas the large ones (more than 50 mm) account for 6 %. Flakes of all sizes often have a plain striking platform. Among the large and medium flakes, 20 % of the artefacts have a natural platform. About the same number of flakes have dihedral and flat platforms. The proportion of pointed and linear platforms is about 10 %. Thus, with decreasing flake size, the number of plain and natural platforms decreases and the number of linear and pointed platform increases. Half of the large and medium flakes have a parallel dorsal surface. Flakes with orthogonal or radial dorsal surfaces make up about one-third of the total. 20 % of the flakes have a plain dorsal surface. The share of chips with a bi-parallel or convergent dorsal surface is small in comparison with the previously described variants. In general, the small flakes are very similar to the large and medium ones. Blades account for only 0.7 % of the total number of artefacts in the collection. Thus, there is on average one blade per 72 flakes. Bladelets can be considered as random by-products.

The numerous tools make up 11.7 % of the total number of artefacts (533 pieces).

	N	%
Core preforms	15	*6.9*
Centripetal	48	*22.0*
Discoid unifacial	45	*20.6*
Discoid bifacial	20	*9.2*
Parallel	10	*4.6*
Parallel transverse	25	*11.5*
Convergent	1	*0.5*
Bi-parallel	5	*2.3*
Bi-parallel transverse	9	*4.1*
Orthogonal	13	*6.0*
Crossed	1	*0.5*
Double-faced orthogonal	8	*3.7*
Levallois (for flakes)	6	*2.8*
Sub-cylindric	6	*2.8*
Conoid	1	*0.5*
Sub-conoid	0	*0.0*
Narrow-faceted	5	*2.3*
All	**218**	***100.0***

Fig. 3. Bioče rock-shelter. Layer 1.4. Cores.
Abb. 3. *Bioče-Felsdach. Schicht 1.4. Kerne.*

Tools

A few tool categories have been determined, among which a number of separate tool types can be distinguished (Fig. 5).

Single side-scrapers (Fig. 6: 1, 4 - 7)

This category is dominated by straight side-scrapers. They vary in size (from 22 to 82 mm) as well as in the degree of working edge convexity. All of these items have a scalar steep continuous retouch. Often they have a natural or prepared back (Fig. 6: 1, 4, 6). One tool has a backed distal part which is set at a right angle to the working edge. Some tools have an irregular retouch on the edge opposite to the working edge. A few items have a thinned back. Transverse side-scrapers (Fig. 6: 3) are almost two times smaller than the longitudinal ones. Massive short blanks of rectangular shape were chosen for their production. Their dimensions vary from 26 to 65 mm. In all cases, the working edges are located at the distal part. Diagonal scrapers are represented by only two items (27 and 43 mm in length), one of which is prepared with a ventral retouch.

Double side-scrapers

Their size is generally smaller than that of the single side-scrapers, and they are shaped with the same retouch. Dejété scrapers (Fig. 6: 8 - 10) are most numerous. Almost all of these tools have a short trapezoidal shape due to intensive retouching at the distal part and at the longitudinal side. Double dejété scrapers (Fig. 6: 14 - 17) have two retouched longitudinal sides as well as a retouched distal part in between. Triple dejété scrapers (Fig. 6: 15, 16) demonstrate the highest degree of reduction. The retouch is located around the entire perimeter. Convergent scrapers (Fig. 6: 12, 13) have two straight working edges. They are much smaller than dejété scrapers and range from 27 to 44 mm in the greatest dimension. Their form is mostly of an elongated equilateral or isosceles triangle. One convergent side-scraper has a thinned back. Double side-scrapers (Fig. 6: 11) are present almost in the same number as convergent side-scrapers, but all of them are fragmented.

Semi-circular and circular scrapers

All of the semi-circular scrapers (retouch extends over ¾ of the perimeter) and one circular scraper (retouch extends over the entire perimeter) vary from 28 to 52 mm in their greatest dimension.

