Quaternary International 337 (2014) 189–224

Contents lists available at SciVerse ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

The Epipaleolithic of the Caucasus after the Last Glacial Maximum

L.V. Golovanova*, V.B. Doronichev, N.E. Cleghorn, M.A. Koulkova, T.V. Sapelko, M.S. Shackley, Yu.N. Spasovskiy

ANO Laboratory of Prehistory, 14 Linia 3 – 11, 199034 St. Petersburg, Russia

ARTICLE INFO

Article history:
Available online 26 April 2012

ABSTRACT

This paper presents a review of the Epipaleolithic (EPP) sites postdating the Last Glacial Maximum in the northern and southern Caucasus. Although securely excavated EPP sites are as yet rare in the Caucasus, those that provide homogeneous artifact assemblages contain tool types characteristic of EPP industries in Europe and in the Near East. Tool types characteristic of the Caucasian Epipaleolithic are discussed, as well as development during more than 10,000 years. A climatostratigraphic scheme of the Caucasian Epipaleolithic is proposed on the basis of paleoenvironmental data and radiocarbon dates. A review of the available data and a critical approach to treating Epipaleolithic variability in the Caucasus recognizes that only several EPP occurrences in the southern and northern Caucasus might represent a specific Epipaleolithic industry that existed from ca 17/16 to ca 13/12 ka BP (cal) in the region. The old term "Imeretian Culture" may be applied only to this industry type. Contacts between the inhabitants of these EPP occupations are shown by new data concerning the EPP obsidian transport networks from sources located in the southwest Caucasus and in the central part of the northern Caucasus to EPP sites in the northwestern Caucasus. High mobility of human groups in the Epipaleolithic was one of the most significant factors providing affinity of the EPP industries across the Caucasus.

1. Introduction

The Caucasus is a vast mountain country diagonally located between the Black and Caspian seas. The Great Caucasus ridge, up to 1100 km in length with elevations of 1000–3600 m.a.s.l. and more (Mt. Elbrus: 5642 m; Mt. Kazbegi: 5033 m), occupies the central position within the Caucasus and divides this into two parts—the Northern Caucasus and the Southern Caucasus or Transcaucasus. The Northern Caucasus abuts the Russian Plain at the southernmost edge of Eastern Europe. The Southern Caucasus is the most northerly part of Western Asia and grades into to the Near Eastern highlands and Zagros Mountains (Fig. 1). The Great Caucasus is divided into the Western (from the Black Sea to Mt. Elbrus), Central (Mt. Elbrus to Mt. Kazbegi) and Eastern (from Mt. Kazbegi to the Caspian Sea) Caucasus.

The boundary position of the Caucasus between Europe and Asia had a great importance during all periods of the Paleolithic. Recent studies allow a better reconstruction of the mosaic and complex cultural dynamics for the Caucasian Paleolithic. Until about 40 ka BP (cal.), the Neanderthals of the Northwestern Caucasus produced distinctly different industries from their counterparts in the Southern Caucasus (Golovanova et al., 2010a,b). In the north, the Middle Paleolithic is Eastern Micoquian, similar to the industry spanning from Central Europe to the south of Russian plain. In the south, the Middle Paleolithic industries are variable, but similar to the Levantine Mousterian or Zagros Mousterian (Golovanova and Doronichev, 2003). Between approximately 39 and 28 ka BP (cal.), an Early Upper Paleolithic (EUP) technology with a highly developed bladelet industry similar to the Early Ahmarian of the Levant appeared in both the Northern and Southern Caucasus, probably with the arrival of modern humans (Golovanova et al., 2006, 2010a,b). In both the Northwestern and Southern Caucasus, the EUP sequence ends at ~30 ka BP (cal.), the Late Upper Paleolithic (LUP) dates from ~30 ka BP (cal.) to the onset of the Last Glacial Maximum (LGM) at ~25 ka BP (cal.).

After the Last Glacial Maximum at ~25–18 ka BP (cal.), a new Epipaleolithic (EPP) industry is found between ~18 ka BP (cal.) and the early Holocene at 10 ka BP (cal.) from Georgia in the Southern Caucasus through the Northwestern Caucasus to the southern Russian Plain. This paper will show how new data from this post-glacial period are reshaping the understanding of the Caucasian Epipaleolithic.

A comment on the terminology is required. Traditionally, and following the initial Zamiatnin (1935, 1957) unilinear three-phased

* Corresponding author.
E-mail address: labprehistory@yandex.ru (L.V. Golovanova).

1040-6182/$ – see front matter © 2012 Elsevier Ltd and INQUA. All rights reserved.
doi:10.1016/j.quaint.2012.04.034

Fig. 1. Map showing the location of Epi-Paleolithic sites on the Caucasus. 1 – Mezmaiskaya; 2 – Dahovskaya 2; 3 – Korotkaya 2; 4–8 – Gubs Rockshelter 1, Satanay (Gubs Rockshelter 7), Kasojskaya, Chigay, Dvoinaya; 9–10 – Baranaha 4, Baranakha 1, 11 – Yavora, 11–12 – Sosruko, Alebastroviy Zavod, 14 – Bodinoko, 15 – Kamennaya Balka; 16 – Devis khvreli; 17 – Dzudzuana; 18 – Sakajia; 19–21 – Gvardjilas Klde; Mgvimevi, Chakhati; 22–23 – Apiancha, Okumi 1; 24–25 – Akhshtirskaya, Malaya Vorontsovskaya.

model based on the typological study of lithic artifacts from the 1920–1930s excavations in Georgia and before the use of radiometric dates, the Caucasian Upper Paleolithic (UP) sequence did not include an 'Epipaleolithic' phase. Researchers suggested the continuous character of UP 'culture' in the Southern Caucasus, defining from four (Tushabramishvili, 1981) to five (Berdzenishvili, 1964) phases in its development, and Formozov (1965) noted the conformity of UP record in the Northern Caucasus with the three-phased Zamiatnin model.

Kozlowsky (1970, 1972a,b) did not accept the presumed chronological sequence and was the first who attempted to apply litho-stratigraphic data for chronological subdivisions of the Georgian UP sequence. He also for the first time suggested a bilinear model of UP development in the Western Caucasus. Research in the 1960–1980s resulted in the replacement of the unilinear model by a new approach, with the presence of several local UP cultural entities in the region (Bader, 1965; Amirkhanov, 1986).

The chronology of the Caucasian UP record has been an issue of debate, and stratigraphic inconsistencies and shortage of chronology data have affected understanding of the timing and cultural peculiarities of the UP development in the region. Since the mid 1980s, Meshveliani (1986), Liubin (1989), and Amirkhanov (1994) revised the UP materials from old excavations and noted admixtures of Mousterian, Upper Paleolithic, and Mesolithic artifacts in many contexts. Also, based on the climate-stratigraphic data, a few available radiocarbon estimates, and peculiarities of lithic industries, Amirkhanov (1994) divided the UP industries of the Caucasus into two major chronological groups separated by the Last Glacial Maximum and concluded about a cultural discontinuity between the earlier and later groups.

The first robust series of radiocarbon dates for the UP context of the Caucasus was done in the 1990s in Georgia (Nioradze and Otte, 2000). These authors sub-divided the Georgian UP industries into three major chronological stages: 'Aurignacoid', 'with straight backed points', and 'with geometric microliths'. These stages do not correspond at all to the contents and definitions of chronological groups within the Zamiatnin (1935, 1957) unilinear three-phased model. In Georgia, scholars use the term 'Late Upper Paleolithic' for the microlith-dominated UP industries postdating the LGM (Nioradze and Otte, 2000; Meshveliani et al., 2004, 2007) or apply in parallel a French term 'Paléolithique final' (Nioradze and Otte, 2000), and, more recently, Bar-Yosef and co-authors (2011: Table 1) have introduced the term 'Terminal Paleolithic' to distinguish this stage (in Dzudzuana Cave, Unit B) from the earlier UP assemblages.

The term 'Epipaleolithic' is applied here to the Caucasian UP industries postdating the LGM (Golovanova et al., 2010b) following the Levantine scheme, in which this term was introduced in the late 1960s (Perrot, 1968; Bar-Yosef, 1970) to separate the Neuville's (1934) last Upper Paleolithic phase VI from the Mesolithic Natufian. Nowadays in the Levant, Epipaleolithic designates all UP industries dating from the final of the Last Glacial Maximum at ca. 23/22 through 11.5 ka BP (cal.) and characterized by high proportion of microliths, including geometrics (Bar-Yosef and Belfer-Cohen, 2010). This term avoids inconsistency between the Caucasian and Near Eastern schemes, which may be caused by introduction of new terms, and does fit the Caucasian UP record that common peculiar feature, the early appearance of microlithic and geometric tools (Amirkhanov, 1986; Liubin, 1989), is conservatively stressed as the analogy with the UP sequence of the Near East, particularly the Zagros and the Levant (Bader, 1984; Amirkhanov, 1986; Liubin, 1989).

2. Northern Caucasus

A major concentration of about 20 EPP sites postdating the LGM is known from the Kuban River basin in the Northwestern Caucasus. There are only 5 known stratified EPP sites for which detailed typological analysis is possible. Of these, Gubs 1, Gubs 7 (Satanai) (Formozov, 1965; Amirkhanov, 1986), and Chygai (Leonova, 2009) rockshelters, and Kasojskaya cave (Autlev, 1988), are all located within a limited area in the Gubs River gorge (Fig. 1), and most were excavated in the 1960s and 1970s. The fifth site, Mezmaiskaya cave (Golovanova et al., 2010a,b), was found more recently and is currently undergoing excavation. Three additional sites have produced representative EPP lithic collections, but are either surface collections (Baranakha 1) or open-air sites (Baranakha 4 and Yavora) (Doronichev, 1987). About a dozen of these sites, including Dakhovskaya 2 (Golovanova, 1988), Korotkaya 2 (Blajko, 2001), Dvoinaya, Ruslanova caves, Gubs 2, Gubs 3, Gubs 4, Gubs 6, Lubochniy rockshelters (Autlev and Liubin, 1994), and others, are known only from preliminary research. These problematic sites document human presence during the EPP, but are undated and non-diagnostic for more detailed analysis.

In the north-central Caucasus, there are few reported EPP occupations. Sosruko and Alebastroviy Zavod rockshelters were excavated in 1950s and described in a preliminary publication (Zamiatnin and Akritas, 1957). At the recently discovered Bodynoko rockshelter (Fig. 1), the EPP Level 5 is radiocarbon dated between 13–14 ka BP (uncal.) (Zenin and Orlova, 2006), but publication of the EPP lithic industry is only preliminary and not diagnostic for more detailed analysis.

New data have begun to emerge, changing the understanding of the character and origin of the EPP in the Northern Caucasus. New numerical dates are available, including dates for sites excavated 30–40 years ago, and some old collections have been re-analyzed using stratigraphic information. Application of modern excavation techniques, including total sediment water screening and an expanded series of numerical dates from the Mezmaiskaya Cave have contributed the richest EPP archaeological, faunal, and paleogeographical data, and revolutionized the perception of the EPP in this region, with important implications for an understanding of the development and spread of the EPP in the entire Caucasus.

3. Mezmaiskaya cave

Mezmaiskaya cave is situated in the North-western Caucasus, on the Lago-Naki plateau, in the Sukhoi Kurdjips river valley (Fig. 1). The cave is located at the elevation 1310 m above sea level, at 44° N and 40° E. It is 15 m in width, 35 m in length, and up to 10 m in height, and faces to the southwest. Since 1987, about 80 square meters have been carefully excavated to a maximum depth of 5 m, yielding thousands of lithic and organic artifacts, and a rich faunal assemblage. Currently the stratigraphic sequence of the cave consists of 3 Holocene and 20 Pleistocene strata. Until recently, Mezmaiskaya was widely known as a MP Micoquian occupation, which yielded a Neanderthal newborn skeleton (Golovanova and Doronichev, 2003; Golovanova et al., 1998, 1999). Since 1997, eight stratified Upper Palaeolithic layers have been identified (from top to bottom): 1-3, 1-4, 1A-1, 1A-2, 1A-3, 1B-1, 1B-2, and 1C. The six Upper Paleolithic layers (1A-1C) date to 38.5-25 ka BP (cal.) and are preserved *in situ* (Golovanova et al., 2006; Pinhasi et al., 2011: Table S2). The only *in situ* EPP level is Layer 1-3, as level 1-4 is a disturbed and eroded deposit.

3.1. Stratigraphic position and radiometric dates of Layer 1-3

Layer 1-3 is a grey-brown loam, with much large rubble and roof spall blocks, and a thickness of up to 0.50 m. As the EUP layers below, the EPP Layer 1-3 is best preserved toward the interior of the cave. Near the cave entrance, heterogeneous erosive processes have destroyed all of the Upper Paleolithic deposits. Since 2001, about 30 m^2 of Layer 1-3 have been excavated. Within this area, a very large, thick fireplace, with at least four charcoal and four ash levels, occupies more than 7 m^2. Isolated charcoal is found scattered across the excavated area. The layer contains numerous burned bone fragments. In total, the archaeological material recovered from Layer 1-3 so far consists of more than 16,000 lithic artifacts from flint, obsidian and other materials, as well as a rich collection of bone tools and personal ornaments from bones and shells. The faunal collection consists of more than 150,000 bone fragments, including small fragments of less than 2 cm, and numerous microfaunal remains.

Underlying Layer 1-3, Layer 1-4 is comprised of reworked deposits and filled pits and hollows that intrude into LUP Layer 1A. Near the cave entrance, these erosive pits have destroyed practically all of the top levels of Layer 1A. In the interior part of the cave, Layer 1-4 is not represented and Layer 1-3 directly overlies the surface of Layer 1A. In this area, Layer 1A is divided into three sublevels (1A-1, 1A-2, and 1A-3, from top to bottom) now dated between 33–23 ka BP (cal.). The uppermost level (Layer 1A-1) has an old radiocarbon conventional date 19,200 ± 180 BP (SPb – 135), and a more recent and secure radiocarbon AMS date 21,040 ± 120 BP (OxA-21814), which places the age of the layer between 25–23 ka BP (cal.) (Pinhasi et al., 2011: Table S2). Layer 1-4, which falls between layers 1A-1 and 1-3, is dated between 25–19 ka BP (cal.) by two radiocarbon dates (Table 1). While the radiocarbon estimates date Layer 1-4 to the LGM (MIS 2, 25–18 ka), the intensive drop erosion resulting in this layer likely began after the LGM. At 1310 m asl, the cave is located near modern glaciers. During the

Table 1
Radiocarbon chronology of the Epipaleolithic and late Upper Paleolithic layers in Mezmaiskaya cave, Northwestern Caucasus.

Layer	Material	Lab #	Method	14C Age (BP)	Calendric Age (cal BP)[a]
1-2	Bone	SPb–86	Conv.	8680 ± 100	9728 ± 145
1-2A	Bone	SPb–85	Conv.	8720 ± 70	9732 ± 124
Hard calcite breccia correlated to the Younger Dryas stadial at 13–11.5 ka cal BP					
1-3	Bone	GrA–25965	AMS	12,960 ± 60	13,832 ± 402
	Bone	GIN–12900	Conv.	13,860 ± 70	15,142 ± 190
1-4	Bone	GIN–12901	Conv.	16,260 ± 100	17,487 ± 325
	Bone	GrA–25933	AMS	21,050 ± 110/120	23,252 ± 379/383
Sedimentary break correlated to the Last Glacial Maximum at 25.5–18.5 ka cal BP					
1A-1	Bone	SPb–135	Conv.	19,200 ± 180	21,035 ± 312

[a] Dates calibrated with CalPal-online (CalCurve: CalPal_2007_HULU).

LGM, it would have been ice-filled and no sedimentation would have been possible.

In the Mezmaiskaya cave stratigraphy, the EPP Layer 1-3 falls between the LGM and Holocene deposits. Layer 1-3 is now dated between 17–15.5 ka BP (cal.) by two radiocarbon dates (Table 1). The layer is capped in many areas by a hard calcite breccia, up to 10 cm in thickness and best preserved near the cave walls. The breccia lies at the boundary between the Pleistocene and Holocene, and is tentatively correlated with the Younger Dryas (ca. 13–11.5 ka BP cal.). Above the breccia, two radiocarbon AMS dates (Table 1) place layers 1-2A and 1-2 in the early Holocene at ~9700 BP (cal.).

3.2. Pollen Data

Mezmaiskaya Cave is currently located in a *Fagus-Abies* (beech and fir) forest zone. A palynological analysis by one of the authors (Sapelko) divides Mezmaiskaya's stratigraphy into 8 pollen zones (Golovanova et al., 2010a,b). The EPP Layer 1-3 includes zones 7 and 8. Pollen and spore identification were carried out using pollen keys and photographs (Kuprianova and Alyoshina, 1972; Moore et al., 1991) and by comparison with pollen-reference slides available at the Institute of Limnology RAS in St. Petersburg. Pollen percentage diagrams were constructed using TILIA, TILIA-GRAPH and TGView (Grimm, 1992).

Pollen zone 7 (Layer 1-4 and lower Layer 1-3) is characterized by a high concentration of arboreal pollen (AP) and spores (55%), and a slightly decreased amount of herbaceous pollen. About 20% of the arboreal pollen from this zone is from broadleaf trees. *Pinus* (pine), *Abies* (fir), *Picea* (spruce), *Fagus* (beech), *Juglans* (walnut), and *Alnus* (birch) dominate the tree species, and the presence of *Castanea* (chestnut), *Acer* (maple), *Carpinus* (hornbeam), and *Zelkova* (Caucasian zelkova) indicates a climatic optimum (Kvavadze and Connor, 2005). This pollen spectrum suggests an *Abies-Fagus-Castanea* forest. Among spores, the dominance of *Polypodiaceae* (ferns) including *Polypodium vulgare*, suggests forest expansion. Climatic conditions were warmer and more humid than earlier periods.

Pollen zone 8 (upper Layer 1-3) is characterized by a high pollen concentration, with high AP values. *Pinus* predominates among trees, but there is also a high percentage of *Abies*, *Tilia* (lime), *Carpinus*, and *Alnus* pollen. *Cyperaceae* (sedges) dominate none-arboreal pollen (NAP), and *Polypodiaceae* prevail among spores. Zone 8 is therefore reconstructed as a pine and broad-leaf forest characteristic of the upper limit of the forest zone. Climate conditions were warm and drier than in pollen zone 7.

On the basis of the pollen spectrums:

1. EPP Layer 1-3 spans the period when humidity decreased and forest composition changed from the *Abies-Fagus-Castanea* forest to the *Pinus* dominated forest.
2. The pollen spectrum of Layer 1-4 indicates conditions of a climatic optimum with a warm and moderate dry climate.
3. Pollen spectrums in layers 1-3 and 1-4 are dominated by tree pollen and characterize totally forested environments.

3.3. Fauna data from Layer 1-3

A small sample of fauna from the EPP Layer 1-3 (2007 excavations) was analyzed. The sample is drawn from a relatively interior area of the cave where UP and EPP levels have been found to be better preserved. Layer 1-3, in particular, produced a dense accumulation of bone in this area, together with multiple clear features such as hearths.

The total faunal complex found in Layer 1-3 in 2007 includes 2001 piece-plotted bones, and about 25,000 fragments recovered in water screening. This latter sample includes small fragments of 1–2 cm and numerous microfaunal bones. With only 1022 fragments of bone and isolated tooth drawn from the total excavated assemblage, this analysis should be considered preliminary. The analyzed faunal sample is drawn mostly from the upper excavation horizons of Layer 1-3 and does not include the microfauna. Nevertheless, this study is quite useful in illuminating some subtle differences in site use compared to earlier periods of occupation at Mezmaiskaya Cave.

Of particular interest in this respect is the apparent emphasis on very young animals within this portion of the fauna. This trend crosscuts several taxa and therefore suggests not only a shift in what types of ungulate herds were targeted, but possibly a trend toward site occupation earlier in the spring than in previous seasons. This may be well correlated with palynological indicators (see above) of an ameliorated climate within this level of occupation.

3.3.1. Preservation and fragmentation

Like most of the faunal remains from Mezmaiskaya Cave, this sample is highly fragmented but structurally and chemically well preserved. Only about 3 percent of tubular bones (i.e., longbones, ribs, and mandibular *corpi*) preserve a full circumference, indicating a very high percentage of breakage that may be related to marrow and grease extraction. Fragment size ranges from 3 to 227 mm in length, with an average of 48 mm. Breakage type was analyzed on 99 percent of the sample. Using Villa and Mahieu's (1991) criteria for assessing peri-mortem versus dry fracture, a high proportion of the sample was broken when fresh. Out of nearly 1400 breaks through the cortical bone of longbones, ribs, and mandibles, 78 percent are either curved or V-shaped, and 79 percent have an obliquely sloping fracture edge. These percentages correspond well with those reported for peri-mortem breakage in experimental studies by Marean et al. (2000). This result indicates that the bones in Layer 1-3 were most likely broken in the process of nutrient extraction.

Cooking processes also contributed to bone fragmentation in this layer. Bone fragments were found in and around a large hearth covered several square meters in this layer. Thus, about 10 percent of bone fragments analyzed have some degree of heat-related alteration, about 1 percent are calcined, and as much as 27 percent show a lesser degree of heat alteration (darkened coloration, often grading into carbonization). Most of the heat-altered bones (including carbonized and calcined fragments) are derived from a hearth area, suggesting a low degree of post-depositional scattering.

3.3.2. Taxonomic composition

About 98 percent of this faunal sample is derived from medium to large taxa (e.g., as large as, or larger than, a goat). Because of the high degree of fragmentation, only about 28 percent of the bones and isolated teeth were identifiable to taxon, and many of these could only be classified to the level of order (Table 2). The overwhelming majority of these specimens (about 97 percent) could be attributed to ungulates. While the largest number of fragments could be attributed specifically to *Bos/Bison*, caprids and cervids were also well represented. When calculated by Minimum Number of Individuals (MNI), large and small ungulates are about evenly represented. With such a small sample however, the relative abundance of these different taxa may not accurately reflect representation within the larger faunal assemblage.

3.3.3. Faunal mortality

Faunal age at death is assessed on the small dental sample, the majority of which is caprid. Interestingly, almost all (19 out of 21) of the caprid dental specimens are upper teeth. Ordinarily, lower

Table 2
Mezmaiskaya cave. Taxonomic representation in the layer 1–3 sample.