Typical and atypical retouched knives

Typical (Fig. 7: 1, 3) and atypical (Fig. 7: 2) retouched knives have a semi-steep retouch in contrast to side-scrapers. Their sizes vary from 32 to 52 mm in the largest dimension. One item was made on a blade. Only ¼ of all knives have a straight working edge, all other products show aconvex working edge. Only one piece exhibits a ventral retouch.

Atypical semi-circular and circular end-scrapers

Atypical semi-circular (Fig. 7: 4) and circular (Fig. 7: 5) end-scrapers are, in fact, analogues of typical semi-circular and circular side-scrapers. They are distinguished by a strong working edge convexity, steep retouching angle, and the form of retouch (sometimes laminar). They repeatedly decrease in comparison to side-scrapes in number and size (from 25 to 29 mm). In contrast, atypical single end-scrapers (Fig. 7: 6, 7), atypical angle end-scrapers and core-shaped scrapers (Fig. 7: 8) are unique. Atypical single end-scrapers (21 to 43 mm in length) are the most numerous in this category. Their working edges at the distal end are more convex than straight. The working edge of one tool was rejuvenated with a ventral retouch.

Mousterian points

Triangular Mousterian points (Fig. 7: 9, 10) were produced with a scalar, steep, and continuous retouch. The dimensions of these points vary from 28 to 45 mm in their maximum dimension. Their working edges converge in the proximal part of blanks. The smallest specimen has a bilaterally thinned base.

Truncated-faceted pieces

Truncated-faceted pieces (Fig. 7: 11) vary in size from 25 to 49 mm. They can be separated into three groups based on the number and location of working edges: at the distal part only (1); at the distal part and one longitudinal edge (2); at the distal part and at both

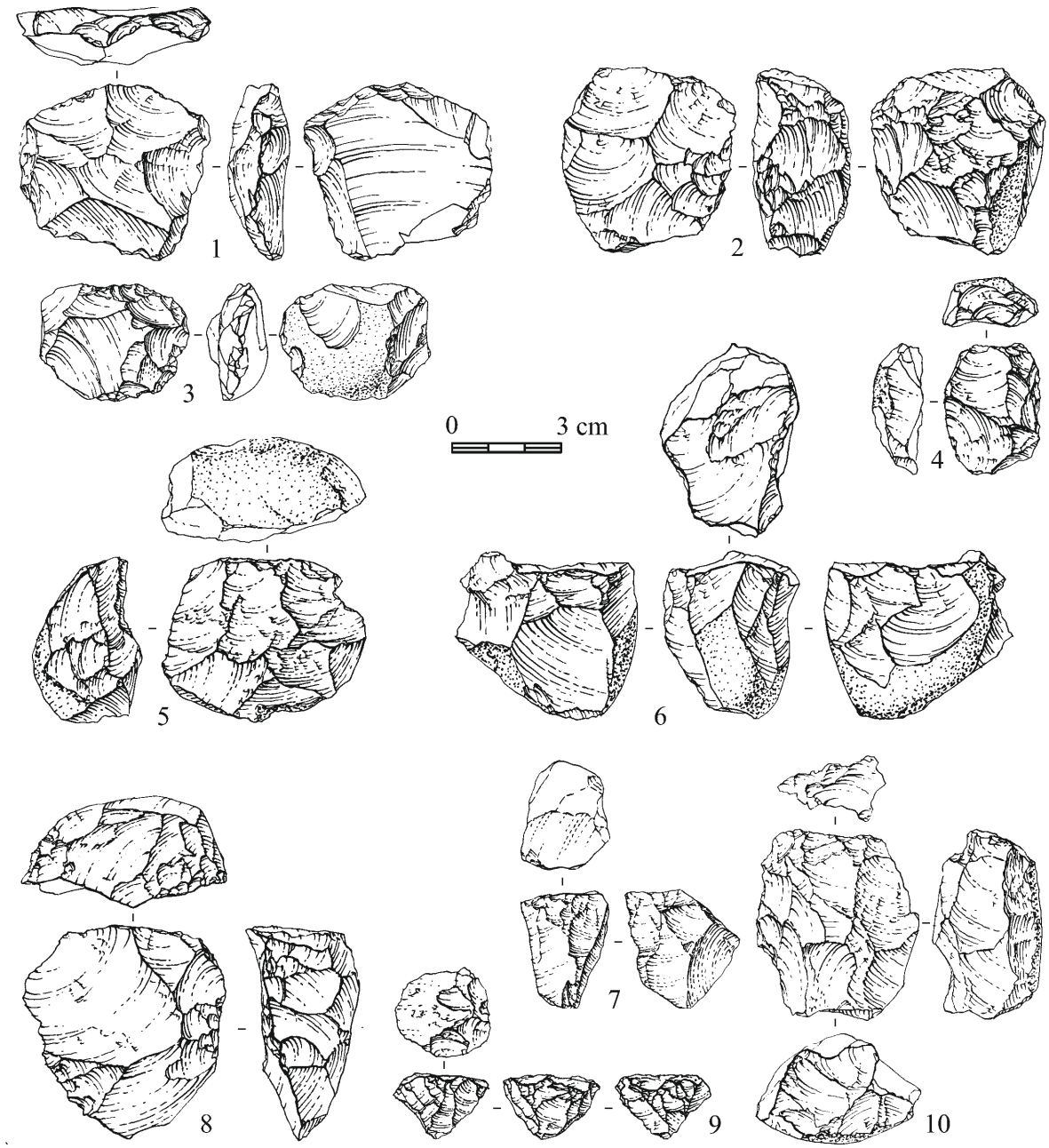

Fig. 4. Bioče rock-shelter. Layer 1.4. Cores: 1, 3 – radial; 2, 4 – orthogonal; 5 – parallel; 6 - sub-cylindric; 7 - narrow-faceted; 8 - Levallois (for flakes); 9 – conoid; 10 - bi-parallel.

Abb. 4. *Bioče-Felsdach. Schicht 1.4. Kerne: 1, 3 – radiale Kerne; 2, 4 – orthogonale Kerne; 5 – paralleler Kern; 6 – annähernd zylindrischer Kern; 7 – Stirnkern; 8 – Levalloiskern für Klingen; 9 – konischer Kern; 10 – bi-paralleler Kern.*

longitudinal edges (3). Thinning spalls were removed from both the dorsal and the ventral surface.

Zinken, Denticulate, and notched pieces

Zinken, denticulates, and notched tools (Fig. 7: 12) show a comparable size which varies from 25 to 57 mm. They are almost always created on the same section of the blank (the angle between the left longitudinal edge and the distal part). Notches were made in the medial part with a careful dorsal or ventral retouch. One tool has a thinned back. Massive denticulated tools don't show any patterns.

Thinned flakes

Thinned flakes - several of which are distinguished by their large size (up to 65 mm) - are modified on one side only in two out of three cases. One third of these tools display a thinning on one longitudinal edge and an irregular dorsal retouch on the other side.

Flakes with irregular retouch

This is the largest group of tools. Like the multi-tools and single side-scrapers, this group shows highly variability in size (from 20 to 80 mm). Medium-sized tools (30 to 50 mm) are the most numerous. Large tools (50 mm) comprise only a tenth of the group,