Taxon	NISP: bone	NISP: teeth	NISP: total	Percent of total ID	MNI
Bird	1		1	0.4%	1
Bos/Bison	54	2	56	20.1%	
Large Bovid/Cervid	23		23	8.3%	7*
Medium/Large Bovid/Cervid	63		63	22.7%	
Medium/Small Bovid/Cervid	90	2	92	33.1%	
Cervus cf. elaphus/Cervid	2	2	4	1.4%	1
Capra caucasica	2		2	0.7%	
Capreolus capreolus	1		1	0.4%	1
Caprid	9	20	29	10.4%	6*
Carnivore	2		2	0.7%	1
Ursus sp.	1	1	2	0.7%	1
Sus scrofa	1	1	2	0.7%	1
Marmota cf. paleocaucasica	1		1	0.4%	1
Total ungulate	244	26	270	97.1%	
Total ID	250	28	278		
Non-ID mammal					
Size 1	17				
Size 2	222				
Size 3	209				
Size 4	125				
Size non-ID	151				
Total (bones and isolated teeth)	1002				

NISP = Number of individual specimens, MNI = Minimum number of individuals. MNI with an asterix were calculated using pooled ungulates that could be identified to the appropriate size class, and which did not overlap with other identified taxa.

teeth tend to preserve better, given the greater protection afforded by the mandibular corpus. It is possible that this bias against lower teeth is the result of a processing strategy. That is, mandibles were systematically disarticulated to access the tongue and to more easily process the head. These mandibles may have then been deposited a slight distance away, and just outside of the range of the limited sample, or they have been thrown into the hearth for disposal. At least one mandibular corpus with teeth *in situ* was recovered in a location very close to or within the hearth, and was in an extremely poor state of preservation due to heat damage. This was not included in the particular sample analyzed here.

Caprid age at death is summarized on the basis of the right P^4, the most abundant of the cheek teeth present, which erupts at between 1 and 2 years of age (see Zeder, 2006). Out of 6 of these teeth, 3 are unworn (and probably unerupted), 1 is in very early wear, and 2 are in middle wear. Root formation is minimal in all but one of the middle wear specimens. There are no deciduous caprid teeth in this analysis, but these are particularly susceptible to destruction by taphonomic processes, and their absence may be a function of sample size. The bulk of the caprid teeth observed were juveniles. This is particularly striking in comparison with the earlier UP and MP levels of the site, in which prime age adults dominate the assemblage (Golovanova et al., 2006).

Juveniles and young animals are also well represented among other taxa. There are two cervid teeth, including a lower deciduous premolar that was in very early wear at the time of death. The other specimen is a P^2 in very early wear. The younger animal probably died early within in its couple of months. *Bos/Bison* is represented by 3 fragmentary dental specimens that may derive from only one individual, although there is no evidence for association. These include a fragment of unworn molar and a fragment of M_2 in early wear. Thus, this may represent a young adult or an older juvenile. The single pig incisor is also unworn, indicating a juvenile animal.

Among postcranial skeletal elements, 2 fragments were clearly derived from neonate or fetal animals, and another 7 show the incomplete ossification of juvenile bone. Those fetal or juvenile specimens that could be identified were clearly ungulate. By contrast, the few carnivores do not appear to be young. The single bear tooth in this sample (an incisor) is in late wear, and the fox and marmot appear are from prime age individuals.

3.3.4. Carcass portion representation

Within faunal assemblages, carcasses may be incompletely represented for several reasons (as summarized in Marean and Cleghorn, 2003; Lam and Pearson, 2005; Cleghorn and Marean, 2006; and others), including post-depositional carnivore ravaging or incomplete transport after preliminary field processing. Vertebral fragments may be under-represented for either of these reasons. Ribs and crania are very susceptible to complete destruction, particularly if there is even a moderate level of carnivore scavenging. Despite the small sample size, this analysis of Layer 1-3 fauna yielded good representation across most carcass portions (Table 3), although there is a clear bias against vertebrae in all size classes. As noted above, there are multiple possible explanations for this, including the possibility that medium and large carcasses were field processed, and the bulk of the spinal column was left near the kill locations. A small sample size can also cause under-represented elements to appear to be absent.

3.3.5. Surface modification and evidence for processing

A small sample (295 specimens) of this assemblage was examined by stereomicroscope (at 16× to 56× magnification), with a high intensity oblique light source. Surface preservation is generally very good, with an average cortical surface visibility of about 74 percent. Thus, surface modification by humans and other processes was generally quite clear. Despite the small sample size, there is extensive evidence for carcass processing by humans, and little to suggest that carnivores brought much in on their own. About 46 percent of the analyzed sample had some sort of human processing mark (either a cut or percussion mark). The tooth marks of small carnivores (possibly foxes) were also present on 22 percent of fragments, but fully half of these occurred on bones that also showed butchery marks. This suggests that small carnivores regularly scavenged the remains of human meals. The remaining fragments with carnivore marks are generally those with adhering trabeculae, and therefore would have been attractive to small carnivores even after humans had removed meat and marrow.

Cut marks were found on specimens from all four size classes, in similar frequencies, except in the largest class (Table 4). More than 50 percent of these *Bos/Bison* sized specimens bear a cut mark, as opposed to an average of 35 percent in smaller size classes. This could be an artifact of the small sample size, although it is also consistent with the hypothesis that these larger taxa required more stone tool processing to effectively remove meat. In all size classes, cuts are found across all represented body portions, indicating

Table 3
Mezmaiskaya cave. Carcass portions by size class.

Carcass portion	Size 1	Size 2	Size 3	Size 4	Size indet.
Cranial	2	39	6	4	1
Vertebral	2	8	4	1	
Rib	4	56	72	62	
Forelimb	2	38	27	16	
Hindlimb	4	39	36	32	
Longbone	8	136	91	76	63
Indeterminate		33	42	17	101
Total NISP in size class	22	349	278	208	165

Table 4
Mezmaiskaya cave. Cut marked fragments by body portion and size class.

Body portion	Size 1	Size 2	Size 3	Size 4	Size Indet.
Cranial	(1)	2 (2)		(1)	
Vertebral	(1)	(2)			
Rib		2 (14)	2 (13)	8 (18)	
Forelimb		6 (11)	9 (13)	5 (8)	
Hindlimb	1 (1)	7 (9)	10 (16)	9 (12)	
Longbone		14 (41)	9 (26)	12 (21)	4 (17)
Indeterminate		(6)	8 (19)	3 (3)	6 (32)
Total fragm. with cuts	1	31	38	37	10
Total NISP in size class	3	85	87	63	49
Percent fragm. with cuts	33%	36%	44%	59%	20%

Total fragments per body portion and size class (within this analytical subset) given in parentheses.

a comprehensive meat removal strategy. Marrow processing was also comprehensive. Percussion marks and notches are found across the best represented body portions of all but the smallest taxa (Table 5). In addition, five specimens in this sample were bone points produced from long bones. These were too fragmentary to assign to taxon, but three could be identified as belonging to a size 2 mammal. This is within the range of the caprids.

From this preliminary analysis of the Layer 1-3 fauna:

1. This faunal assemblage is derived from the remains of human hunting and consumption activities. It seems likely that the ungulates were hunted by humans, and that human hunters were responsible for the presence of goat, and wild auroch or bison.
2. Other, more poorly represented taxa, lack the clear processing marks that would definitively associate them with humans. These may have been brought in by humans, or they may have been either natural deaths or carnivore kills.
3. The presence of juveniles and neonates among the ungulates suggests an early spring occupation of the site, and the possible targeting of nursery herds.
4. It appears that ungulate carcasses were transported rather completely to the cave, although some field processing may have occurred, resulting in the under-representation of spinal elements. Processing consisted of very complete meat-removal, cracking of marrowbones, and cooking (presumably roasting).
5. Animal carcasses served both subsistence and technology. There are several bone tools from this level, including finished and broken tools, as well as those in the process of manufacture.

3.4. *Lithic industry of Layer 1-3*

In most excavation areas, Layer 1-3 perfectly preserves cultural deposits with dense evidence for human activity. In addition, this level includes the largest lithic assemblage from any layer in the site. Since 2001, the 30 m^2 excavated in Layer 1-3 have yielded about 16 thousand lithic artifacts. This paper reports statistical data from the 2006–2007 excavations. While the collection analyzed is derived from a small (about 9 m^2) excavation area, it well represents the common composition of the EPP industry from Layer 1-3 at Mezmaiskaya Cave. Because the excavation process in Mezmaiskaya involves water sieving of all sediments in a double sieve set, the smallest of which is a 1 mm mesh, numerous micro-lithics were recovered in addition to larger artifacts.

Table 5
Mezmaiskaya cave. Percussion marks and notches by body portion and size class.

Body portion	Size 1	Size 2	Size 3	Size 4	Size indet.
Cranial					
Vertebral					
Rib		2	3	3	
Forelimb		3		3	
Hindlimb		4	5	8	
Longbone		4	5	8	
Indeterminate			3		1
Total fragm. with percussion		13	16	21	
Total NISP in size class	3	85	87	63	49

The collection from the 2006–2007 excavations includes 7324 lithic artifacts (Table 6). The overwhelming majority (81.5 percent) of these lithics are made from local grey flint, for which nearest source location is found 2–3 km from the cave. Another 18 percent of this collection is high quality, mostly colored flints. Obsidian artifacts comprise only 0.4 percent (32 pieces) of the industry.

Determining the source of the Mezmaiskaya obsidians provides important insights into the social networks of the Epipaleolithic. The trace element analyses (by S.Shackley) using a Thermo-Scientific *Quant'X* EDXRF spectrometer of three obsidian artifacts from Layer 1-3 (Table 18) indicated this material may have been procured for 2 pieces from the Kojun Dag source (as listed in Poidevin, 1998:200) located more than 300 km to the southeast of Mezmaiskaya, in southern Georgia, and one piece was produced from the Zayukovo source located more than 250 km of Mezmaiskaya in the central part of Northern Caucasus, Russia. These results suggest that the inhabitants of the EPP levels at Mezmaiskaya had some contacts with areas quite distant from the cave, including the Southern Caucasus and the North Central Caucasus.

More than half (54.3 percent) of this industry is comprised of chips (1044 flakes measuring 5–10 mm in size) and microchips (2935 flakes 1–5 mm in size). Also, there are 20 cores, all heavily reduced, among which prismatic cores dominate. Lithic artifact production on-site is evidenced by the cores and numerous (59 pieces) technical flakes resulting from core preparation or rejuvenation. Among technical flakes, crested blades and bladelets, tablets, and various platform-preparation flakes are identified. Together, blades, bladelets, and microbladelets are overwhelmingly better represented (75.4 percent) than plain flakes (Table 6). Among laminar blanks, bladelets and microbladelets dominate (76.5 percent) compared with blades. In EPP Layer 1-3, the bladelet and microbladelet flaking technology is more highly developed than in the earlier EUP levels at Mezmaiskaya (Golovanova et al., 2006, 2010a,b).

Compared with earlier levels, the more significant changes occur in the EPP tool set (Table 7). The 2006–2007 excavations yielded 296 retouched tools from Layer 1-3. While points are not numerous in the industry, shouldered points are especially significant. To date, 7 shouldered points have been identified in Layer 1-3 (Fig. 2, 1–7), 3 of which are from the 2006–2007 excavation. Most of these points are fragmented. They are characterized by a lateral notch made by abrupt retouch in the proximal part; this notch forms a short and small tang in the base of a tool. The point is usually made by thin retouch along one side and additional retouch at the tip (Fig. 2, 1, 3), or lacking retouch at the tip (Fig. 2, 4), or sometimes by retouching the tip from the opposite lateral side (Fig. 2, 2).

Gravette points dominate in the industry (Fig. 2, 16,17,19), including micro-Gravette points (Fig. 2, 18). The EPP industry of layer 1-3 is characterized by the first appearance of Vachons points, which have additional ventral retouch in both tip and base (Fig. 2, 8–10,12). Also, there are points symmetrically retouched by abrupt retouch.

In the EPP layer 1-3, geometric micro-lithics first appear (Fig. 3, 1–11). They include segments or lunates (49), trapezes (6), and

Table 6
Distribution of major artifact classes in the late Upper Paleolithic and Epipaleolithic sites in the Northwestern Caucasus.

Site/layer	Core	Tech. flake	Fragment	Chip/micro chip	Plain flake	Blade	Bladelet	Micro bladelet	Tool	Total
Mezmaiskaya 2006–2007 ex. Layer 1–3	20	59	769	1044/2935	541	391	1026	243	296	7324
Gubs rocksh. 1 Upper Layer	41	11	50	355/2	486	26	325		54	1347
Kasojskaya Horizons 3–6	41	214	507	901/2	569	289	562	418	254	3757
Gubs rocksh. 7 Horizons 3–4	136	74	18/4	115	1263	661	810		270	3351
Baranakha 4 Surface finds 1989 and 1996	5	3	2	18	48	15	14		16	121
Baranakha 4 1989 & 1996 ex. Layer 1A	3/4	2	2	43	55	13	38		24	184
Baranakha 1	5/3	8	35	3	58	29	27	7	71	246
Yavora	7	8	69	105	144/164	126	69	58	82	901

triangles (4). The segments are made on rather large bladelets by abrupt retouch forming an arch and are close to forms called lunates in the EPP in the Levant. Trapezes are represented by simple forms, while trapezes with retouched backs are absent.

Among tools made on bladelets, the most numerous are backed pieces (Fig. 3, 15,16). There are a few double backed pieces (Fig. 3, 17), straight truncated bladelets (Fig. 3, 22), oblique truncated bladelets (Fig. 3, 20,21), and backed pieces with truncation (Fig. 3, 23). It is worth noting the appearance of new bladelet tools, not found in the EUP levels, such as backed pieces with micro-end-scrapers (Fig. 3, 18,19) and variable bladelets with ventral retouch (Fig. 3, 12–14).

End-scrapers and burins together compose 14.5 percent of retouched tools. Among these, scrapers on blades dominate (Fig. 4, 2). There are a few scrapers made on striking platforms (Fig. 4, 1), scrapers on flakes (Fig. 4, 3,5), thumbnail scrapers (Fig. 4, 4), and rounded or circular scrapers (Fig. 4, 6,7). There are few burins (Fig. 4, 8–10), and only one chisel-like tool (*pièces esquillé*).

Among other tools, denticulates on blades are typical for the industry of Layer 1-3 (Fig. 4, 11–13). Also, in the layer, there is a stone retoucher made on small sandstone pebbles, and several sandstone pebbles or slabs with grinding areas that were apparently used for polishing bone tools.

3.5. Bone tools and ornaments

An innovative technology of biconical drilling appears in the EPP bone industry at Mezmaiskaya. This production technique is evident on a pendant (Fig. 7, 3) and a needle fragment (Fig. 5, 1). Additionally, Layer 1-3 artifacts include 2 caprid incisor pendants with V-shaped notches in the crowns (Fig. 7, 3,4).

Of the 8 needle fragments (5 distal, 2 middle, and 1 base) found in Layer 1-3, two distal fragments have rounded cross-sections (Fig. 5, 2,3), and two have flat cross-section (Fig. 5, 4). One distal needle or micro-point fragment has two converging engraved lines (Fig. 6, 2). The middle fragments have rounded cross-sections, and the base fragment has an oval cross-section (Fig. 5, 1).

In Layer 1-3, 2 bone point fragments have rounded cross-sections (Fig. 5, 6), and 3 fragments have flat-convex cross-sections. One of these has two engraved incisions converging at the tip (Fig. 6, 1). There is only one complete bone awl (Fig. 5, 9) and two awl fragments (Fig. 5, 5). A micro-awl (Fig. 5, 7) is close to the needles in the size, but just its tip is completed.

A polisher fragment is made from a flat bone (Fig. 5, 8), heavily smoothed on one surface. A scraped and heavily polished bone tubule made from the shaft portion of a small ($61 \times 4 \times 3$ mm) long bone was found in EPP Layer 1-3 (Fig. 6, 3), as well as a long bone fragment with engraved ornamentation (Fig. 7, 1).

The shells of small terrestrial gastropods, including *Helicidae gen.*, *Succinidae gen.* (*Succinaea* sp.), and *Pupillidae gen.*, are present in Layer 1-3 at Mezmaiskaya. While most of these shells are broken into small or very small fragments, there are 32 unbroken shells with perforations (Fig. 7, 2).

In conclusion, EPP hunters may have visited Mezmaiskaya in early spring, while targeting ungulate nursery herds. Even at 1300 m asl, it is clear that conditions around the cave during the time of Layer 1-3 would have been mild enough to attract both the herds and their pursuers much earlier in the year than in previous periods. The cave was a nexus for multiple activities including food processing, tool manufacture and maintenance, and clothing production and/or repair. Like some of their predecessors before the LGM, these people had access to raw materials from regions far to the south, and thus a potentially extensive social network. This and the fact that populations were most likely expanding in the increasingly hospitable post-glacial climate suggests that there could be many similar localities throughout the Northern Caucasus. As this EPP record grows, the rich and various stone and bone industries from Mezmaiskaya have numerous analogies in other EPP assemblages of the Caucasus.

Table 7
Distribution of major retouched tool classes in the late Upper Paleolithic and Epipaleolithic sites in the Northwestern Caucasus.

Site/layer	Geometric microlith	Shouldered point	Point	Backed piece/double BP	End scraper on BP	Oblique truncation on bladelet	Endscraper	Burin	Pièces esquillé	Denticulate	Retouc piece/Varia	Total
Mezmaiskaya 2006-2007 ex.Layer 1–3	59	3	13	66/2	2	14	35	8	2	52	30/10	296
Gubs rocksh. 1 Upper Layer			10	10			7	2		17	5/3	54
Kasojskaya Horizons 3–6		8	25	72			26	18	1	67	32/5	254
Gubs rocksh. 7 Horizons 3–4	9		3	40		21/1	88	46		49	9/4	270
Baranakha 4 Surface finds 1989 and 1996	1		1	2			8	2			1/1	16
Baranakha 4 1989 and 1996 ex. Layer 1A		2	5	10		1	2	1			2/1	24
Baranakha 1	1	2	15	5		2/1	13	1	1	14	13/3	71
Yavora	3		3	24		/1	2	14		1	32/2	82

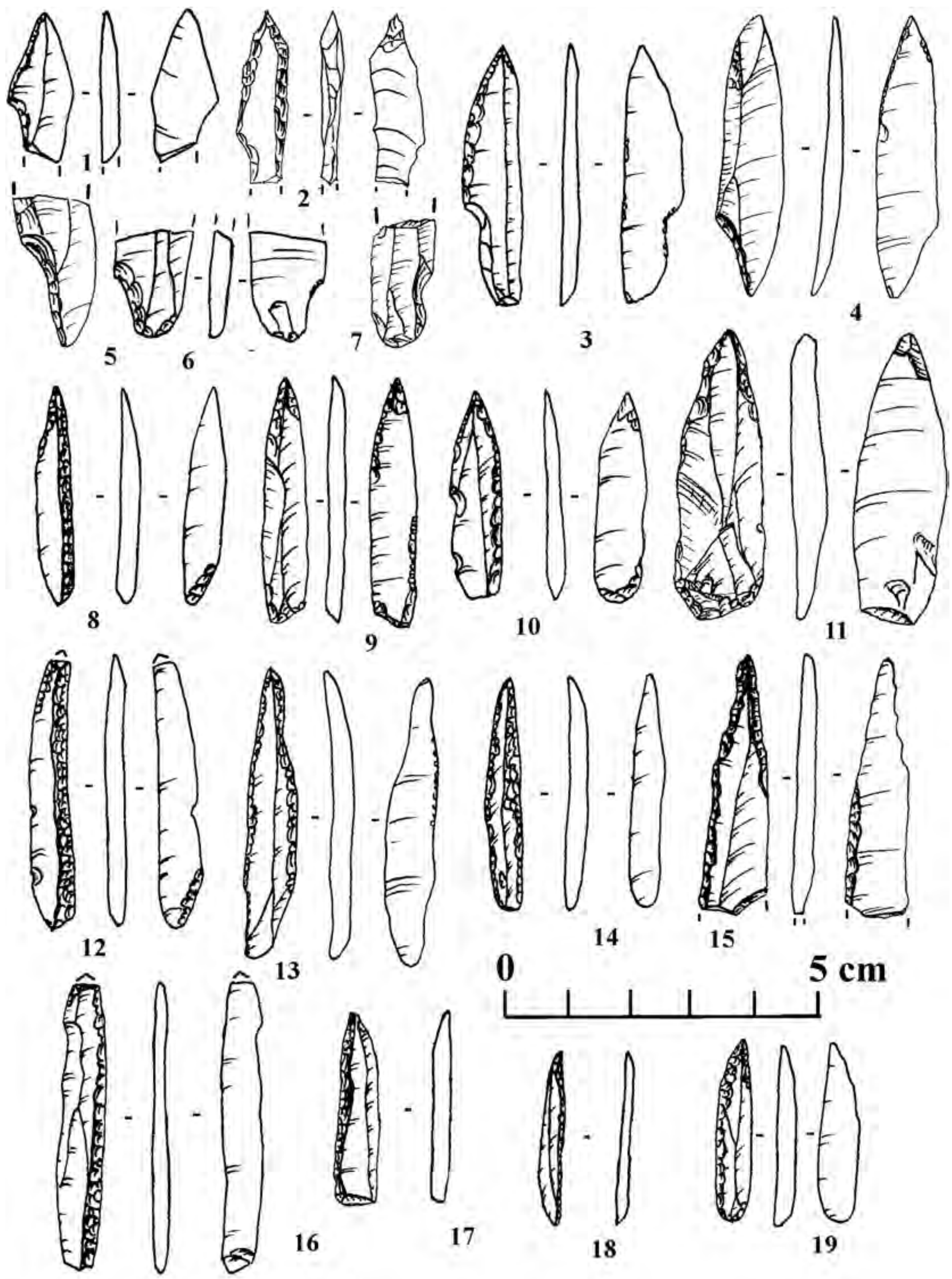

Fig. 2. Mezmaiskaya Cave. Different point types from Layer 1-3.

4. Gubs Rockshelter 1

Gubs Rockshelter 1 is one of only a few sites in the Northwestern Caucasus that preserved both Middle and Upper Paleolithic layers within one section. The Paleolithic occupation in this rockshelter, on the left bank of the Borisovskoe Gorge of the Gubs river valley, a rocky canyon known for several Paleolithic localities, was first discovered by Autlev in 1962. In 1964, Muratov made a detailed description of the stratigraphy and lithology of the deposits, and between 1975 and 1976, Amirkhanov conducted further excavations in the rockshelter. Amirkhanov's work revealed a second and later Upper Paleolithic layer. The layer was missing from the previous excavation area, in which it had been completely destroyed by Holocene pits and erosive processes (Amirkhanov, 1986). The new section of rockshelter deposits contained 14 strata, in which Amirkhanov identified three cultural layers: two Upper Paleolithic layers and a Mousterian layer separated from the former by sterile levels.