	N	%
Side-scrapers	**182**	***34.1***
strait	63	*11.8*
convex	16	*3.0*
concave	3	*0.6*
strait transverse	7	*1.3*
convex transverse	35	*6.6*
diagonal	3	*0.6*
double strait	11	*2.1*
convergent	8	*1.5*
dejété	20	*3.8*
double dejété	8	*1.5*
triple dejété	2	*0.4*
semi-circular	4	*0.8*
circular	2	*0.4*
Atypical end-scrapers	**14**	***2.6***
single	9	*1.7*
angle	1	*0.2*
semi-circular	2	*0.4*
circular	1	*0.2*
core-shaped	1	*0.2*
Retouched knives	**22**	*4.1*
typical	12	*2.3*
atypical	10	*1.9*
Mousterian points	**5**	*0.9*
Truncated-faceted pieces	**10**	*1.9*
Zinken	**6**	*1.1*
Notched	**7**	*1.3*
Denticulate	**2**	*0.4*
Thinned flakes	**18**	*3.4*
with dorsal retouch	4	*0.8*
without dorsal retouch	14	*2.6*
Blade with one retouched edge	**1**	*0.2*
Blade with two retouched edges	**1**	*0.2*
Flakes with irregular retouch	**143**	*26.8*
Chunks with irregular retouch	**4**	*0.8*
Fragments of tools	**118**	*22.1*
All	**533**	***100.0***

Fig. 5. Bioče rock-shelter. Layer 1.4. Tools.
Abb. 5. *Bioče-Felsdach. Schicht 1.4. Werkzeuge.*

small pieces (30 mm) amount to a share of one-fifth. Tools with a dorsal retouch dominate the group. Pieces with a ventral and a bifacial retouch are represented by six specimens each, and one specimen exhibits an alternate retouch. Tools with two retouched longitudinal edges and specimens with a retouch on both sides and the distal part (five and six items, respectively) look like exceptions compared to the previous groups.

Retouched blades

Retouched blades have an irregular retouch on one or two sides, respectively. They are represented by fragments.

Chunks

Chunks with irregular retouch (35 to 55 mm) are represented by only four items.

Conclusion

The overall composition of the lithic industry, namely the significant amount of debris, numerous core preforms, cores in various stages of reduction, the abundance of decortication flakes and non-modified flake blanks of different sizes and proportions, shows that the whole knapping process took place on the site. Flakes – suitable for tool making – outnumber the nuclei by either eight or nine to one. Unretouched flakes outnumber the tools by five to one. These calculations clearly point to an extreme tool production activity in the industry of layer 1.4.

This intensity of tool production creates major problems for the determination of tool typology. The distinctive feature of the toolkit of layer 1.4 is its "microlithic" character. Very common in this assemblage are pieces with size ranges from 2 to 4 cm in both length and width (Đuričić 2006). It is important to note that the size of raw material is not the only factor affecting the size of the tools. Despite the low raw material quality, the presence of river cobbles with a size up to 110 mm in maximum dimension in raw material outcrops would make the production of much larger tools possible.

We suggest that the reason for the abundance of small tools lies in the long-term use of the site by its inhabitants, as well as in the re-use of tools. A reflection of these processes is found in the reduction of tool size due to the increasing number of working edges. This pattern of artefact reduction is known as/referred to as the „Frison effect" (Frison 1968; Jelinek 1976; Dibble 1995). Reduction most clearly manifests itself in the scraper group (Fig. 8). After a number of working edge rejuvenation episodes and the creation of new edges in the course of the tool's biography, they end up short, narrow, and relatively thick (Fig. 6). A huge number of small flakes and chips in the collection which were not modified into tools are probably the result of this working edge rejuvenation.

Except for the tool types associated with the effect of artefact reduction, numerous simple side-scrapers and transverse side-scrapers are also present; the near absence of the Levallois method as well as the use of dorsal scalar retouch most closely associates the assemblage of layer 1.4 of Bioče rock-shelter with the Mousterian of Charentian type which is characterized by an abundance of highly worn tools. Previously, this Mousterian type was identified in some Middle Palaeolithic surface collections in Dalmatia, also based on the typology of its tools (Vujević 2009).

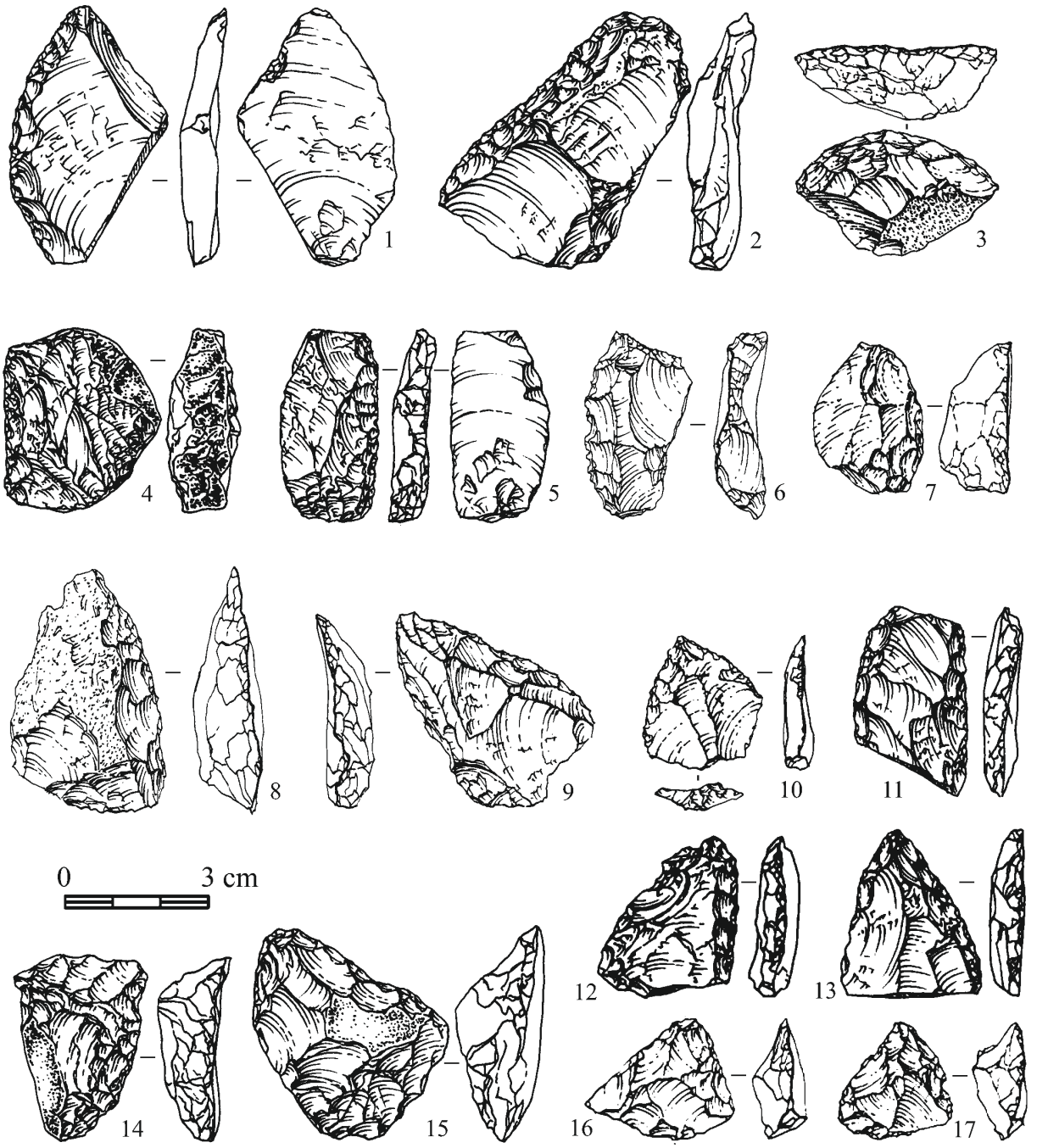

Fig. 6. Bioče rock-shelter. Layer 1.4. Side-scrapers: 1, 6, 7 - convex side-scrapers; 2 - diagonal side-scraper; 3 - convex transverse side-scraper; 4, 5 – straight side-scrapers; 8 - 10 - dejété side-scrapers; 11 - double straight side-scraper; 12, 13 - convergent side-scrapers; 14 - 17 – double dejété side-scrapers; 15 - 16 - triple dejété side-scrapers.