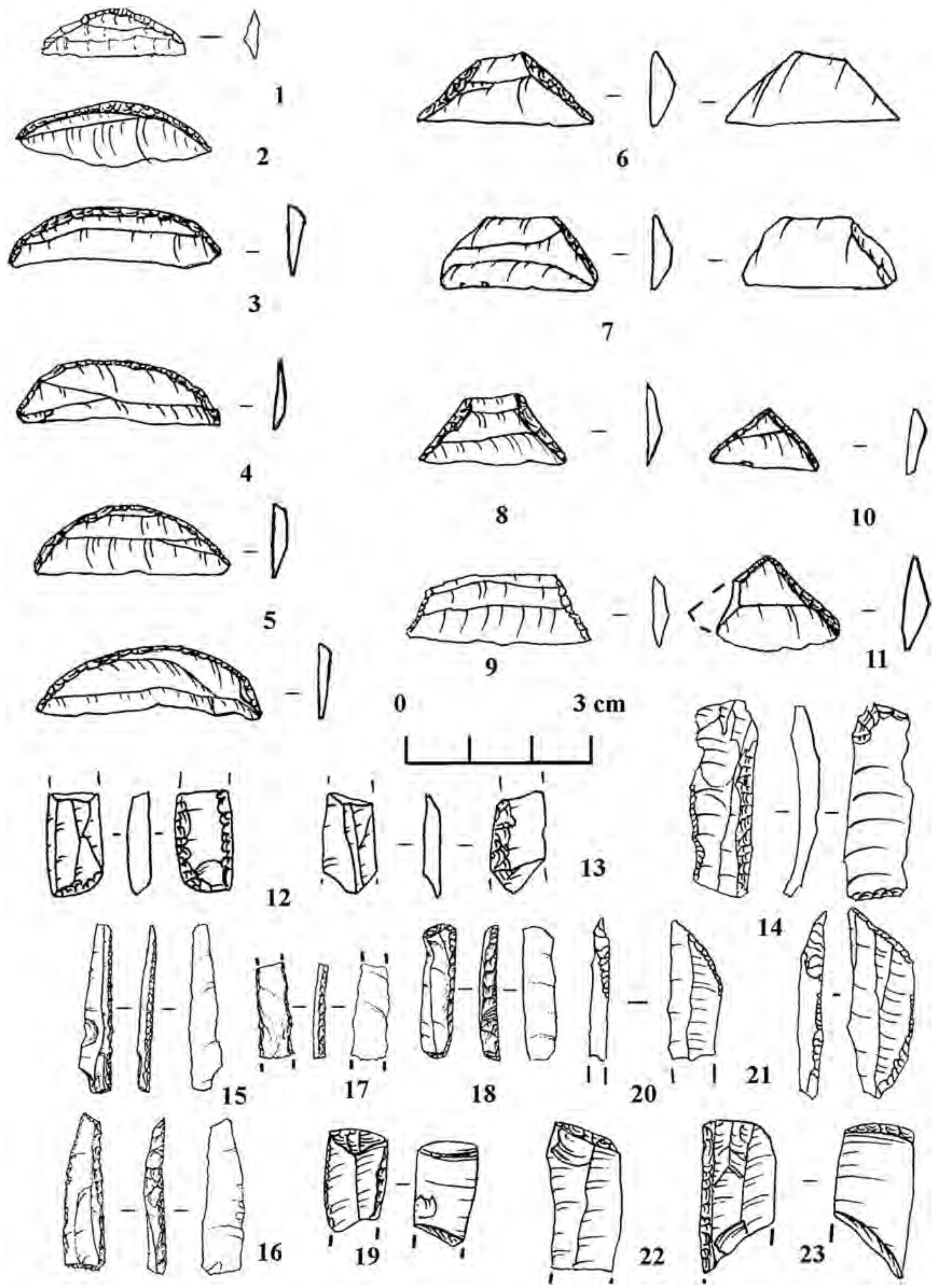

Fig. 3. Mezmaiskaya cave. Stone tools from Layer 1-3.

4.1. Stratigraphy and environmental data

The top UP layer (Stratum 2) contains an Epipaleolithic industry. The deposit is a brown loam with small rubble, and a thickness of 10–17 cm.

As expected, the relatively exposed condition of the rockshelter has not been conducive to the preservation of organic remains. As a result, faunal and botanical analyses from Gubs Rockshelter 1 are much less conclusive than at Mezmaiskaya. Bones are very poorly preserved, and in the latest UP layer, only 3 general taxonomic groups have been identified: bison (*Bison* sp.), goat/sheep (*Capra/Ovis*), and *Microtus* sp. (Amirkhanov, 1986). Taphonomic problems also impacted the analysis of 15 pollen samples, conducted in the 1970s. No pollen was found in Stratum 2 (zone 3 of 8 pollen zones).

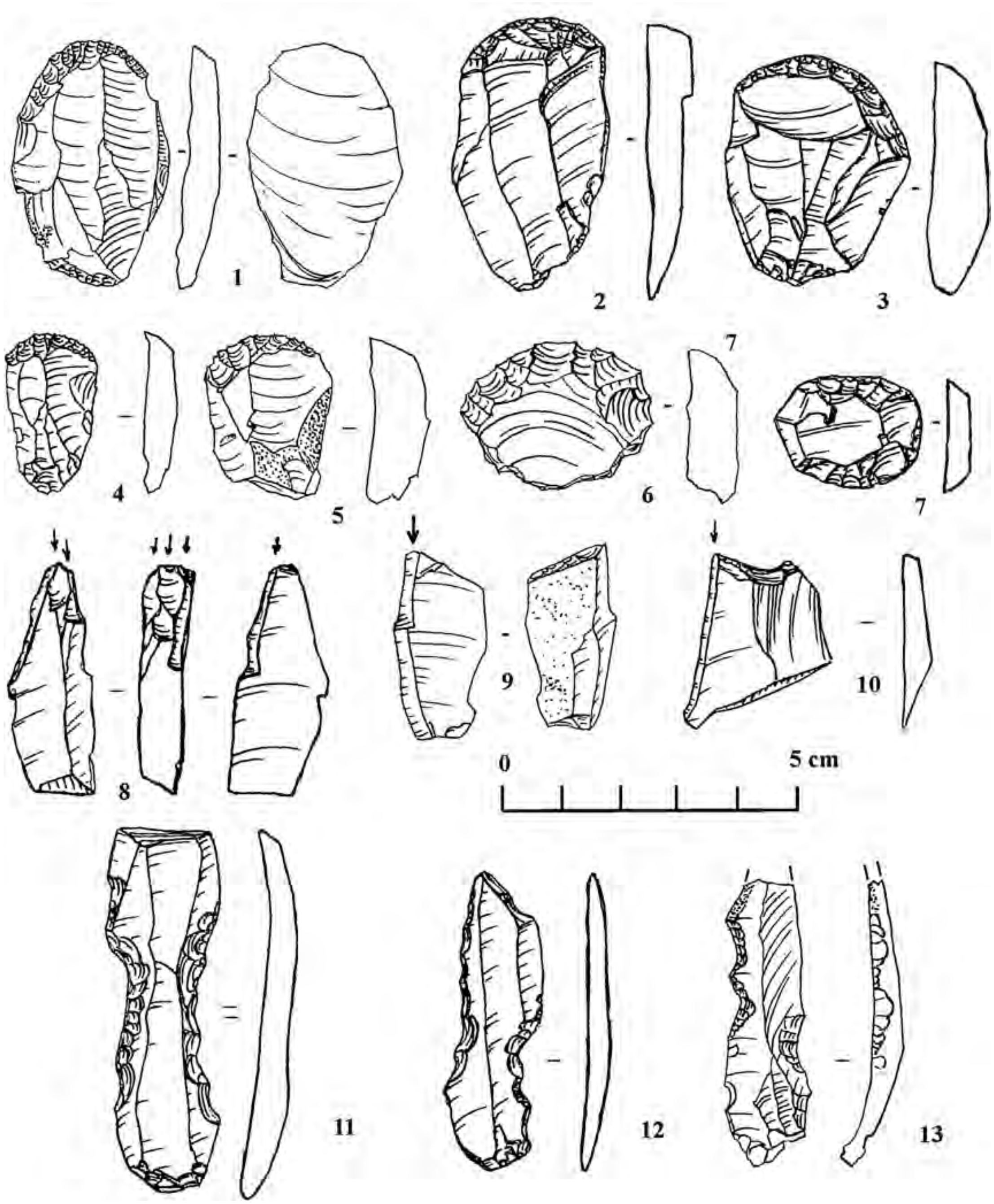

Fig. 4. Mezmaiskaya cave. Stone tools from Layer 1-3.

Amirkhanov (1986) proposed conditions similar to the underlying Stratum 3 on the basis of similarity of lithological characteristics of the strata. The Stratum 3 (Zone 4) flora is analogous to modern upper forest belt. It preserves the highest representation of arboreal pollen (45%), including fir (25%), pine, broad leaf arboreal species (18%), and non-arboreal (22%), and was formed during the most humid conditions in the section. The lower strata 7-4 (Zone 5) are archaeologically sterile deposits formed under conditions of cold and dry periglacial forest-steppe.

Unfortunately, the poor preservation of bones at Gubs Rockshelter 1 has also precluded radiocarbon dating. Amirkhanov (1986) proposed the EPP age of the top UP layer based on general characteristics of the industry, the industry's stratigraphic context, and the paleogeographic correlation of the underlying strata to the LGM.

4.2. Lithic industry of the epipaleolithic layer

The lithic assemblage from Gubs Rockshelter 1, stored at the Adygeya National Museum in Maikop, includes 1347 flint artifacts and a bone awl from Amirkhanov's 1975–1976 excavations (Table 6). Amirkhanov (1986) published an analysis of 513 artifacts from 1975 excavation. More recently, Golovanova studied the entire assemblage from 1975–1976 excavations.

The overwhelming majority of lithics are made on local grey flint, which is sometimes very dark grey and closer to black in

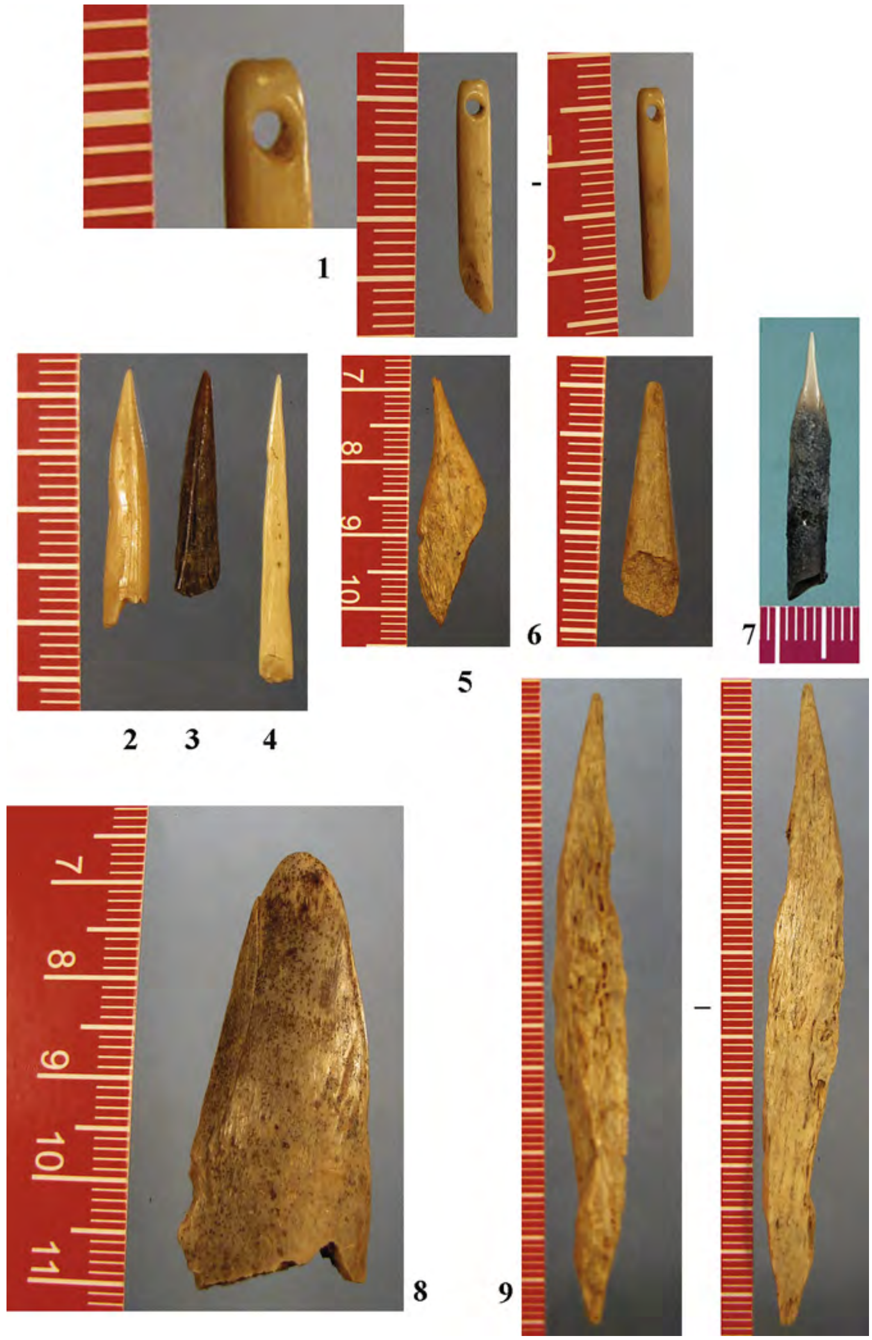

Fig. 5. Mezmaiskaya cave. Bone tools from Layer 1-3.

color. This flint occurs in limestones, in which the rockshelter is formed. Only a few bladelets are made from non-local beige transparent flint. The industry demonstrates that a complete cycle of stone flaking was conducted in the site – from raw material (flint nodule) testing and nodule decortication, to core preparation and blank production. More than 65.9% of cores are tested cores and tested core fragments. In addition, a third (32.0%) of all flakes have cortical areas on dorsal faces or are primary flakes (1.2%). Also, the collection includes 11 technical flakes, four of which are crested.

Among identifiable cores, there is an approximately equal distribution between prismatic (5 pieces) and N-fronted (6 pieces) cores. All of these cores are specially prepared and most have plain or linear platforms with platform angles ranging from 54 to 75 degrees. Most of these cores are unidirectional, however there are 3 cores with bipolar platforms.

About a half (43.1%) of all flakes are blades and bladelets (Table 6). Considering that the 1975–1976 excavations were conducted without water screening, this is a fairly high percentage. The recovery methods are most likely responsible for the absence of micro-bladelets with width less than 5 mm. Bladelets absolutely dominate (91.7%) laminar blanks, as well as (53.7% of all tools) manufacturing retouched tools.

Fifty-four retouched tools have been identified from the top UP layer at Gubs Rockshelter 1 (Table 7). Among these, the following types are present:

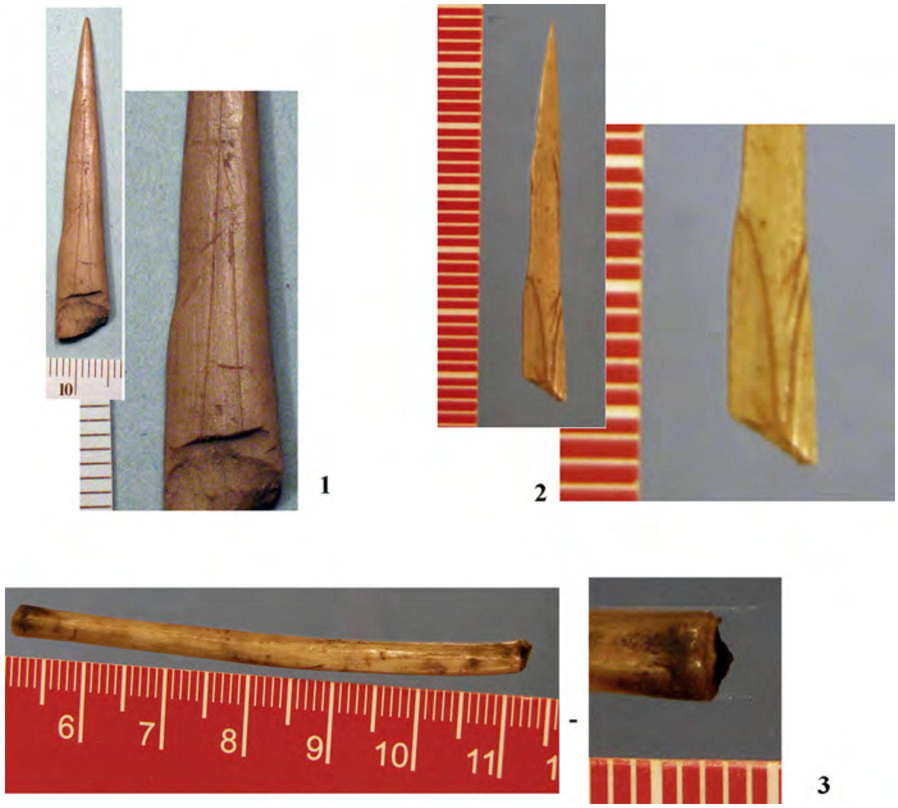

Fig. 6. Mezmaiskaya cave. Bone implements from Layer 1-3.

1) Six Gravette points made on bladelets. All are fragmented (Fig. 12, 6,7,10). There is also a variant with ventral retouch on the tip, which may be defined as a Vashon point (Fig. 12, 11).
2) One symmetrically retouched point on bladelet.
3) Two points with a very long tang or humpbacked points, both are fragmented (Fig. 12, 4). These points are very similar to tools identified by Sonneville-Bordes (1950, p. 359, fig. 189 – 23–24) as points with very long tang (*pointes a tres long cran*). Such points are characteristic for the late Magdalenian in the West Europe.
4) Ten backed bladelets, all of which are fragmented (Fig. 12, 8,9).
5) Two backed bladelets with ventral retouch (Fig. 12, 1,2) or an oblique retouched distal end (Fig. 12, 3).
6) One bladelet with fine retouch and a small retouched notch on the distal end.
7) Two burins, one of which is a micro-burin with a retouched notch on one side (Fig. 12, 13). This tool resembles micro-burins characteristic for the Epipaleolithic of the Near East (Olzewski, 1993; Goring-Morris et al., 2009; Bar-Yosef and Belfer-Cohen, 2010). Another tool is a burin on the angle of a blade (Fig. 12, 14).
8) Among the 4 end-scrapers, scrapers on plain flake are predominant (Fig. 12, 16); other scrapers include 2 on bladelets (Fig. 12, 15) and a carinated scraper on plain flake. It is worth noting that most of end-scrapers are made on plain flakes. Scrapers on plain flakes and carinated scrapers are very characteristic for the lower UP layer in Gubs Rockshelter 1.
9) Seventeen notches and denticulates, with fine, sometimes irregular denticulate retouch (probably from utilization) (Fig. 12, 5) or retouched notches.
10) Other tools include a blade fragment with semi-abrupt retouch (Fig. 12, 17).
11) The collection includes one bone tool – a massive awl made from a long bone fragment (Fig. 12 – 18).

In conclusion, the EPP industry from Gubs Rockshelter 1 has many analogies in others EPP sites in the Caucasus. However, its exact age is unclear without carrying out new excavation and numerical dating.

5. Kasojskaya cave

Kasojskaya Cave was discovered by Autlev in 1979 and then excavated in 1981 and 1985–1987. The south-facing cave is located in the Borisovskoe Gorge of the Gubs river valley (Autlev and Liubin, 1994). The excavated sequence in this 40 sq. m. cave ranges from the UP through the Medieval period, through about 2 m of sediment depth. The uppermost Layers 1, 2, and 3 (Medieval, Bronze Age, and probably Neolithic respectively) comprise about 1 meter of humic loam with rubble. Below these, Layer 4 is dated to the UP. This UP layer is a brown loam with both angular and rolled rubble, and is comparatively thin (i.e., from 10 to 35 cm). The uppermost part of the UP layer includes a level of limestone slabs. Below Layer 4, Layer 5 is a 10 to 15 cm deposit of archaeologically sterile sediment and angular rubble.

5.1. Faunal identification

The faunal collection from Kasojskaya Cave is stored in the Adygeya Republic Museum. It consists of 1595 bone fragments and 6 *Helix* shells. Indefinable fragments represent an overwhelming majority of the bones. Species definitions were possible to do for 7

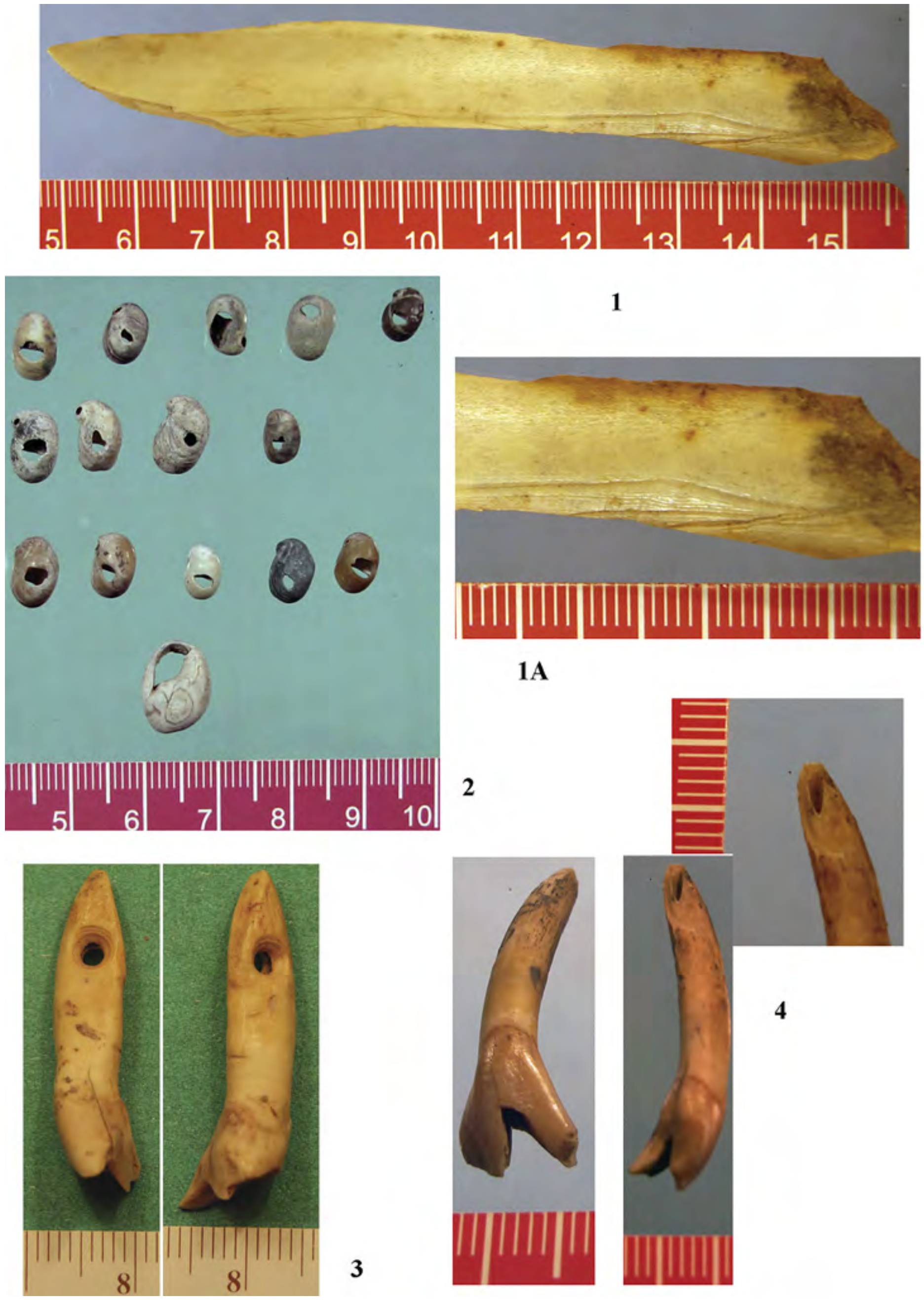

Fig. 7. Mezmaiskaya cave. Personal ornaments and an engraved bone from Layer 1-3.

bones from Layer 4 (excavation horizons 1–6) only, as the following: *Equus* sp. – 4 bones (horizon 1 – 2 pieces, horizon 4 – 1, without horizon – 1). In horizon 1, the following animals have been identified too: *Cervus* sp. – 1 bone, *Bison* sp. – 1 bone. A bone of *Rupicapra* sp. originates from a talus. The faunal remains from Layer 4 are subdivided into excavation horizons as shown in Table 8.

5.2. Radiocarbon dating

As noted above, based on the stratigraphic data and archaeological material, the top layers 1, 2, and 3 are Holocene in age. An important stratigraphic marker level of limestone slabs in the upper part of Layer 4 may be tentatively dated to the Younger Dryas. A series of radiocarbon dates obtained from the faunal assemblages of horizons 3, 4, and 5 of Layer 4 (Table 13) dates the EPP occupation in Layer 4 between 12.5 and 17 ka BP (cal.).

Table 8
Representation of the total NISP (bones and isolated teeth) by horizon in Kasojskaya Cave.

Horizons	NISP per horizon	Percent to total NISP in the site
1	249	16.0
2	396	25.0
3	535	34.0
4	254	16.0
5	137	9.0
6	24	1.5

5.3. Lithic industries

The Paleolithic artifacts from Layer 4 have been divided into arbitrary excavation horizons, from 3 to 6 (top to bottom), allowing us to study the dynamics of technological change within the EPP (Tables 6 and 7). Apparently, the top horizons 1 and 2 of Layer 4 contain an admixture of later materials. At the very top of this sequence (Layer 4, horizon 1), the presence of Ounan (Haour, 2003) and Khiam (Gopher, 1994) points, pebble tools, slabs that were probably used for grinding, and marine shells suggests an intrusion of a Neolithic-age material. About 62% (2355 specimens) of the 3757 lithic artifacts in Layer 4 are from horizon 3 (Table 9).

5.3.1. Horizon 3

The industry of the 3rd horizon derives from 23 sq. meters of excavation. In addition to flint artifacts, the industry includes a chopping-tool on a large sandstone pebble, 2 small sandstone pebbles, a triangular block of limestone with traces of use, and a split quartz pebble. In addition, two bone artifacts were found in this horizon – including a fragment of an unfinished bone point (Fig. 10, 3) and the tip of a massive point with a rounded cross-section (Fig. 10, 2), Finally, three perforated shells (Fig. 10, 1) from this horizon are fully analogous to perforated shells from the EPP Layer 1-3 at Mezmaiskaya.

The overwhelming majority (86.1%) of lithics are made from local grey flint. More exotic flint accounts for a small percentage of all artifacts (13.6%), but slightly more (up to 28%) of the stone tools, and some cores and technical flakes are made on a high-quality non-local flint. One tool (a Gravette point) is made from obsidian, the source for which is probably at least a couple hundred kilometers away. Sandstone is present, but was mainly used for manufacturing larger tools such as choppers. Humans were clearly transporting some exotic materials to the cave in the form of curated, finished tools, as well as raw materials for further manufacture.

Overall, however, the cave does not appear to be a place of intense lithic production. All tested cores (pieces of rock with few scars) are made from the local poor quality grey flint. The number of identifiable cores ($N = 14$) in Horizon 3 is small relative to the number of technical flakes ($N = 123$). There are 2 N-fronted, 6 prismatic, and 3 combined bi-platform cores. Also, there are 3 residual cores made from non-local flint. Some technical flakes made from red, pink, and yellow flints, lack associated cores. These may have fallen outside the scope of the excavation, or they fit the larger picture of humans spending more time on primary lithic manufacture outside the cave. The presence of so many technical flakes further suggests that core reduction occurred somewhere relatively close to the site.

A large number of these technical flakes testify to an advanced technique of core preparation. These include 5 crested blades, 18 crested bladelets, and one core tablet. Other flakes derive from platform preparation and lateral side removals. Only 7 of the technical flakes recovered were used as tools. The majority of flakes (67.0%) are blades, bladelets, and microbladelets, and bladelets and microbladelets comprise 80.4% of laminar flakes. The majority of plain flakes are the result of core preparation, and almost a half of these flakes (45.6%) retain cortex on their dorsal surface. By contrast, only a couple of blades or bladelets retain any cortex. Core reduction techniques were efficient in producing small laminar blanks.

The majority (87.2%) of retouched tools are made on blades ($N = 31$), bladelets ($N = 39$), and especially microbladelets ($N = 66$). Most of points are fragmented Gravette points ($N = 14$) made on bladelets or micro-bladelets. These include 5 distal (Fig. 8, 8, 9,13, 14, 15) and 9 proximal end fragments, with additional retouch on the second lateral side (Fig. 8, 16, 17, 18). In addition, there are four tools similar to Vachons points. Two of these are distal fragments with ventral retouch (Fig. 8, 11, 12), and one complete point has ventral retouch on both the distal end and the base (Fig. 8, 10). There are also eight shouldered points made on bladelets, all of which have broken distal ends (Fig. 8, 1, 2, 3, 4, 5, 6). These points have a retouched notch at their base, forming a short tang.

Truncated, backed, and finely retouched tools are also made on laminar flakes. All 47 backed tools are made on micro-bladelets and almost all are fragmented (Fig. 8, 23–25,29). Four tools with obliquely truncated distal ends are made on bladelets (Fig. 8, 19, 22); two of these are also backed (Fig. 8, 21, 20). Of the 10 finely retouched tools, six are made on micro-bladelets (Fig. 8, 27) and four on bladelets (Fig. 8, 26, 28).

The few diverse remaining tools in the assemblage are made on a variety of blanks, including blades and flakes. Five of the 10 end-scrapers are made on blades and blade fragments (Fig. 9, 9,10,12,13). In addition, one thumb-nail-like scraper is made on a flake (Fig. 9, 8), two scrapers are made on technical flakes (Fig. 9, 11), another is made on a striking platform, and a one is a combination scraper and burin made on a fracture.

There are a variety of burin forms, of which four are made on a fracture (Fig. 9, 1). There is also a burin on a concave truncation (Fig. 9, 2), a double burin on fracture (Fig. 9, 3), a burin on a convex truncation, a dihedral burin (Fig. 9, 4, 5), and a transverse micro-burin (Fig. 9, 6).

The only *pièces esquillé* tool is made on a fragment of a massive blade (Fig. 9, 7). Notched tools ($N = 18$, Fig. 9, 14) and denticulates ($N = 17$) are quite numerous, and all have micro-denticulate retouch, probably as a result of use.

In conclusion, there are several striking similarities between the material of Kasojskaya Horizon 3 and the EPP Layer 1-3 of Mezmaiskaya Cave. Common features include a large number of shouldered points, Gravette and Vashon points, similar types of end-scrapers and burins, a similar end-scraper to burin ratio, bone points with rounded cross-sections, and similar striped beads. Unlike Mezmaiskaya, Kasojskaya's lithic assemblage includes practically no geometric microliths. However, this difference may be due to the lack of water sieving during excavation at Kasojskaya. Detailed analysis of the industry of Kasojskaya together with a new series of radiocarbon dates puts the site in context with other EPP localities of the Northwestern Caucasus. However, data from Kasojskaya are still quite limited, and modern excavation techniques and a taphonomic approach to the faunal and botanical remains would greatly improve understanding of the paleogeography, precise chronology, and cultural dynamics of the EPP occupation.

Table 9
Distribution of major retouched tool classes in the horizon 3 at Kasojskaya Cave.

Point	Shouldered point	Backed piece	Bladelet with fine retouch	Truncation	Burin	Endscraper	Pièces esquillé	Denticulated and notched pieces	Retouched piece	Total
17	8	47	10	4	9	10	1	35	15	156

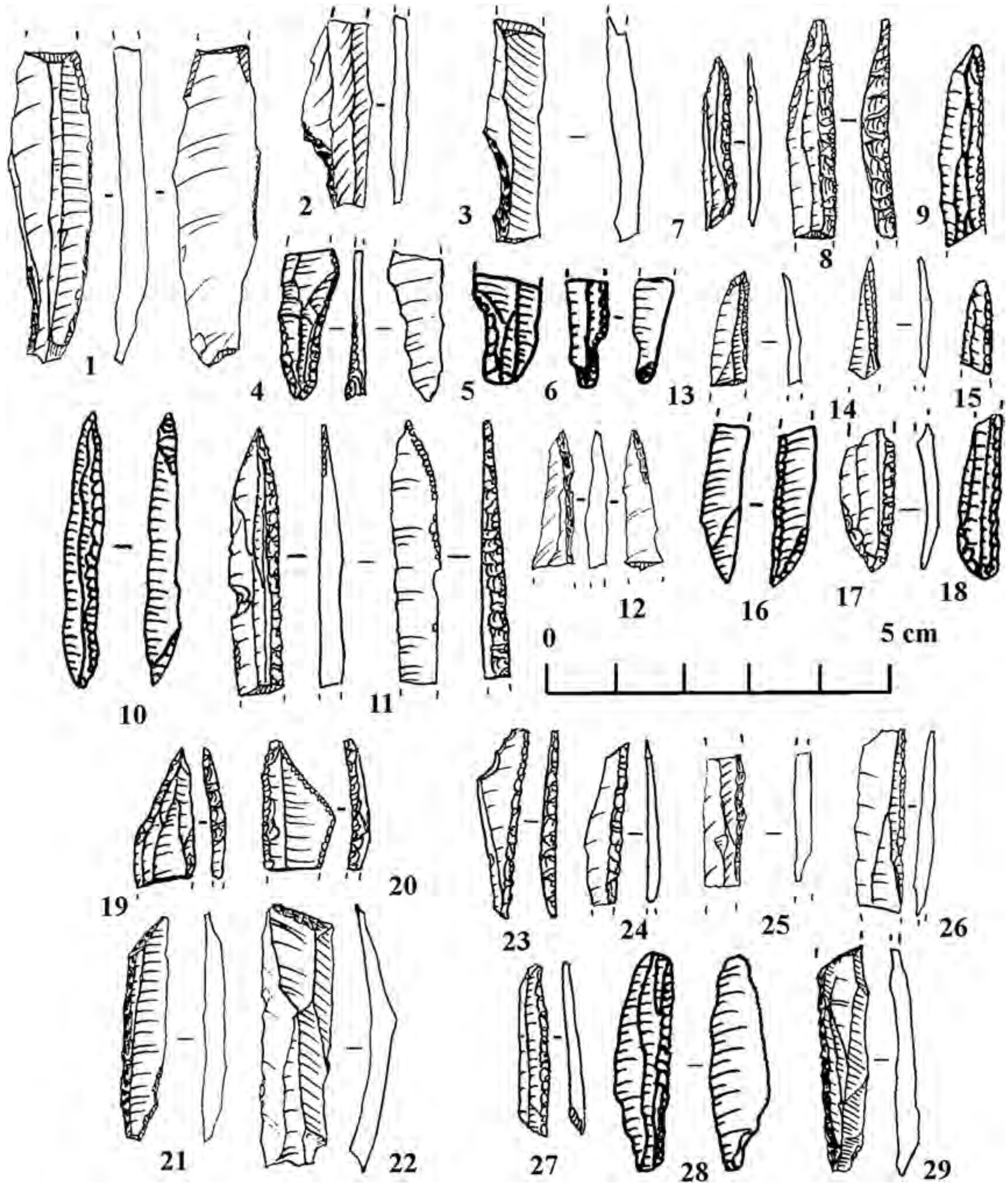

Fig. 8. Stone tools from Kasojskaya cave.

6. Gubs Rockshelter 7 (Satanai)

Gubs Rockshelter 7 or Satanai Rockshelter is located on the left bank of Gubs Gorge, near the Gubs Rockshelter 1. Autlev's 1961 test pit revealed a rich Upper Paleolithic layer, and Formozov (1965) conducted excavations in 1962. The next year, Autlev expanded the dig to 42 sq. m. Amirkhanov and Autlev returned to the site in 1975 to dig a small additional area (4 sq. m.). These excavations produced a large collection of artifacts – primarily on flint. In 1986, Amirkhanov published the materials of Satanai Rockshelter as a uniform assemblage without division into sub-levels, despite the fact that various researchers dated the site from the end of Upper Paleolithic (Formozov, 1965; Amirkhanov, 1986) to the Mesolithic (Gabunia and Tsereteli, 1977; Bader and Tsereteli, 1989).

6.1. Stratigraphy

In Satanai rockshelter, excavators identified two main cultural layers: Layer 1, a Holocene humus deposit with limestone debris (5–35 cm thick) and Layer 2, a brown loam (24–150 cm thick) with smaller limestone inclusions and large rock fall horizon in the lower part. Layer 2 contains Upper Paleolithic material. Although Autlev, in his unpublished field reports, noted some minor lithological distinctions between the top and bottom parts of Layer 2, Formozov (1965) placed greater significance on the collapsed limestone blocks as a stratigraphical marker and divided materials from the layer into three assemblages: below the horizon of collapsed blocks, within the horizon, and above the blocks. Formosov did not, however, identify any

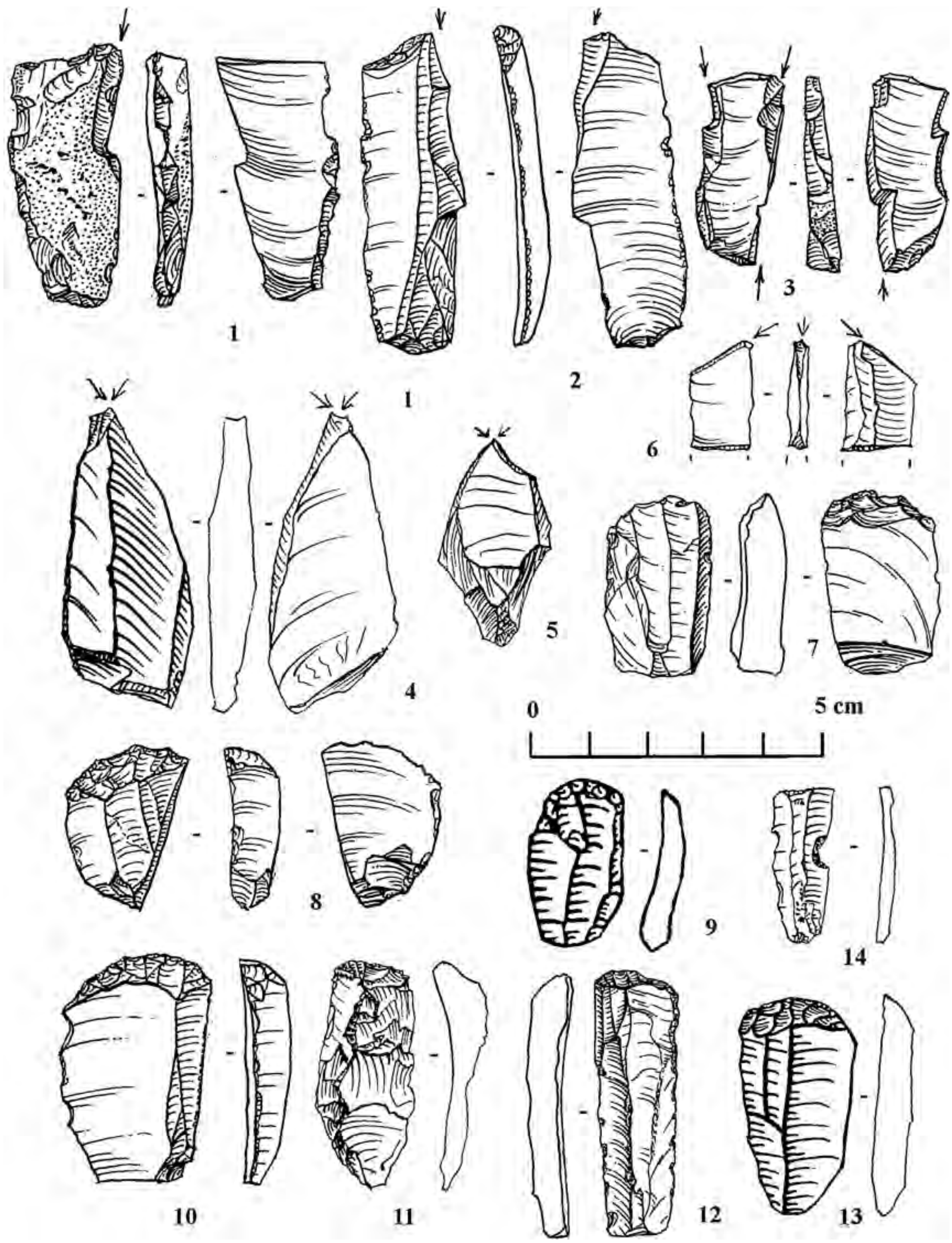

Fig. 9. Kasojskaya cave. Stone tools.

distinctions among these three assemblages. Later, Amirkhanov (1986) categorically denied that there was in fact a rockfall, and instead proposed an anthropogenic origin for the large limestone blocks in the UP layer. Surprisingly, he used this idea as a supporting argument to reject any stratigraphical sub-divisions within Layer 2, and treated all materials from the layer as a single assemblage.

New research of the rockshelter section by Aleksandrovsky in 2006, revealed several lithological horizons within UP Layer 2 (Aleksandrovskiy et al., in press). According to Aleksandrovsky, processes of Holocene soil formation in Layer 1 affected all sediments at Satanai, almost completely eliminating sediment lamination. In addition, the deposits lie outside the rockshelter's modern drop line and are intensively washed out by atmosphere waters. Aleksandrovsky identified 5 strata in the preserved section at Satanai rockshelter. In the upper part of the section, he defines two horizons of modern soil formation: the upper humus and the lower semi-humic levels. Below the soil (Layer 1 in the former excavations), three more strata (Layer 2 in the former excavations) are defined:

2a – A gray-brown friable sandy loam, with numerous worm holes, tree roots, and limestone debris, and gradual transitions to strata above and below. The middle part of the layer contains numerous large animal bones. The total thickness is between 60 and 70 cm.

2b – A gray-brown friable loam, with fewer worm holes and tree roots, many limestone blocks, a lighter colored matrix in the bottom part of the layer, and gradual transitions to strata above and below. The total thickness is about 60 cm.

2c – A brown-whitish loam with small, whitish limestone debris in the bottom. The thickness is about 15 cm.

6.2. Faunal identification

The faunal collection from Gubs Rockshelter 7 is stored in the Adygeya Republican Museum. It includes 221 *Helix* shells and 5457 bones subdivided into excavation horizons (Table 10). The majority of bone specimens were unidentified, and only 177 could be assigned to species. Among the total number of bones, 1217 specimens lacked provenience, and so the collection studied does not reflect a real distribution of the fauna. To illustrate this point, although 26.7 percent of the total archaeological material belongs to horizon 3, only 2.5 percent of faunal remains are assigned to this horizon. This discrepancy likely reflects a loss of some portion of the fauna (Tables 11 and 12).

6.3. Radiocarbon dating

Initially, bone samples from Gubs Rockshelter 7 produced radiocarbon dates of about 8 ka for horizons 1 and 2. More recently, Aleksandrovsky reported a date of about 11.2 ka for Level 2b, and bone samples from horizons 3 and 4 produced similar dates about 11.2 ka (Table 13).

These controversial radiocarbon estimates indicate that the older excavated collections incorporate materials from different strata and occupational layers, dating from the late Pleistocene to early Holocene. It is tentatively possible to correlate excavation horizons 1 and 2 of the old excavation with Layer 2a. The level of collapsed limestone blocks may correlate with Layer 2b and date to the Young Dryas; and the underlying horizons 3 and 4 can be dated the late Epipaleolithic.

6.4. Lithic industry

The collection from Gubs Rockshelter 7 (Satanai), now stored in the Adygeya National Museum in Maikop (Adygeay Republic), has suffered due to poor storage conditions. The bulk of the lithics are stored in paper bags with the codes of excavation horizons. However, other materials, mainly from test pits and section cleanings, now lacks provenience, and a part of the lithics, including the most representative tools, is stored separately without indication of excavation horizons. It seems likely that a portion of the assemblage has been lost. This is evidenced by the fact that the number of geometric microliths in the collection is less than Autlev reported in his field reports. The early excavations at Satanai rockshelter in the 1960s–1970s did not use water-screening and most finds were not recorded on plans. This rudimentary level of recovery techniques seems to have skewed the micro-lithic count, in that the number of chips is very small, and there are only isolated microbladelets. Most of the 8904 analyzed artifacts in the collection come from EPP horizon 3.

The horizon 3 collection includes 2380 lithic artifacts. The overwhelming majority (98.1%) of these is made on local grey flint, and was apparently flaked on site. One flint pebble, possibly a hammerstone, is part of this assemblage. In addition, several sandstone artifacts are present, including a large pebble with a few scars, another fragment of a pebble, a broken slab, and 6 flakes that possibly resulted from the use of the pebbles as hard hammers or for other activities. There is no evidence of regular flaking of sandstone to produce flakes. Only a small part of the lithics (1.5%) is made from various kinds of exotic colored flints, and these are represented by ready-to-use blanks and retouched tools.

There is clear evidence that raw material reduction and tool production happened on site. A portion of all cores (14%) is represented by tested cores. Flakes retaining cortex on dorsal faces are quite numerous (10% of all flakes), and the collection includes 24 technical flakes. Together, these data testify that raw material (local grey flint) testing, removal of primary cortex, and core preparation happened at the site. The following core types are identified (total $n = 92$): prismatic unidirectional (52), N-fronted unidirectional (5), N-fronted bipolar (2), surfacial (4), exhausted (6), core fragments (10), and tested (13).

In the 3-rd horizon, 82.5% of all indefinable cores (63 pieces, excluding exhausted and tested cores, and core fragments) are prismatic – all are unidirectional cores with one striking platform. N-fronted cores are not numerous, and surfacial cores that are likely residual cores of prismatic (volumetric) flaking are less representative (13.9% of all definable cores). Exhausted cores and core fragments together compose only 17.4% of all cores.