Abb. 6. *Bioče-Felsdach. Schicht 1.4. Schaber: 1, 6, 7 – konvexe Schaber; 2 – diagonaler Schaber; 3 – konvexer Breitschaber; 4, 5 – gerade Schaber; 8 - 10 – Winkelschaber; 11 – gerader Doppelschaber; 12, 13 – Spitzschaber; 14 - 17 – doppelte Winkelschaber; 15, 16 – dreifache Winkelschaber.*

Discussion

For a long time it has been thought that the presence of Micro-Mousterian complexes is a common feature of the Terminal Middle Palaeolithic in the eastern Adriatic region. Moreover, based on toolkit typology and artefact size, several researchers observed a similarity between assemblages from Dalmatia (Mujina Pecina) and from north-west Greece (Asprochaliko, Kokkinopilos) (Dakaris et al. 1964; Higgs & Vita-Finzi 1966; Bailey et al. 1983; Papaconstantinou 1989). I. Karavanić (2007) notes that several Pontinian sites in central and western Italy (Grotte Breuil, Sant 'Agostino) (Schwarcz et al. 1990-91; Kuhn 1995), as well as a few sites in the centre of Florence (Galceti, Santa Lucia II, Impruneta) (Palma di Cesnola 1993) also contain Micro-Mousterian assemblages with side-scrapers dominating in the toolkit. Therefore, the "influence zone" of the Micro-Mousterian extends over a major part of the Mediterranean region.