The majority of blanks (53.8% of all blank forms) in the industry are blades and bladelets. This is most likely an underestimate of the actual percentage, as many bladelets, microbladelets, and their fragments were lost during the excavation. In addition, the majority (84.3%) of retouched tools are made on blades and bladelets. The production of laminar blanks was the dominant characteristic of the lithic industry at Satanai.

Although there are few geometric microliths in horizon 3, they are quite varied in form, including lunates or segments (3 specimens, Fig. 11, 14, 15, 16), a triangle (Fig. 11, 13), and trapezes (5 specimens, Fig. 11, 12). All trapezes are simple forms with abrupt truncation on both ends. All the microliths are made on bladelets.

Backed pieces (33 specimens, Fig. 11, 2, 3, 4, 5, 6) are all made on bladelet fragments. There are numerous bladelets with the oblique truncations (18 specimens, Fig. 11, 10, 11) that are characteristic of EPP Layer 1-3 at Mezmaiskaya cave. Also, the industry includes two symmetrical retouched points made on bladelets (Fig. 11, 8, 9) and a tool similar to Gravette points (Fig. 11 – 1).

Table 10
Representation of the total NISP (bones and isolated teeth) by horizon in Gubs Rockshelter 7 (Satanai).

Horizons	NISP per horizon	Percent to total NISP in the site
1	2807	66.2
2	1140	26.9
3	105	2.5
4	183	4.4

Table 11
Taxonomic representation in the Gubs Rockshelter 7 (Satanai) fauna.

Taxon	NISP: Total (bones and teeth)	Percent of Total ID
Equus sp.	116	65.5
Bison sp.	31	17.5
Cervus sp.	13	7.3
Sus sp.	4	2.3
Capra sp.	2	1.1
Rupicapra sp.	1	0.6
Canis sp.	3	1.7
Ursus sp.	1	0.6
Microlus ex gr.	2	1.1

Table 12
Distribution of major retouched tool classes in the horizon 3 at Gubs Rockshelter 7 (Satanai).

Point	Trapeze	Lunate	Triangle	Backed piece	Truncation	Burin	Endscraper	Notched and denticulated pieces	Awl	Retouched flake/side-scraper	Total
3	5	3	1	33	18	41	74	47	3	3/4	235

Angle burins on break absolutely prevail (87.8%) among burins; all of them are made on blades or blade fragments (Fig. 11, 22), and there are also 7 dihedral burins on blades (Fig. 11, 20, 21).

Almost a half (47.3%) of all scrapers are made on blades (Fig. 11, 19). A lesser portion of scrapers (16.2%) is made on bladelets; these are mostly fragmented (Fig. 11, 17, 18). In addition, 18.9% of scrapers are made on flakes or laminar flakes (17.6%).

The overwhelming majority (95.7%) of notched and denticulate tools (47 in total) are made on bladelets and blades. The majority (80.9%) of notched (Fig. 11, 23, 25) and denticulate (Fig. 11, 24, 26) tools have denticulate retouch on one lateral side. The industry also includes 3 awls, 4 side-scrapers, and 3 retouched flakes.

In conclusion, the material from horizon 3 at Gubs Rockshelter 7 (Satanai) is in agreement with the late Epipaleolithic age supported by radiocarbon estimates between 11–11.5 ka for this occupation. The industry has many analogues in other EPP sites. Layer 1-3 at Mezmaiskaya includes similar tool types, such as backed pieces, Gravette points, symmetrical retouched points, oblique truncated bladelets, lunates, simple low trapezes, and triangles. In addition, some bone awls, horse incisor pendants (Fig. 10 – 5), and a bone polisher from the EPP levels but lacking horizon provenience, are known from other EPP sites in the Caucasus.

Unfortunately, the poor recovery methods of the old excavation at Satanai resulted in the loss of a portion of the micro-lithics, limiting the ability to make an accurate and detailed comparison with other EPP assemblages. It is also possible that the collection is "contaminated" with later, intrusive materials, most likely including geometric microliths (Amirkhanov, 1986, Fig. 18) such as high trapezes with retouched or notched backs, high trapezes with concave sides, and Helwan segments. Bader (1984, p. 286) noted that these forms have analogues in the Mesolithic and Neolithic sites in the Southern Caucasus, and thus most likely originate from the early Holocene horizons. It is quite possible that large (14–17 cm) bone double points with flat-convex cross-sections (Fig. 10 – 6-8), and a large bone awl-pin with a rounded head (Fig. 10-4) are also derived from the upper horizons, because these tools lack analogues in other Caucasus EPP sites.

7. Yavora open-air site

This is the most eastern EPP occupation in the Northwestern Caucasus (Fig. 1). It is located on a watershed division between the Bolshoy Zelenchuk and Khusa rivers in the upper Kuban River basin. The site was first excavated in 1956 by Liubin, and then in 1976 by Liubin and Amirkhanov. Several test pits revealed the following stratigraphy (Amirkhanov, 1986):

Layer 1 – modern soil (up to 0.5 m in depth),
Layer 2 – light yellow loam (up to 1.0 m),
Layer 3 – yellow sterile clay (up to 1.3 m).

Archaeological finds occurred from the bottom of Layer 1 throughout the entire Layer 2. The industry of Yavora includes 901 artifacts (Table 6) made from pebble grey and cobble pink flint. The cores present include prismatic (4), prismatic double platform (2), and a fragment. Laminar flakes, including 144 complete flakes and

Table 13
Radiocarbon chronology of the Epipaleolithic and late Upper Paleolithic sites in the Caucasus.

Site and Layer	14C Age (BP)	Lab #	Method	Source
Northern Caucasus				
Mezmaiskaya, Layer 1–3	12,960 ± 60	GrA–25965	AMS	Golovanova et al., 2006
	13,860 ± 70	GIN–12900	Conv.	
Mezmaiskaya, Layer 1-4	16,260 ± 100	GIN–12901	Conv.	Golovanova et al., 2006
	21,050 ± 110/120	GrA–25933	AMS	
Kasojskaya, Layer 4, hor. 3	10,550 ± 130	SPb–130	Conv.	First publication
Kasojskaya, Layer 4, hor. 4	11,000 ± 150	SPb–128	Conv.	First publication
Kasojskaya, Layer 4, hor. 5	14,050 ± 100	SPb–129	Conv.	First publication
Chygai, layers 9-10 (?)	13,250 ± 500	LE–8317	Conv.	Leonova, 2009
Satanai, level 2b (horizons 2-3?)	11,200 ± 110	Ki–14280	Conv.	Aleksandrovskiy et al., in press
Satanai, hor. 3	11,140 ± 100	SPb–132	Conv.	First publication
Satanai, hor. 4	11,200 ± 130	SPb–131	Conv.	First publication
Badinoko, horizon 5 middle	12,635 ± 150	SOAN–5896	Conv.	Zenin and Orlova, 2006
Badinoko, horizon 5 lower	13,990 ± 340	SOAN–5897	Conv.	Zenin and Orlova, 2006
Southern Caucasus				
Sakajia, Layer 4	11,700 ± 80	OxA–7853	AMS	Nioradze and Otte, 2000
Devis-Khvreli	10,025 ± 55	OxA–8020	AMS	Nioradze and Otte, 2000
Dzudzuana, Layer B	11,500 ± 75	RTT–3282	AMS	Bar-Yosef et al., 2011
	13,250 ± 70	RTT–3821	AMS	
	13,860 ± 90	RTT–3278	AMS	
Dzudzuana, Layer C	12 dates, from/to			Bar-Yosef et al., 2011
	19,920 ± 300	RTT–5744	AMS	
	23,240 ± 200	RTT–3823	AMS	
Gvardjilas klde	15,960 ± 120	OxA–7855	AMS	Nioradze and Otte, 2000
	15,010 ± 110	OxA–7856	AMS	
Apiancha, horizon 4	14,640 ± 350	U2AM–630	AMS	Korkia, 1990
Apiancha, horizon 5	17,300 ± 500	GIN–2565	Conv.	Korkia, 1990
Akhshtirskaya, Layer 2	19,500 ± 500	GIN–108	Conv.	Liubin, 1989
Malaya Vorontsovskaya, Layer 1	14,100 ± 140	LE–700	Conv.	Liubin, 1989

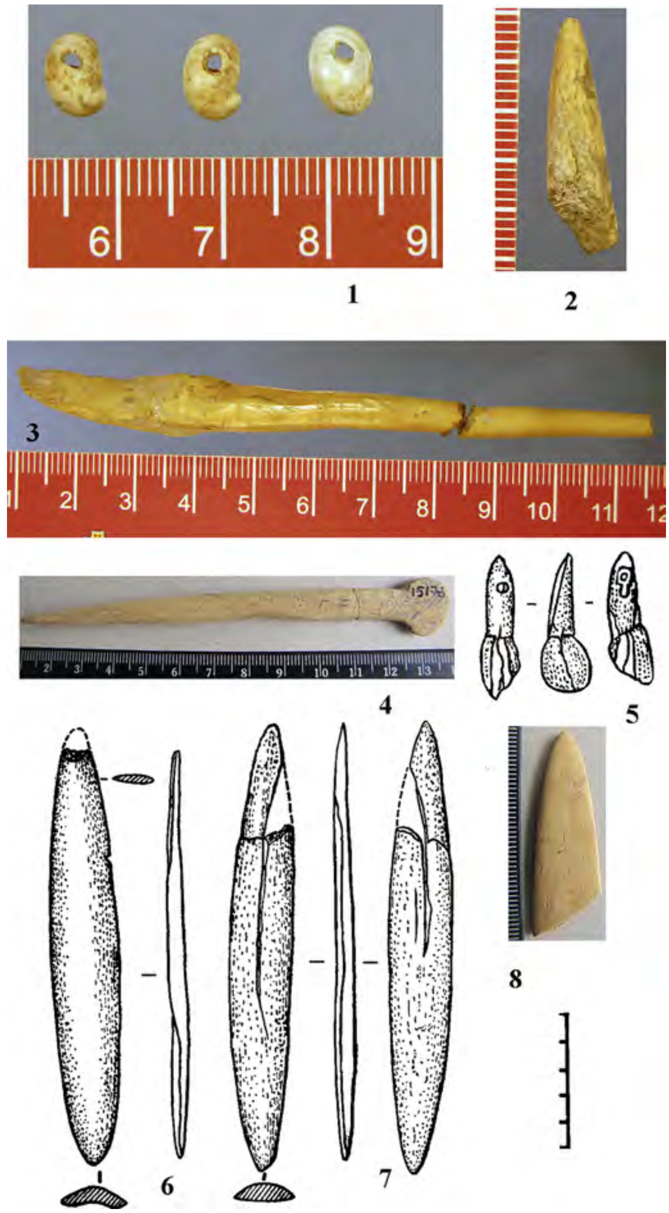

Fig. 10. Bone tools and personal ornaments from Kasojskaya cave (1–3) and Satanai rockshelter (4–8), (5, 6, 7 after Amirkhanov, 1986).

164 fragments, make up the majority of definable flakes (63.7 percent). About half (50.2 percent) of these laminar flakes are bladelets and micro-bladelets.

Tools include Vachons points (Fig. 12, 20, 21), which Amirkhanov (1986) defined as Gvardjilas-klde points, noting their similarity to points from the Imerethian UP culture in Georgia and Kamennobalkovskaya culture on the Sea of Azov coast. Indeed, Vashon type points are widely known in the EPP industries in the Caucasus. Another important tool type, which Amirkhanov (1986) defined as an oblique retouched blade with a lateral notch (Fig. 12, 19), is similar to Hambourgienne points known from the final Magdalenian of North-eastern Europe (Demars and Laurent, 1992, p.148).

About a third (29.3%) of all tools (Table 7) are backed pieces (Fig. 12, 23, 24, 27). They include pieces with truncation (Fig. 12, 29) or micro-retouch on the second side (Fig. 12, 25). Retouched bladelets are also present – one with ventral retouch along the perimeter (Fig. 12, 28), and a few with fine retouch (Fig. 12, 22, 27). The only type of geometric microlithics are rectangulars (Fig. 12, 30).

There are few end-scrapers (Fig. 12, 31), but numerous burins (Table 7). These latter include straight (Fig. 12, 26), oblique (Fig. 12, 32, 33), truncations, and burins on a break. The industry also includes a notched blade (Fig. 12, 34) and many (39.0 percent of all tools) retouched flakes and blades.

In conclusion, the industry of Yavora has analogues in other EPP sites in the Caucasus, but the exact chronological position of this industry will require additional excavation.

8. Baranakha 4 open-air site

Baranakha 4 is located in eastern part of the Northwestern Caucasus, in the upper Kuban River basin, within a valley of a small Morkaya River (an inflow of Urup River), at 1477 m a.s.l. The site was found in 1989 (Doronichev, 1995), and small excavations were done in 1989 and 1996. The site's stratigraphy is the following:

Layer 1 – A modern soil with fragments of Medieval ceramic, up to 70 cm deep.
Layer 1A – A humus-colored loam with Epipaleolithic finds, up to 30 cm thick.
Layer 2-1 – A yellowy-brown loam, up to 30 cm thick. The top of this layer is deeply eroded, suggesting a chronological hiatus between Layer 2-1 and the upper deposits.
Layer 2-2 – A yellowy-brown loam, with high value of corroded limestone debris, up to 10 cm thick.
Layer 2-3 – A yellowy brown loam with numerous limestone fragments, and a rich Middle Paleolithic industry, up to 40 cm thick.
Layer 3 – A sterile, orange-brown loam with numerous limestone fragments, up to 25 cm thick.
Layer 4 – The limestone bedrock.

A palynological analysis of pollen samples from Baranakha 4 was carried out by T.V. Sapelko. In the EPP layer 1A, pollen concentration is considerably higher than in the lower levels. The pollen spectrum is characterized by a high concentration of arboreal pollen that includes *Pinus* (pine), *Alnus* (birch), *Pterocarya* (wingnut), *Juniperus* (juniper), and a grain of *Zelkova* (Caucasian zelkova). Herbaceous pollen is variable and dominated by *Poaceae*, *Cyperaceae* (sedges), and *Asteraceae*. Pollen of *Chenopodiaceae*, *Polygonaceae*, *Apiaceae*, *Geraniaceae*, *Rubiaceae*, and others is also found. Also, *Sphagnum* is found. A much-increased value of spores and the dominance of *Polypodiaceae* (ferns) among spores suggest forest expansion. The EPP layer 1A formed in warm and humid conditions favorable for the growth of vegetation and active expansion of the forest zone. The presence of *Zelkova* indicates the warmest climatic conditions in the site stratigraphy that were warmer than today.

The Epipaleolithic materials of Baranakha 4 consist of two collections: surface finds and lithics excavated in 1989 and 1996 from Layer 1A (Table 6). Unfortunately, bones are not preserved, and no radiocarbon dates are available as yet.

The industry in total consists of 305 lithic artifacts (Tables 6 and 7). The flaking technology is documented by 8 prismatic cores with oblique platforms, 4 tested cores, and core preparation flakes. Laminar flakes compose 43.7 percent of all flakes, and the ratio of bladelets is high (65.0% of all laminar flakes). There are many flakes with cortex areas on dorsal faces.

Tools are not numerous (13.1% of the total lithics). There are two shouldered points (Fig. 13, 1, 2); a complete one has additional fine retouch of the tip. Also, there are Gravette points

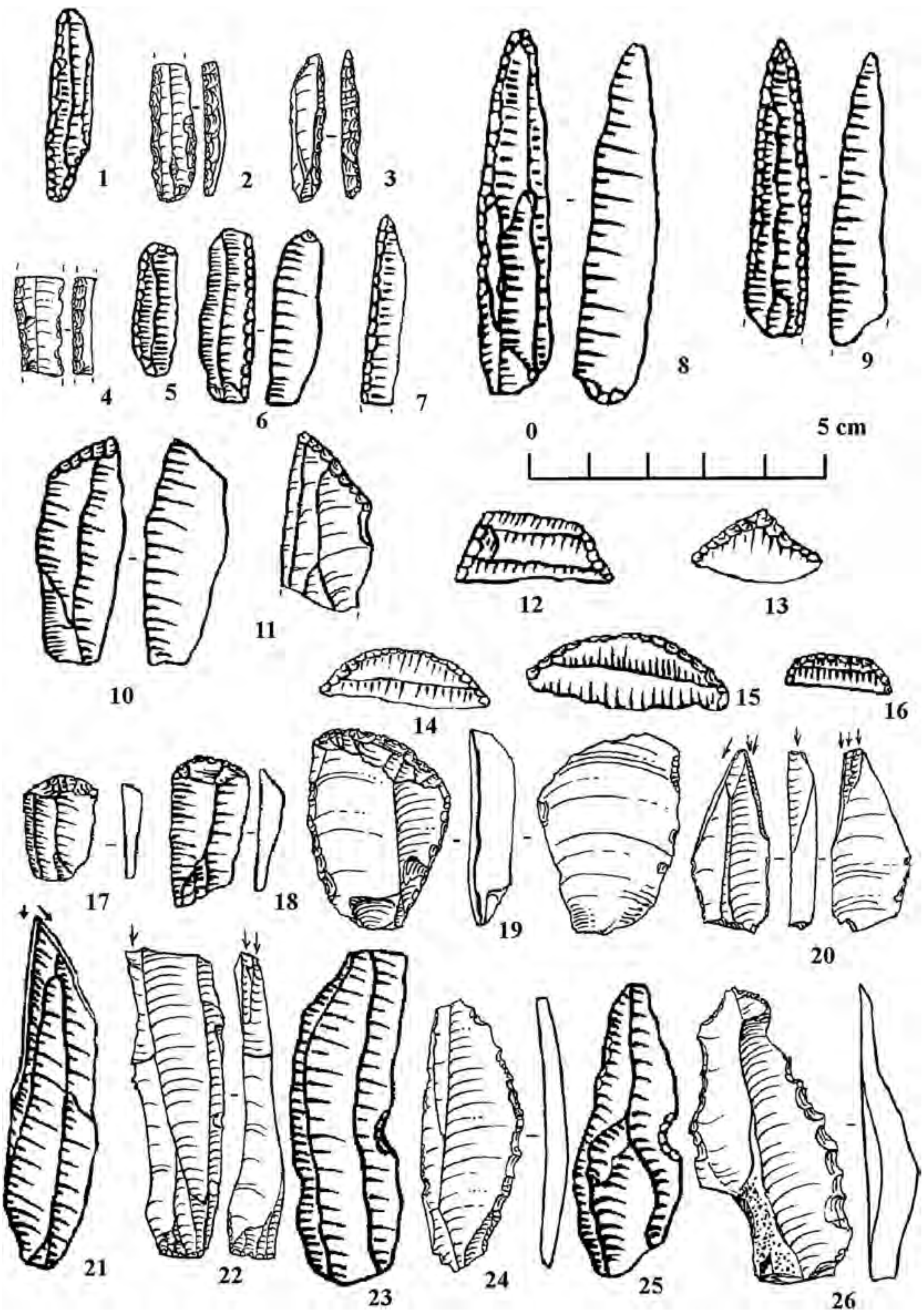

Fig. 11. Stone tools from Satanai Rockshelter, horizons 3–4.

(Fig. 13, 4) or similar forms (Fig. 13, 3, 6), and a fragment of symmetrical retouched point (Fig. 13, 5). Geometric micro-lithics are only rectangular in form (Fig. 13, 11). Backed pieces (Fig. 13, 9) are most numerous (Table 7); one of the backed bladelets has fine ventral retouch on the opposite side and resembles Dufour bladelets (Fig. 13, 8). One bladelet has an oblique retouched end (Fig. 13, 10).

End-scrapers are made on technical (core preparation) flakes (Fig. 13, 13), plain flakes (Fig. 13, 14, 15), or blade fragments (Fig. 13, 16, 17) and often have retouched lateral sides. Burins are few and include an asymmetrical dihedral (Fig. 13, 18), dihedral (Fig. 13, 19), and double (Fig. 13, 20) burin. One tool is defined as a knife on blade (Fig. 13, 12). Also, the industry includes blades or flakes with denticulate retouch (Fig. 13, 21, 22).

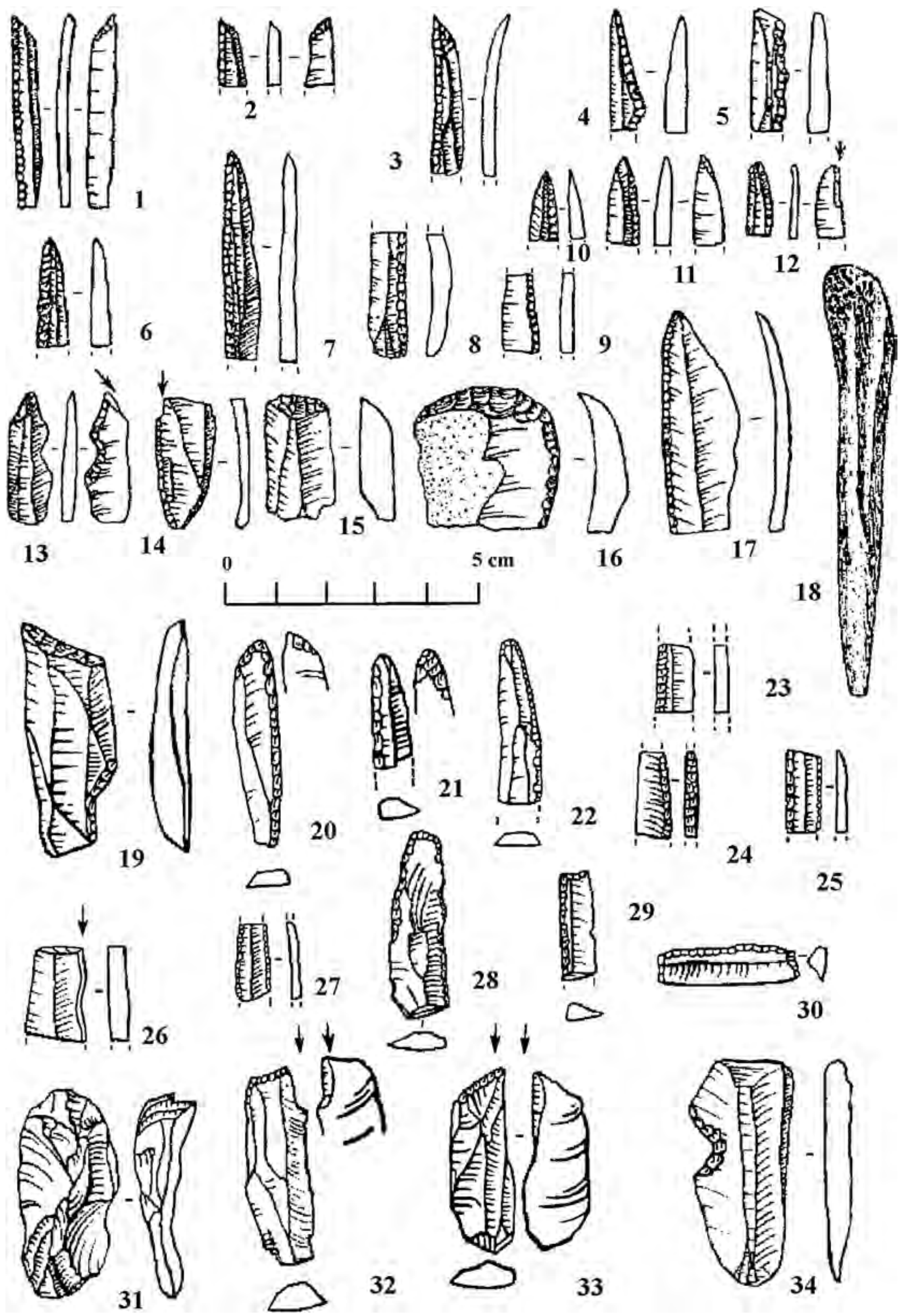

Fig. 12. Stone tools and a bone awl (18) from Gubs Rockshelter 1, Epipaleolithic layer (1–18,) and Yavora site (19–34; after Amirkhanov, 1986).

In conclusion, the age and peculiarities of the EPP industry are determined on the basis of techno-typological characteristics. The site is located on a source of silicified limestone, and therefore can be treated as occupation-workshop, from which a portion of the high quality flakes have been carried away.

9. Baranakha 1 open-air site

Baranakha 1 site was located about 300 m upwards on the Mokraya River ravine from Baranakha 4, but was destroyed during construction of a road. The site was found in 1989

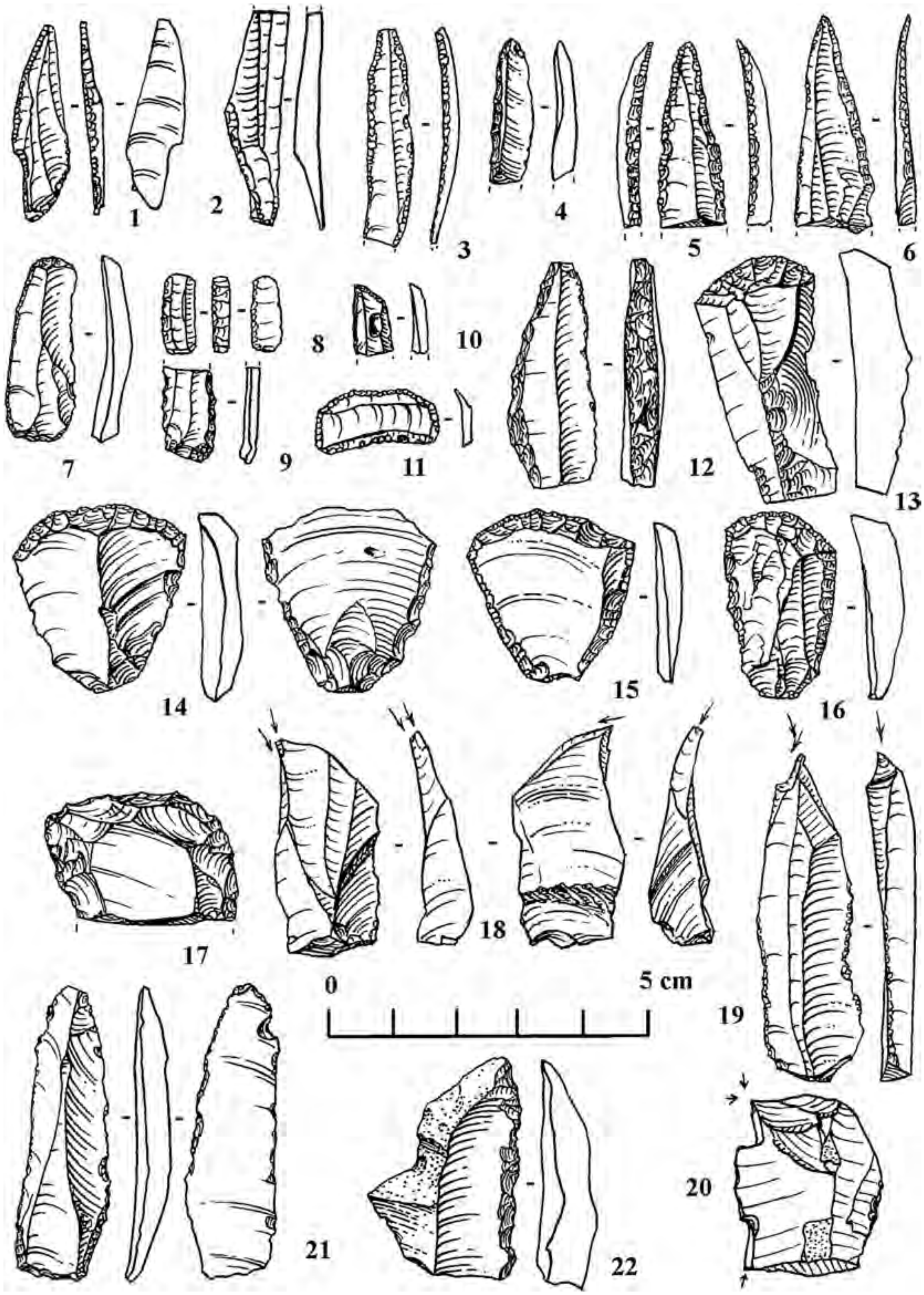

Fig. 13. Stone tools from Baranakha 4. Epipaleolithic assemblage.

(Doronichev, 1995) when a rich surface assemblage with analogues at many Caucasus EPP sites was collected in the area (Table 6).

The flaking technology is characterized by 3 prismatic cores, a prismatic bipolar core, and the predominance of laminar blanks (52.1% of all flakes), among which bladelets and micro-bladelets prevail (54.0% of laminar flakes).

Among tools, there are two shouldered points (Fig. 14, 1), as well as Gravette (Fig. 14, 3) and Vachons (Fig. 14, 4, 5) points. Backed pieces are numerous (Table 7) and mostly fragmented (Fig. 14, 6), some of these have ventral retouch on the opposite side (Fig. 14, 7, 10). The only geometric micro-lithic is a rectangular (Fig. 14, 9). Also, a few bladelets and blades with oblique truncations are identified (Fig. 14, 8, 12, 13). End-scrapers are made on blades or

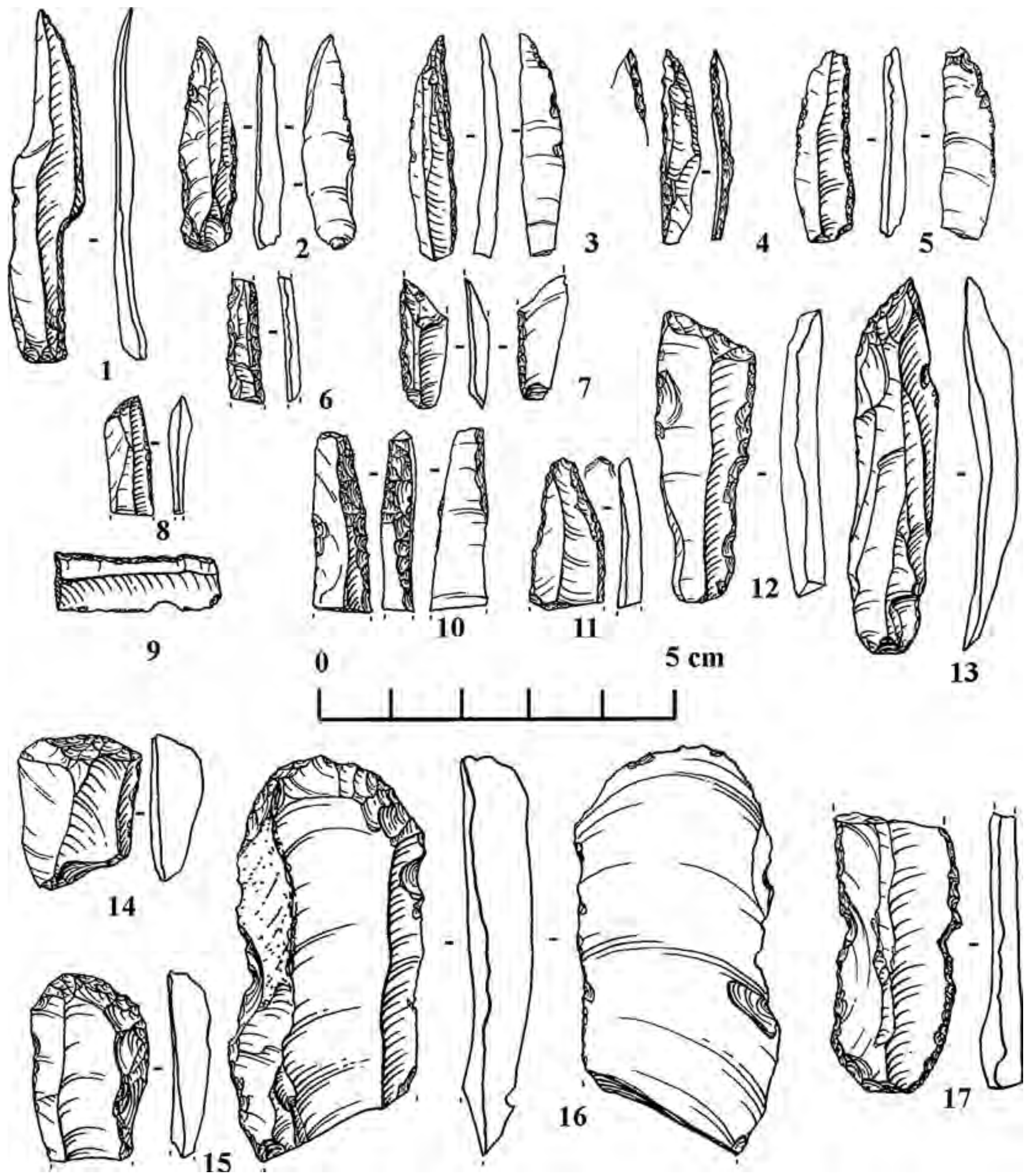

Fig. 14. Stone tools from Baranakha 1. Epipaleolithic assemblage.

blade fragments (Fig. 14, 15, 16), and rarely on plain flakes (Fig. 14, 4). There is one atypical burin. Half of the tools are denticulates on blades (Fig. 14, 17) touched flakes and blades, and bladelets with fine retouch (Fig. 14, 2, 11).

In general, the EPP industries of both Baranakha 4 and Baranakha 1 have analogues in many other terminal Upper Paleolithic sites of the Caucasus. Together with Yavora, these two sites delineate the eastern border of EPP industries in the Northwestern Caucasus.

10. Conclusion

The consistent presence and character of the EPP in the Northwestern Caucasus is emerging from new radiocarbon dating, paleoecological analyses, and archaeological research (including new excavations), as well as re-analyses of older collections. As a result, it is now possible to identify at least three major stages of paleoclimate and cultural dynamics during the latest Upper Paleolithic in the region (Table 14):

- *The Last Glacial Maximum* (MIS 2, 25–18 ka BP cal.) extremely cold event, recorded in several sites within the region, interrupts the development of Late Upper Paleolithic (LUP). In Mezmaiskaya Cave, which has the most extensive and detailed fossil and stratigraphic record in the Northwestern Caucasus, this event is marked by a break in sedimentation and the subsequent erosion of the surface of LUP layer 1A-1 (Table 1). In Gubs Rockshelter 1, this period correlates with sterile strata 7-4 and with periglacial forest-steppe conditions (Table 14). After the Last Glacial Maximum, a new Epipaleolithic (EPP) culture, between ~18 ka BP (cal.) and the Pleistocene and Holocene boundary at 10 ka BP (cal.), spread from Georgia in the Southern Caucasus, through Northwestern Caucasus, to the southern Russian plain.

Table 14
Correlation of environmental and climate data for the Epipaleolithic sites in the Northern Caucasus.

Chronology (^{14}C yr BP)[a]	Gubs 1 Rockshelter	Mezmaiskaya Cave	Kasojskaya Cave	Satanai Rockshelter	Chygai Rockshelter	Badinoko Rockshelter
The Holocene						
8000–10,000 Boreal and Preboreal		Layer 1–2 8680 ± 100 Layer 1–2A 8720 ± 70 warm and dry	Horizon 1	Horizons 1 and 2	Layers 3–5 goat	
The Late Glacial (ca. 17,000–10,000 ^{14}C yr BP)						
10,000–10,800 Younger Dryas (cold)		Brechee level	Slabs level	Collapsed level cold steppe	Layer 7	
10,800–11,800 Allerod (cool)			Horizon 3 10,550 ± 130 Horizon 4 11,000 ± 150 Equus, Bison, Cervus	Horizon 2–3 11,200 ± 110 Horizon 3 11,140 ± 100 Horizon 4 11,200 ± 130 Equus, Bison, Capra, Sus scrofa, Capreolus, Helixs shells cold steppe	Layers 6–8 Cricetus cricetus (ordinary hamster) steppe climate	
11,800–12,000 Older Dryas (cold)						
12,000–12,400 Bolling (warm)						
12,400–13,200 Oldest Dryas (cold)						
13,200–17,000 Unnamed Interstadial	Layer 2 Bison, Capra/Ovis Layer 3 deciduous woods, warm and humid	Layer 1–3 deciduous woods, warm Bos/Bison, Sus scrofa, Cervus elaphus, Capra, Capreolus 12,960 ± 60 13,860 ± 70 Layer 1–4 deciduous woods, most favorable conditions 16,260 ± 100 21,050 ± 110/120	Horizon 5 14,050 ± 100		Layer 9 Sus scrofa, Emys (marsh turtle) 13,250 ± 500	Horizon 5 Helix shells middle level 12,635 ± 150 lower level 13,990 ± 340
The Last Glacial Maximum (ca. 23,000–17,000 ^{14}C yr BP)						
	Layers 4–7 periglacial forest-steppe					

[a] Radiocarbon chronology and paleoenvironmental stages after Bolikhovskaya (2007: fig. 7).

- *The main stage of Epipaleolithic*, from ca 18 to ca 13 ka BP (cal.), was the most favorable period in the end of Upper Pleistocene. The largest number of EPP sites may be correlated with this stage (Tables 13 and 14). At Mezmaiskaya Cave (layer 1-3) and Gubs Rockshelter 1 (the top UP layer), this period is marked by deciduous woods and a warm, humid climate. Two additional recently discovered EPP occupations, Layer 9 at Chygai Rockshelter and horizon 5 at Bodinoko Rockshelter, also appear to correlate with this period, based on faunal data and radiocarbon dates. Unfortunately, materials from both rockshelters are only preliminarily published.
- *The Younger Dryas* period of climatic stress, dated between 13–10 ka BP (cal.), marks the end of Epipaleolithic culture development in the Northern Caucasus. At several sites, this period is recorded by breaks in normal sedimentation: a thick (up to 20 cm) strong calcite breccia level at Mezmaiskaya, a horizon of collapsed limestone blocks at Satanai, a horizon of limestone blocks and slabs at Kasojskaya, and a calcified layer 7 with dense limestone eboulis at Chygai. In Chygai Rockshelter, the underlying layers 6 through 8 were deposited in a steppe environment. Apparently, horizons 3 and 4 at Satanai Rockshelter, and horizons 3–5 at Kasojskaya Cave may also date to this unfavorable period, based on radiocarbon dates and the appearance of a horse (*Equus* sp.) in the fauna. In Satanai, with only one pollen sample taken from the 1.5 m thick UP layer (Amirkhanov, 1986, p. 18), little evidence for climate is available. The reconstructed for this sample cold climate conditions and poorly forested steppe, lacking broad-leaf trees, are likely correlated to the collapsed level.

In general, the EPP industries in the Northern Caucasus are characterized by highly developed bladelet technologies and large quantities of backed bladelets in tool sets. These industries build upon the earlier UP preceding the Last Glacial Maximum, adding geometric micro-lithics (segments or lunates, trapezes, triangles, and rectangles) and shouldered points, as well as a new technique of biconical drilling and a new style of pierced terrestrial shells for personal decoration (both recorded at Mezmaiskaya).

Although the currently available data on chronology and paleogeography are limited, they indicate that the development of the Upper Paleolithic in the Northern Caucasus was not continuous. Two periods of ecological stress corresponding to climate coolings are evident at several stratified sites. Periods of warm climates were favorable for human migrations and the spread of cultural innovations from the Southern to Northern Caucasus, and the establishment of relative cultural homogeneity across the Caucasus.

11. Southern Caucasus

In the Southern Caucasus, the overwhelming majority of Upper Paleolithic sites are located in the territory of Western Georgia, within the Colkhic mountain province (Fig. 1). In Azerbaijan and Armenia, a few isolated localities were identified in the middle of 20 century, and these have yet to be studied (Panichkina, 1948; Sardarian, 1954; Zamiatnin, 1958). The majority of UP sites in Georgia were excavated in the first half and middle of the 20 century (Table 15) without modern recovery techniques, such as water-screening, and lack detailed find records and stratigraphic analysis. As a result, the archaeological materials from many of these sites appear to be a mixture of Middle Paleolithic, Mesolithic, and Neolithic finds (Meshveliani, 1986; Liubin, 1989; Amirkhanov, 1994).

Nevertheless, since the 1930s, discussions of the position of the Caucasian UP within the greater West Eurasian context have been largely influenced by the West Georgian sites. Zamiatnin (1935) described the Caucasian UP as generally Aurignacian in character, and drew broad analogies with the Mediterranean, from North Africa and Italy, across to Syria and Palestine. Later, Formozov (1959) argued for more geographically limited affinities with the nearest regions, particularly Syria, Palestine and Iraq. Bader (1966) noted similarities between the UP of the western Caucasus and the Baradostian and Zarzian industries of the Zagros Mountains (Iran). Amirkhanov (1986) emphasised the Aurignacian-Perigordian character of the industries and also the rarity of bone tools as a distinguishing feature of the Caucasian UP. More recently, Kozlowski (1998) has argued for a bilinear development of the Early Upper Palaeolithic (EUP) in Georgia, linking the Georgian EUP industries to the Early Ahmarian and Aurignacian of the Levant.

Until the end of the 20th century, most researchers considered the Caucasian UP to be a uniform entity, developing into the cultural phenomenon called the Imeretian, with three (Zamiatnin, 1935), four (Tushabramishvili, 1981), or even five (Berdzenishvili, 1964) stages of development. Kozlowsky (1972a,b) was the first to use climate data to try to understand periodization of the Caucasian UP. A significant advantage of this approach was that it recognized the importance of Last Glacial Maximum deposits as the main climatic and chronological marker within the UP deposits of several cave sites. Later, Amirkhanov (1994) also used the Last Glacial Maximum as the main chronological division with the Caucasian UP. He was also the first to propose that the Imeretian culture concept should be applied mainly to UP assemblages postdating the Last Glacial Maximum.

More recently, a series of numerical dates has joined the lithic techno-typological analyses available for several UP sites in the Southern Caucasus (Table 13). Unfortunately, the mixed faunal collections and limited pollen data of the older excavations preclude reliable reconstruction of the paleoclimate and biogeographic context in different stages of the Southern Caucasian UP. Thus, important diachronic variation is almost certainly missing within this record. Despite this contextual problem, the materials currently available from the period between the Last Glacial Maximum and the Younger Dryas, or from approximately 18–10 ka, will be considered.

Materials from Gvardjilas klde cave include more than 26,000 stone and bone artifacts (Tushabramishvili, 1960). Zamiatnin (1935) used these to identify the third (and last) stage of UP development

Table 15
Comparison of lithic industries from the Epipaleolithic sites of the Colkhic mountain province in the Southern Caucasus.

Site	Excavations	Epipaleolithic deposits	Industry	Source
Dzudzuana, Georgia	1966–1975 D. Tushabramishvili 1983–1986 Meshveliani 1996-recent Meshveliani, Bar-Yosef, Belfer-Cohen	Unit B	Micro-Gravette points, backed pieces, geometrics	Meshveliani et al., 2004; Bar-Yosef et al., 2011
Sakajia, Georgia	1914 P. Shmidt and L. Kozlowsky 1936–1937 G. Nioradze 1973–1980 M. Nioradze	Horizon 3 Layer 4 up to 2.3 m thick > 100 sq.m excavated	Micro-Gravette, Gravette and Vashon points, backed pieces, asymmetric triangles, backed pieces with ventral truncations, segments	Bader, 1984; Nioradze, 1992; Nioradze and Otte, 2000
Devis-Khvreli, Georgia	1926–1927 G. Nioradze	Layer 3 0.5 m thick	Gravette and Vashon points, backed pieces, asymmetric triangles, backed pieces with ventral truncations, segments	Bader, 1984; Liubin, 1989; Nioradze and Otte, 2000
Gvardjilas klde, Georgia	1916 Krukowsky 1953 Kalandadze and D. Tushabramishvili	Layer II 0.2 m thick	Gravette and Vashon points, shouldered points, backed pieces, asymmetric triangles, segments, micro-burins	Tushabramishvili, 1960; Bader, 1984; Nioradze and Otte, 2000
Chakhati, Georgia	1954 Berdzenishvili	Layers I–III up to 1.3 m thick	Shouldered points, segments	Berdzenishvili, 1964; Bader, 1984
Apiancha, Abkhazia	1940 L. Soloviev 1975–1977 Berdzenishvili and Tsereteli, 1978, 1985–1986 Tsereteli	Three layers	Layer 4 – Gravette and Vashon points, shouldered points, backed pieces, asymmetric triangles, segments Layer 5 – Gravette and Font Yves points, backed pieces	Tsereteli et al., 1982; Korkia, 1990; Nioradze and Otte, 2000
Akhshtyrskaya Cave, Russia	1936 Panichkina 1937–1938 Zamiatnin, 1961 Panichkina and Vekilova 1962–1963, 1965, 1978 Vekilova	Layer 2b 0.6–1.0 m thick Layers 4,5,6 after Vekilova and Grishcenko Layers 2/1,2/2,2/3 after Muratov and Fridenberg	Gravette points, backed pieces, blades with truncations	Tchistiakov, 1996
Malaya Vorontsovskaya Cave, Russia	1940 Krainov 1950–1951 L. Soloviev 1964–1965 Liubin 1983–1984, 1986 Chistyakov	Layer 1	Scarce tools	Liubin, 1989; Tchistiakov, 1996

in the Caucasus. Kozlowsky (1972a,b) subdivided the Gvardjilas klde material into three assemblages, assigning the earliest to the period immediately before the Last Glacial Maximum, and the latest to a cooling phase after the Lascaux interstadial. Paleontological analyses suggest that the fauna represent a variety of landscape zones.