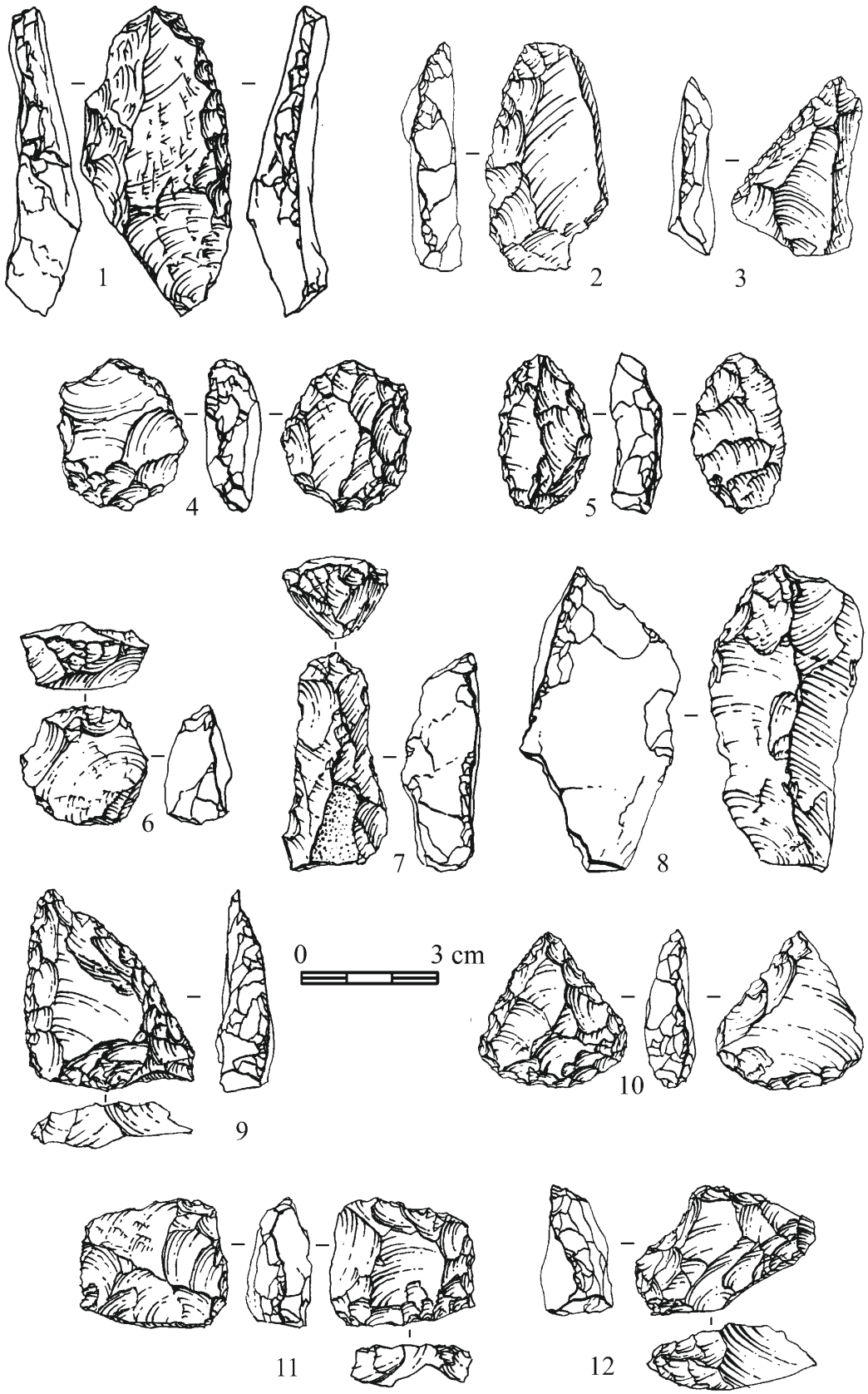

Fig. 7. Bioče rock-shelter. Layer 1.4. Tools: 1, 3 - typical retouched knifes; 2 - atypical retouched knife; 4 - semi-circular atypical end-scraper; 5 - circular atypical end-scraper; 6, 7 - atypical single end-scraper; 8 - core-shaped end-scraper; 9, 10 - Mousterian points; 11 - truncated-faceted piece; 12 – notched piece.

Abb. 7. *Bioče-Felsdach. Schicht 1.4. Werkzeuge: 1, 3 – typische retuschierte Messer; 2 – atypisch retuschiertes Messer; 4 – halbrunder atypischer Kratzer; 5 – runder atypischer Kratzer; 6, 7 – atypische Kratzer; 8 – kernartiger Kratzer; 9, 10 – Moustérien-Spitzen; 11 – ausgesplittertes Stück; 12 – gekerbtes Stück.*