Point types identified in the Gvardjilas klde industry include Gravette (Fig. 15, 14, 15), "Gvardjilas klde" (i.e., Vashon) (Fig. 15, 8–13), shouldered (Fig. 15, 1–5), large symmetrically retouched (Fig. 15, 6), and Font-Yves points (Fig. 15, 7). Backed pieces are numerous (Fig. 15, 21, 22), and there is a large variety of retouched bladelets, including forms similar to *pointe a dos courbe* (Fig. 15, 22) and bladelets with ventral retouch (Fig. 15, 23, 25). There are also geometric micro-lithics, such as segments (Fig. 15, 16–18), asymmetric triangles, and tools similar to scalene bladelets (Fig. 15, 19, 20) or rectangulars (Fig. 15, 24). Burins are variable, and include micro-burins, burins on breaks (Fig. 15, 29), burins on retouched truncation (Fig. 15, 28), double burins (Fig. 15, 30), and others. Among the varied of end-scrapers, simple end-scrapers on blades predominate (Fig. 15, 33), but there are also end-scrapers on flakes, including on retouched flakes (Fig. 15, 27, 31), and a few rounded end-scrapers (Fig. 15, 26).

The Gvardjilas klde assemblage includes 125 bone tools and personal ornaments (Tushabramishvili, 1960). Among these bone awls (Fig. 16, 2, 3, 4, 5) and fragments of bone points with ovate cross-sections (Fig. 16, 1, 6, 7, 8) are most numerous. Other notable bone tools include a bone pendant with an incised groove around the eye (Fig. 16, 12), a fragment of a decorated bone tool (Fig. 16, 11), and bone needles with eyes (Fig. 16, 9, 10).

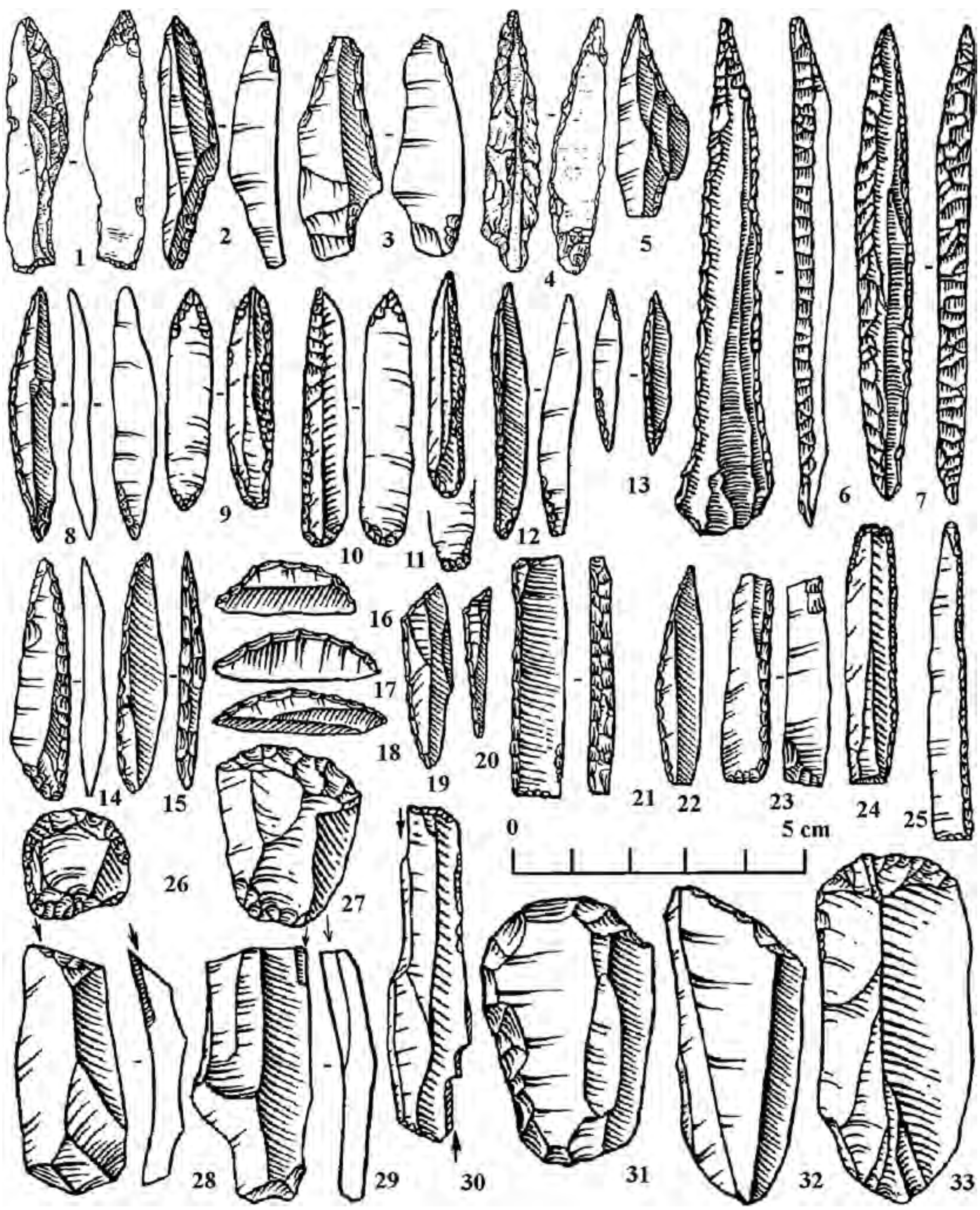

Fig. 15. Stone tools from Gvardjilas klde (after Tushabramishvili, 1960; Bader, 1984; Nioradze and Otte, 2000).

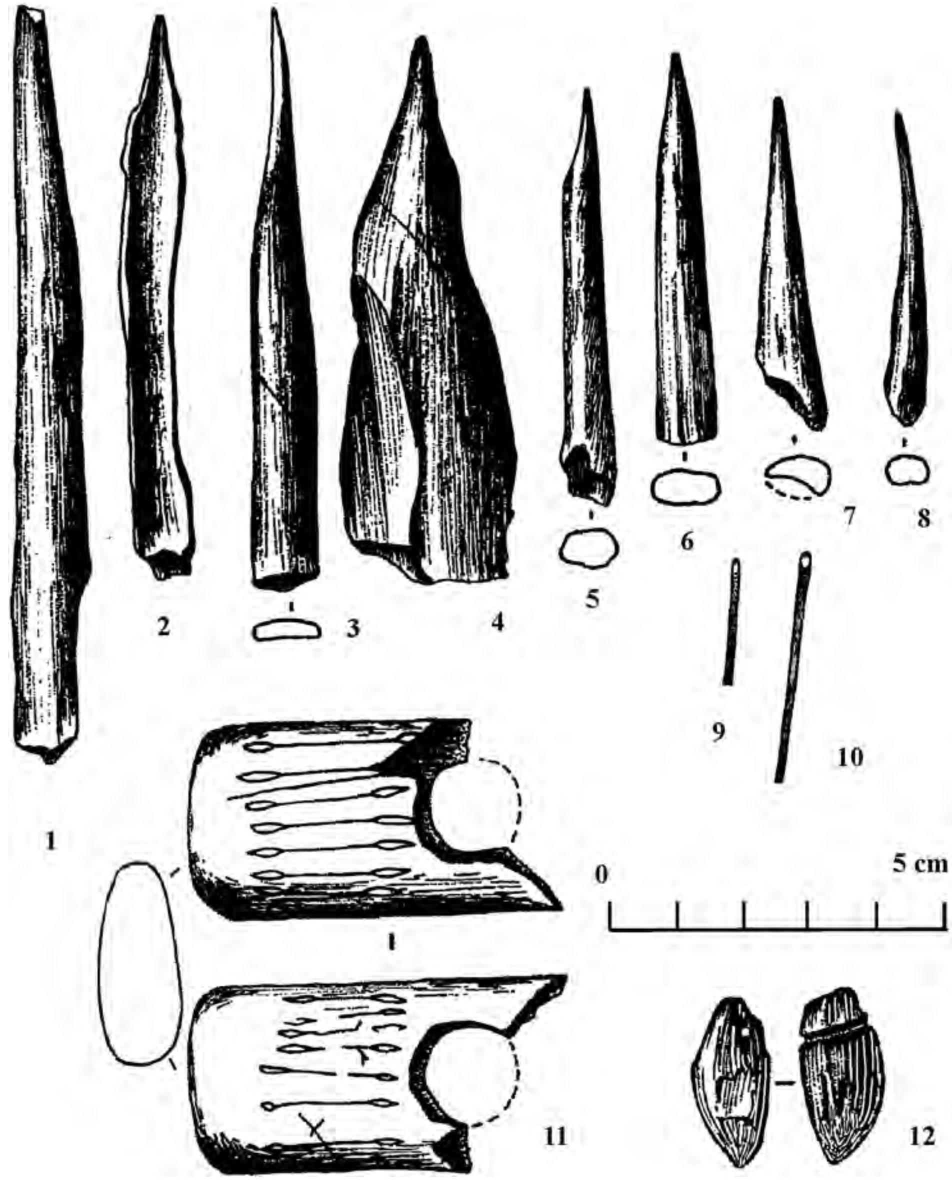

Fig. 16. Bone tools and personal ornaments from Gvardjilas klde (after Tushabramishvili, 1960; Nioradze and Otte, 2000).

Tortladze (1990) links the UP industry at the more recently discovered Sabelasuri open-air site with that of Gvardjilas klde cave. Excavated in 1985–1986, the only occupational layer was 0.20–0.25 m deep, covered at least 32 m^2, and produced 5503 lithic finds. Blades and bladelets predominate (57.2 percent, 2289 pieces), and among these almost 22 percent (502 pieces) are bladelets. Tools include micro-points, bladelets with oblique retouched truncation, end-scrapers on bladelets and blades, and burins.

Kozlowsky (1972a,b) earlier divided the Upper Paleolithic materials from Sakajia cave into three assemblages, dating from the Paudorf to the Lascaux interstadials. However, nowadays Nioradze and Otte (2000) describe the industry as a uniform assemblage and date it to the middle stage of Upper Paleolithic.

The Sakajia UP lithic industry is characterized by Gravette points (Fig. 17, 1, 2, 3, 4, 5), micro-Gravette points, Vashon points (Fig. 17, 7), numerous backed bladelets (Fig. 17, 7, 8), variable types of bladelets with ventral retouch (Fig. 17, 9, 10, 11, 12), asymmetric triangles (Fig. 17, 13, 14, 15), and segment-like forms (Fig. 17, 16). Burins are numerous and variable (Fig. 17, 22, 23, 24), and Zamiatnin (1957) noted the presence of micro-burins. Among end-scrapers, simple end-scrapers on blades and blade fragments predominate (Fig. 17, 18, 19, 20, 25). Also, there are composite tools (Fig. 17, 21) and large backed blades with retouched bases (Fig. 17, 17).

Numerous bone artifacts are also present in the Sakajia materials, including bone awls (Fig. 18, 7, 9) and point fragments (Fig. 18, 2, 3, 5, 6, 8, 10, 11, 12), a tool with a drilled eye (Fig. 18, 4), pendants with geometric ornamentation (Fig. 18, 13,14), and an ornamented bone needle (Fig. 18, 1).

According to radiocarbon estimates (Table 13), UP materials from Gvardjilas klde and Sakajia date to the interval from 19/18 to 13.5 ka BP (cal.). Undoubtedly, the Epipaleolithic material dominates in both these not securely excavated collections. At Devis Khvreli, a later phase of the EPP lithic industry dates to approximately 11.5 ka BP (cal.).

Kozlowsky (1972a,b) drew similarities between this assemblage and the UP materials from Sakajia, Mgvimevi, and Chakhati. Later, Tushabramishvili (1981) also equated Devis Khvreli with the UP assemblages of Sakajia, Mgvimevi, as well as with layers I–IV at

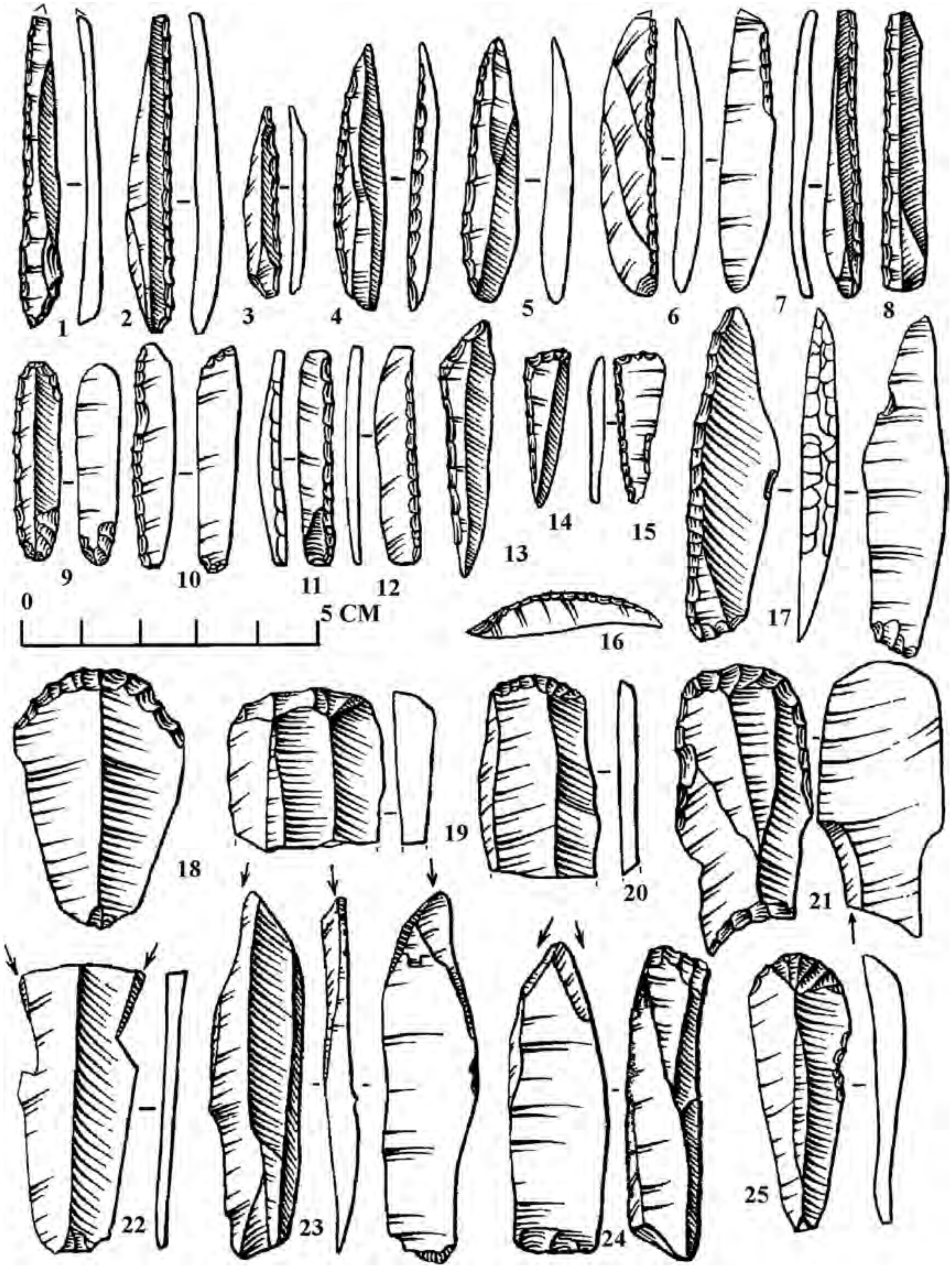

Fig. 17. Stone tools from the Upper Paleolithic assemblage of Sakajia (after Bader, 1984; Liubin, 1989; Nioradze and Otte, 2000).

Dzudzuana, and layer IV at Sagvardjile. These researchers identified Gravette points (Fig. 20, 15), and Vashon points (Fig. 20, 14) in the Devis Khvreli assemblage. In addition, a fragment of a shouldered point (Fig. 20, 13), asymmetric triangles (Fig. 20, 16), and segment-like tools (Fig. 20, 17) are present. End-scrapers include simple end-scrapers on blades and end-scrapers on flakes (Fig. 20, 18, 21). There are burins on retouched truncations (Fig. 20, 20) and blades or knives with backed retouch (Fig. 20, 19). Multiple researchers also reported the presence of bone tools (Fig. 21, 6, 7, 8) at Devis Khvreli (Zamiatnin, 1957; Bader, 1984; Nioradze and Otte, 2000).

As noted above, researchers have linked the UP industry at Chakhati cave, with that at other southern sites, including Sakajia and Mgvimevi, although Chakhati lacks radiocarbon dates. Berdzenishvili (1964) reported a shouldered point (Fig. 20, 23), backed bladelets, and segments from three strata in this site. At Okumi 1, such finds as Gravette points, triangulars, and

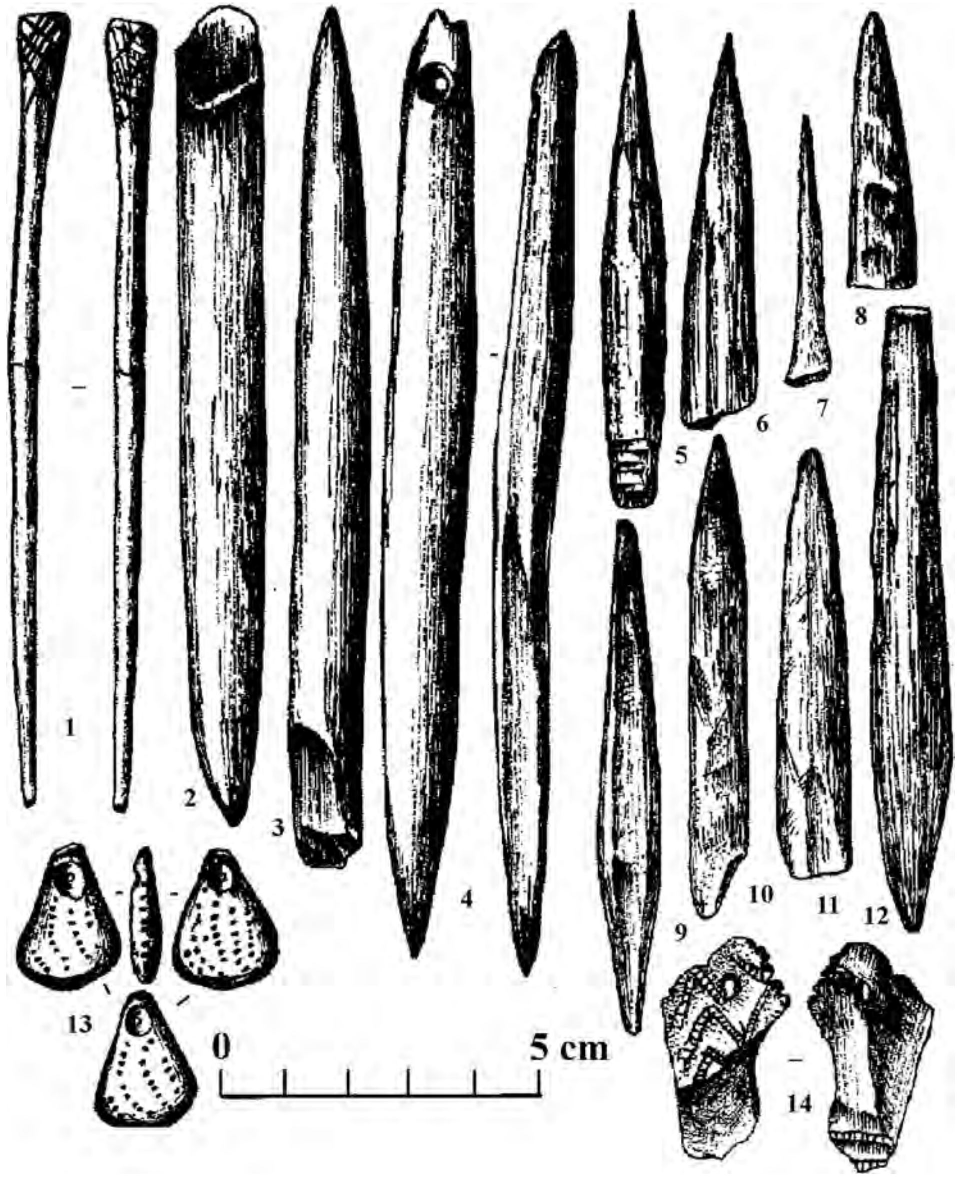

Fig. 18. Bone tools and personal ornaments from Sakajia (after Nioradze and Otte, 2000).

segments also attest to presence of the Epipaleolithic, although Tushabramishvili (1981) dated the assemblage to the early Upper Paleolithic. EPP-like segments and trapezoids are also present in the Khergulis klde assemblage, which Meshveliani (1986) noted contains mixed materials.

The multilayer cave site of Apiancha in the northwestern part of Colkhic mountain province, Abkhazia, is one of the most interesting UP sites in Caucasus. Korkia (1990) reported that a sterile level (Layer 8) separates a Middle Paleolithic stratum (Layer 9) from the overlying UP strata (layers 7, 5 and 4). The early UP layer 7 is also separated from the later UP layers 5 and 4 by a sterile level (Layer 6), which probably corresponds the Last Glacial Maximum. Layers 5 and 4 have dates (Table 13) that confirm these formed after the Last Glacial Maximum, and therefore date to the Epipaleolithic.

The lower EPP layer 5 was excavated over an area of 120 sq. m and has thickness of 0.10–0.45 m. The lithic industry includes Gravette (Fig. 19, 18, 20) and Font-Yves (Fig. 19, 19) points, backed bladelets (Fig. 19, 21), and asymmetric triangulars. End-scrapers on blades or flakes are well represented (Fig. 19, 12, 13, 24), and end-scrapers on retouched bladelets are found. The assemblage also includes burins (Fig. 19, 23), blades or bladelets with denticulate retouch (Fig. 19, 25, 22), core-like multifaceted burins, and utilized pebbles. Among bone tools, a needle with eye 9 cm in length is reported (Fig. 21, 4).