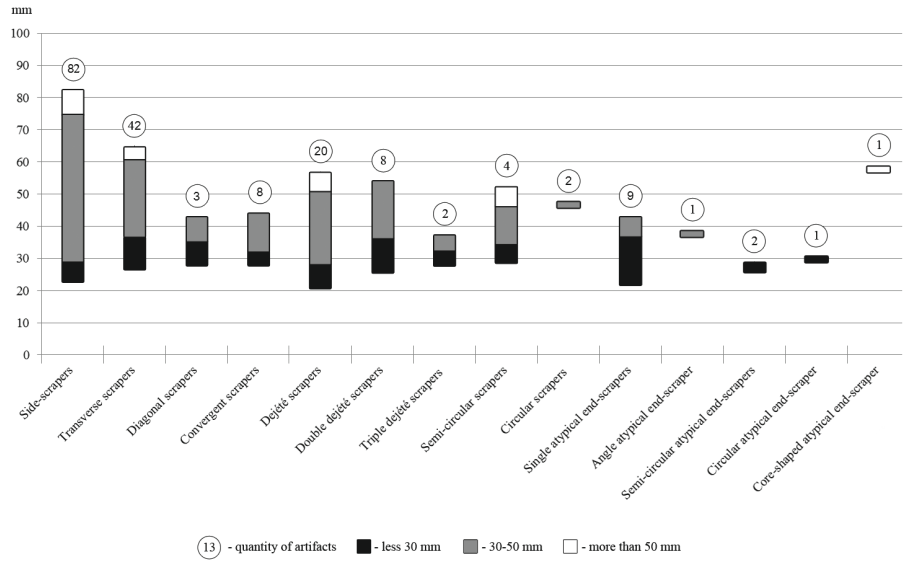

Fig. 8. Bioče rock-shelter. Layer 1.4. Frequency distribution of tools in relation to their maximum dimension.

Abb. 8. *Bioče-Felsdach. Schicht 1.4. Häufigkeitsverteilung der Geräte entsprechend ihrer maximalen Grösse.*

The analysis of the artefact collection from layer 1.4 of Bioče rock-shelter shows that the decrease in tool-size in major groups is determined by the number of working edge rejuvenation episodes. In parallel with the size decrease due to artefact reduction, there is a change of tool forms from simple to more complex (single side-scrapers – double side-scrapers – triple, semi-circular, circular side-scrapers). Thus, the degree of typological variability would be substantially overestimated if it is solely based on formal typology.

These results advise us to be careful in the search for comparable assemblages in the region around Bioče. The Greek Micro-Mousterian is primarily associated with the Mousterian layer 14 of Asprochaliko rock-shelter. In this industry, pseudo-Levallois points, 25 - 35 mm long, and formed by knapping radial and discoid cores are very frequent. These blanks were subsequently converted, via intensive retouching, into different types of scrapers (Papaconstantinou 1989). On the Kokkinopilos site, two kilometres from Asprohaliko rock-shelter (Dakaris et al. 1964), the primary reduction strategy of the Mousterian industry is the Levallois method. The toolkit is characterized by the prevalence of single side-scrapers (often with a convex working edge) over other forms. Convergent side-scrapers, dejété side-scrapers and double side-scrapers occur less frequently. A significant part of the tools are classic Mousterian points, including elongated ones. Specific features of this complex are bifacial leaf points, truncated-faceted pieces and burins (Dakaris et al. 1964). Because of a variable use of the Levallois method and blade production, the Greek Micro-Mousterian assemblages show differences in tool kit composition. In addition, the toolkit of Kokkinopilos contains tool types that are otherwise rare in the Middle Palaeolithic of the region (bifacial leaf points, truncated spalls, burins).

A distinctive characteristic of the Micro-Mousterian assemblages of Dalmatia, which were discussed above, is the dominance of notched and denticulated tools. These categories are rare in the Bioče rock-shelter industry described above.

As a result, the Micro-Mousterian assemblage of Bioče shows a certain similarity with the complexes of Crvena Stijena, also discussed in this article. Similar features are present in both the primary reduction and in the toolkits. However, alongside the Middle Palaeolithic tool types from Bioče, core-like end-scrapers, and truncated-faceted pieces are present.

Unfortunately, the material from many Micro-Mousterian sites is still unpublished. This makes a comparison between these locations impossible. However, current data is sufficient to understand that the cultural processes that took place at the end of the Middle Palaeolithic in the region were complex. It seems that the similarity between the Micro-Mousterian complexes of the region concerns the raw material reduction strategy and/or the economizing behaviour of ancient populations during OIS 3 that condition the "metric standards" of the lithic production. Meanwhile, the cultural, stylistic and functional factors cause a high degree of variability in Middle Palaeolithic assemblages, which are mistakenly merged under a single "Micro-Mousterian" label.

Acknowledgements: Investigation of Bioče rock-shelter was supported by the Russian Science Foundation (Project No. 14-50-00036). Many thanks goes to Natalia Vavilina for the skillfully drawings of stone artefacts. Ewa Jablonska helps correcting our English, and Alexandre Gnes helps in German translation.

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