The upper EPP layer 4, which is 0.30–0.35 m deep, yielded 994 artifacts on flint, obsidian and other rocks. Among tools, Korkia (1990) reported the presence of shouldered points (Fig. 19, 1, 2), Gravette points, backed bladelets, backed bladelets with ventral retouch on ends (Fig. 19, 5), bladelets with denticulate retouch (Fig. 19, 6), segments (Fig. 19, 7, 8), and asymmetric triangulars (Fig. 19, 9). Also, the industry includes tools similar to Vashon points (Fig. 19, 3, 4), blades or bladelets with oblique truncation (Fig. 19, 16), backed pieces with truncation (Fig. 19, 10), and end-scrapers on backed pieces (Fig. 19, 11). End-scrapers on blades are present (Fig. 19, 12, 13), and are more numerous than burins. Most burins are made on truncations (Fig. 19, 15) and there are few dihedral burins (Fig. 19, 14). Bone tools include points with rounded

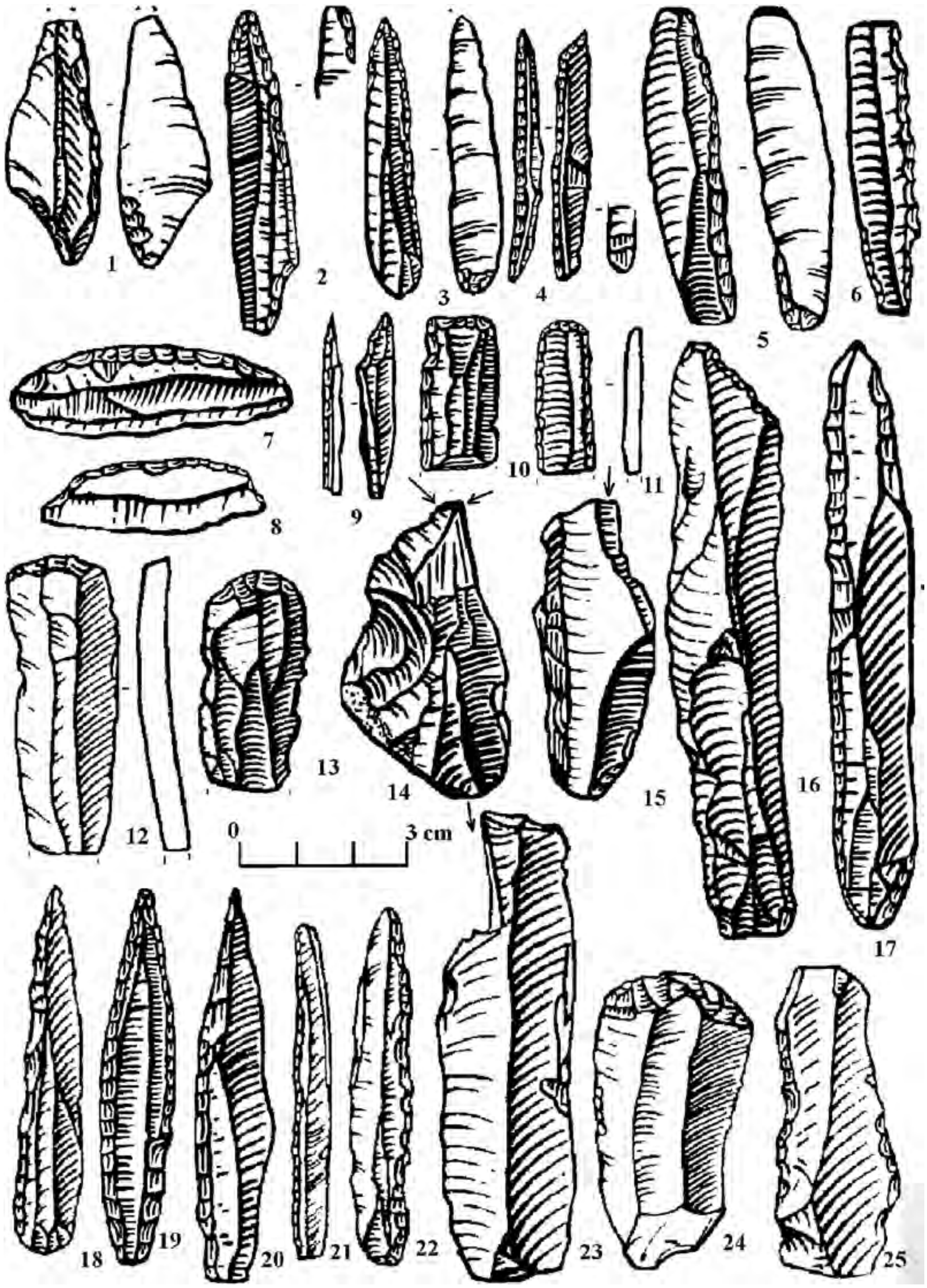

Fig. 19. Stone tools from Apiancha (after Liubin, 1989; Korkia, 1990).

cross-sections (Fig. 21, 3, 5), a polisher (Fig. 21, 2), and a bone needle with 17 parallel cut marks (Fig. 21, 1).

Korkia (1990) concluded that the Apiancha Layer 4 assemblage is similar to UP materials from Gvardjilas klde and layer G at Kholodniy Grot, and the Layer 5 assemblage is similar to that of Sakajia. A fragment of bone harpoon from Apiancha Layer 4 is similar to one found in Kholodniy Grot. However, Bader (1984: 282) reported admixture of Upper Paleolithic, Mesolithic, and Neolithic materials in Kholodniy Grot. This raises the possibility Apiancha Layer 4 may also contain intrusive finds from the overlying Mesolithic level. Bader (1984) also noted similarities between materials from Apiancha and assemblages from Atsinskaya and Navalishenskaya caves located in the same area, but the latter two sites have yet to be studied using modern excavation techniques.

Within the same northwestern part of Kolchic mountain province, but in the territory of the Russian Federation (Krasnodar Krai), small UP assemblages have been recovered from several sites. Navalishenskaya and Malaya Vorontsovskaya caves each have UP layers with a few finds, and with only one radiocarbon date of ca. 17.5 ka BP cal. published for the latter site (Table 13).

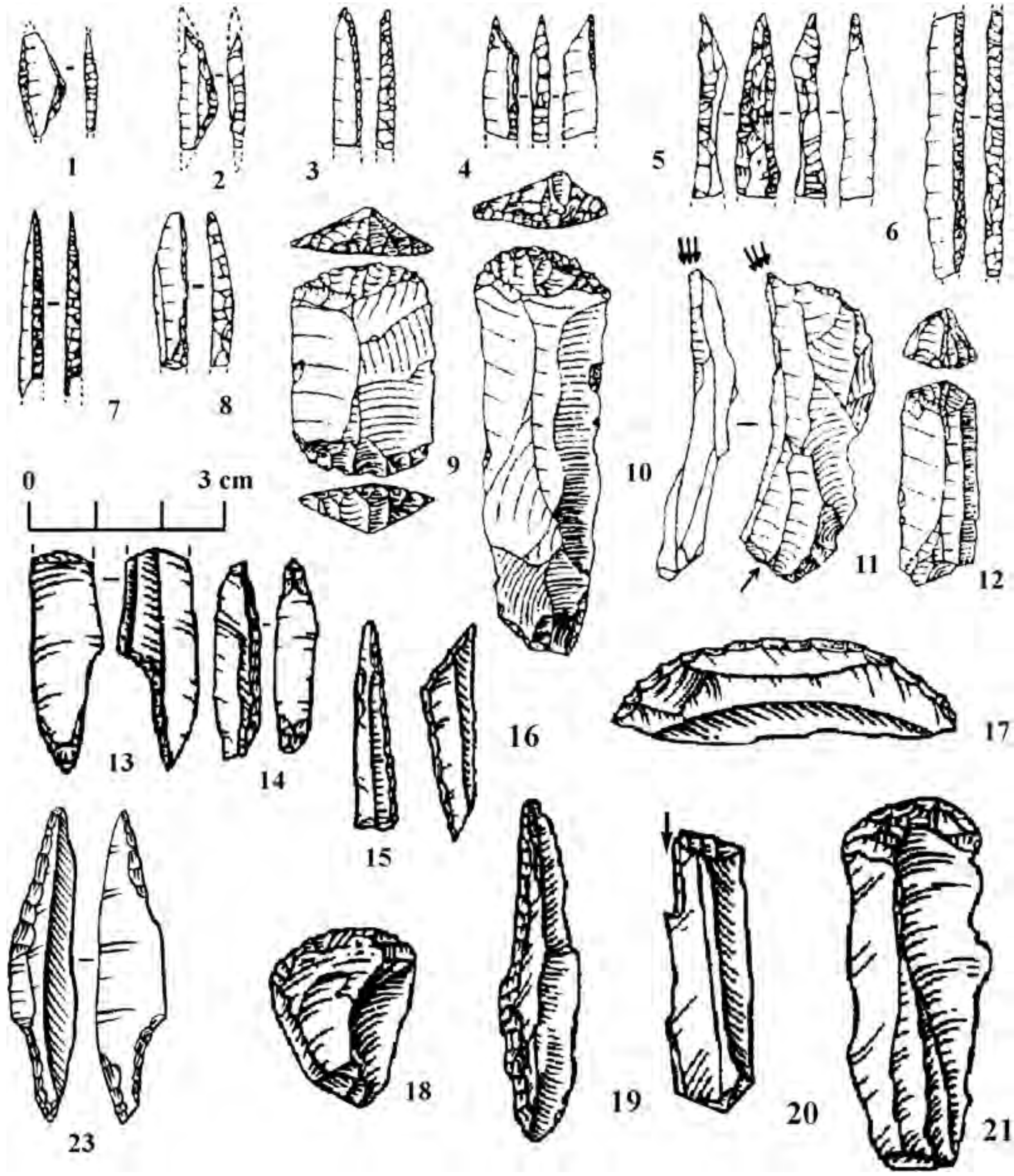

Fig. 20. Stone tools from Dzudzuana, unit B (1–12) (after Meshveliani et al., 2004), Devis Khvreli (13–21), and Chakhati (22) (after Liubin, 1989).

Of the three UP strata excavated in Akhshtyrskaya cave, the middle level 2/2 is radiocarbon dated to ca. 23.5 ka BP cal. (Table 13). Thus, it is quite possible that only the upper UP level 2/1 at Akhshtyrskaya is Epipaleolithic and postdates the Last Glacial Maximum. The lithic industry from all three levels of Akhshtyrskaya cave is very small, and the description of finds from the UP levels is still not published.

Certainly, a key site for entire Upper Paleolithic epoch within the Colkhic mountain province is now Dzudzuana Cave. D. Tushabramishvili, who found and studied this site from 1966 to 1975, identified 12 strata and attributed levels 2 through 8 to the Upper Paleolithic. Later Meshveliani (1986) analyzed these materials and concluded that only this cave site was unique in preserving a homogeneous early Upper Paleolithic assemblage. Meshveliani excavated Dzudzuana from 1983 to 1986. Since 1996, an international team of scholars led by researchers from Georgia (T. Meshveliani), the USA (O. Bar-Yosef), and Israel (A. Belfer-Cohen) excavated this site. As a result of this research, a large series of numerical dates was obtained, confirming that the earlier UP industries in the cave are older than 30 ka.

The upper UP (Epipaleolithic) levels at Dzudzuana are part of Unit B, within which levels II.4 and II.5 have radiocarbon dates about 13 and 16.5 ka BP cal., respectively (Table 13). This Epipaleolithic assemblage is preceded by a chronological break apparently corresponding to the Last Glacial Maximum, which is dated to 25–18 ka BP (cal.). The calendric age of Unit B coincides with an interstadial, for which conditions of deciduous woods and climate warmer than today are defined even in higher elevated mountain sites such as Mezmaiskaya (1350 m asl) and Baranakha 4 (1477 m asl). A plenty of rhododendron (*Rhododendron caucasica*) pollen and other highland elements defined in palynological spectra for the lower part of Unit B is the only argument for Bar-Yosef and colleague's (2011) conclusion about sub-alpine conditions and cold and dry climate in Unit B in total at Dzudzuana. This conclusion does not coincide with the data from EPP sites in the northwestern Caucasus, especially taking into account that

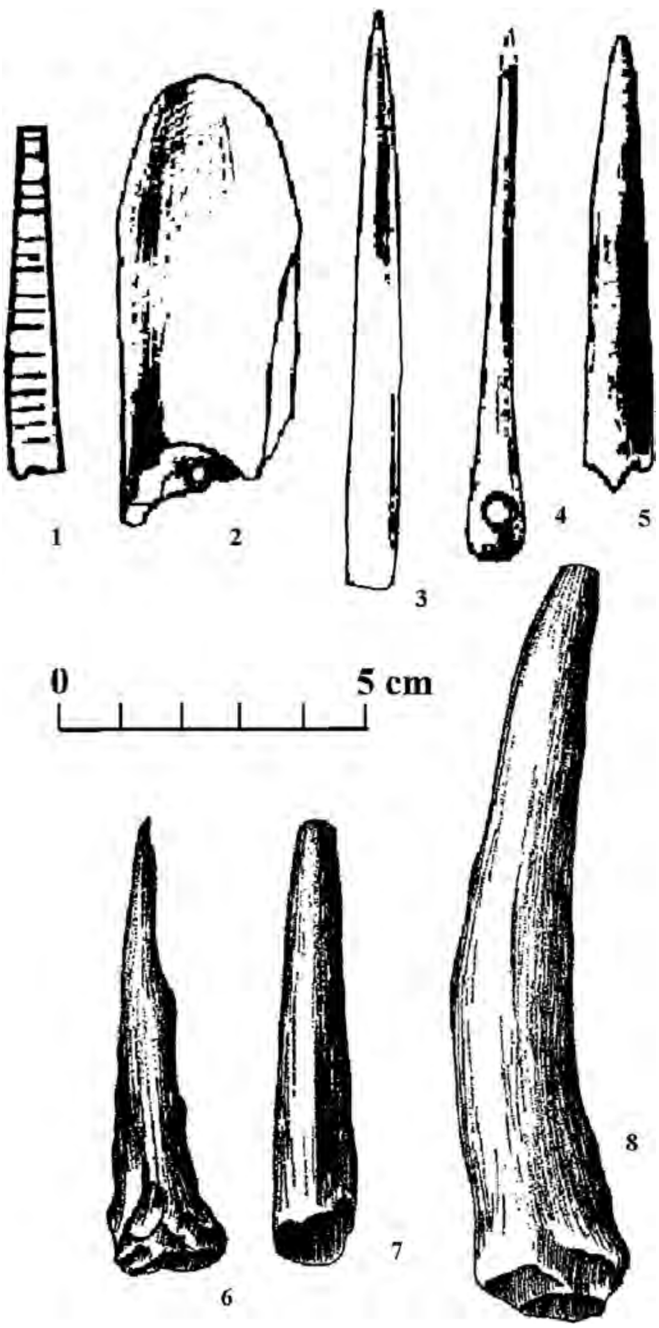

Fig. 21. Bone tools and engraved bones from Apiancha (1–5; after Korkia, 1990) and Devis Khvreli (6–8; after Nioradze and Otte, 2000).

Dzudzuana cave is located only about 560 m asl in the southern Caucasus foothills.

The Epipaleolithic assemblage B of Dzudzuana includes plenty of blades and bladelets struck mostly from unipolar (38.2% of cores) or bipolar (28.8% of cores) cores. Together, blades and bladelets are almost equally represented (36.8%) compared with flakes (37.2%) in debitage (Bar-Yosef et al., 2011, t. 4). Among laminar blanks, blades slightly dominate (1653 pieces) over bladelets (1470 pieces). Crested blades and core tablets represent core trimming elements (CTE). Among tools, end-scrapers predominate (26.2%), and most of these are similar to thumbnail scrapers. There are end-scrapers on blades (Fig. 20, 10, 12), including double scrapers (Fig. 20, 9). End-scrapers are much more numerous than burins (4.6%; Fig. 20, 11). Among micro-lithic tools, micro-Gravette points (9.2% of tools; Fig. 20, 3, 7) and backed bladelets (13.1% of tools; Fig. 20, 6, 8) predominate. Points with ventral retouch (Fig. 20, 4, 5) and triangulars (Fig. 20, 1, 2) are present. It is very important that 10 *á cran* points (1.1%) and 10 geometrics (1.1%) are defined in Unit B (Bar-Yosef et al., 2011, t. 3). Bone tools include simple points (1), awls (4), polished fragment (2) and some decorated pieces (1) (Bar-Yosef et al., 2011, t. 7).

Bar-Yosef and colleagues (2011) define the Unit B assemblage as a Terminal Paleolithic Epi-Gravettian industry and conclude that the EPP materials from Dzudzuana are similar to those of Gvardjilas klde, Mgvimevi, Apiancha, and Sakajia. Among them, the EPP industry of Unit B at Dzudzuana includes practically all tool types that are characteristic for Layer 1-3 of Mezmaiskaya. Especially important is the presence of identical point types, including *á cran* points, micro-Gravette points, and points with ventral retouch, as well as backed bladelets and some geometrics at Dzudzuana (Bar-Yosef et al., 2011, t. 3).

12. Discussion

The Epipaleolithic of the Caucasus spanned nearly 10,000 years, from the Last Glacial Maximum to the beginning of the Holocene, or from approximately 20 ka to 10 ka BP. In synthesizing the known EPP record as described above, it is important first examine the peculiarities of these industries that many researchers, over several decades, have defined as "the Imeretian culture".

The concept of Imeretian culture has undergone significant changes for its long research history. Initially Bader (1965) defined "the Transcaucasian culture" in the Upper Paleolithic of the Imeretian region (western Georgia). Grigoriev (1970) was the first who applied the term "Imeretian culture" to the Transcaucasian culture; he believed that the Zamiatnin (1957) unilinear three-phased model is applicable to this cultural entity. Only much later Amirkhanov (1994) revised the UP materials from old excavations in Western Caucasus and concluded about the absence of continuity thru the Imeretian UP development. Amirkhanov (1994) noted the incomparability between two major chronological groups of UP industries in Western Caucasus separated by the Last Glacial Maximum and assumed that most diagnostic features of the former Imeretian culture are applicable to the later chronological group. This group is defined as the Epipaleolithic in this paper.

Most of these industries contain Gravettian and Epi-Gravettian tool types, particularly Gravette and micro-Gravette points. Many researchers cited the Gvardjilas klde point as a key component of the Imeretian UP culture. This tool has one backed side formed by abrupt retouch, a tip pointed from both sides and thinned by ventral retouch, and (in a majority of complete tools) a base thinned by ventral retouch. Previously, this tool type was defined in Western European UP industries as a Vashon point. Sonneville-Bordes and Perrot (1956, p. 545) defined Vashon points as a variant of Gravette points.

The most diagnostic point type defined in Imerethian culture sites are shouldered points. While these points are not extremely abundant in the published reports, they are quite variable (Table 17). For example, five shouldered points are published from Gvardjilas klde (Fig. 15 – 1–5). Of these, one (Fig. 15 – 5) is very similar by in form and manufacture to Hambourgienne points typical for the final Magdalenian in northeastern Europe (Demars and Laurent, 1992, p.148). Another point made on a bladelet, with two retouched laterals and a symmetrical tang with ventral retouch (Fig. 15 – 4), has analogues in Mesolithic assemblages in Georgia, such as Edzany (Bader and Tsereteli, 1989, pp. 66–43; Gabunia and Tsereteli, 1977, Fig. 2 – 32,39). This suggests that the UP assemblage from Gvardjilas klde contains younger intrusive materials.

Among published shouldered points, similar specimens from the Southern Caucasus include one point from Chakhaty (Fig. 20, 22), one typical (Fig. 15, 2) and two atypical (Fig. 15, 1, 3) points from Gvardjilas klde, a point fragment from Devis Khvrely (Fig. 20, 13), and a typical shouldered point from Layer 4 at Apiancha (Fig. 19, 2). These also resemble specimens from the Northern Caucasus including, 6 typical points (3 complete and 3 basal fragments) from Layer 1-3 at Mezmaiskaya (Fig. 2, 1, 3, 4, 5, 6, 7), 8 points from Kasojskaya (Fig. 8, 1, 2. 3, 4, 5, 6), 2 points from Baranakha 4 (Fig. 13, 1, 2), and 2 points from Baranakha 1 (Fig. 14, 1). This tool type one can be described as an elongated shouldered point made on bladelet, with an asymmetric and short tang formed by abrupt dorsal retouch on the base, and a tip pointed from one lateral edge by continuous or partial retouch. This shouldered point type specific to the Caucasian Epipaleolithic differs in shape, proportion, and details of tang shaping, from shouldered points known in other regions and, hence, can be defined as a specific type called an Imeretian point.

A wide variety of shouldered or tanged points are known from the Gravettian and Epi-Gravettian industries of Europe. For example, the *pointe a cran Méditerranéenne* (Demars and Laurent, 1992, p. 142–143) is quite similar to the Caucasian EPP shouldered point on bladelet. However, details of tang and tip retouching, as well as general shape and proportions, distinguish these two types.

In Zarzian EPP industries of the Near East, so-called Zarzian "shouldered" points were defined by Garrod (1930) as a "shouldered point" in which "the tang has been shaped by an inverse retouch which is prolonged right up the left-hand edge of the blade of a tip". The specific method of shaping of an asymmetric tang by ventral (inverse) retouch distinguishes Zarzian points from shouldered points characteristic of the Caucasian EPP. In Zarzian sites, these points are found in association with geometric micro-lithics (especially scalene triangles) and non-geometric micro-lithic tools, such as backed blades, thumbnail scrapers, perforators, and micro-burins, as well as denticulate and notched tools (Wahida, 1981; Smith, 1986; Olszewski, 1993). Previously, authors have noted the similarity between the Caucasian Upper Paleolithic industries and those of the Near East (e.g., Bader, 1984; Liubin, 1989) and emphasized the early appearance of micro-lithic tools and geometric micro-lithics in both regions.

Currently, researchers (Belfer-Cohen and Gorring-Morris, 2003; Goring-Morris et al., 2009; Bar-Yosef and Belfer-Cohen, 2010) identify three stages and several local industrial variants within the Epipaleolithic in the Levant. In the first stage, dating between 22 and 16 ka cal BC, only asymmetric triangulars represent geometric micro-lithics. In the second stage, dating between 16 and 13.1 ka cal BC, geometric micro-lithics are well developed, especially in the Geometric Kebaran industries, and include not only various triangulars but also trapezes and asymmetric trapezes. In Ramonian and Natufien industries of the third and latest stage (13.1–9.6 ka cal BC), Helwan lunates appear. It is worth noting that while different point types are found in the Levantine EPP industries, shouldered or tanged points are completely absent, in contrast to the Caucasian EPP industries.

In Jordan, researchers also note that only non-geometric micro-lithics are found in the early stage of the Epipaleolithic (22.5–15 ka BP), while geometric micro-lithics appear after 15 ka. In the Natufien later EPP industries (12.8–10.3 ka BP) of Jordan, lunates, Helwan lunates, and many point types analogues to the Levantine Epipaleolithic are found. As in the Levantine EPP industries, there are no shouldered or tanged points (Olszewski, 2008).

The Epipaleolithic industries of the Near East, predominantly in the Levant, Jordan and Iran, are characterized by a wide spread micro-burin technique that is present throughout this epoch. In the Southern Caucasus, Zamiatnin (1957) identified such tools in Gvardjilas klde and Sakajia. However, micro-burins are not reported from old excavations at other EPP sites in the Southern Caucasus, probably, because they have been lost due to their small size and the absence of water screening recovery techniques. In the Northern Caucasus, micro-burins are absent, even at the recent excavations of Layer 1-3 at Mezmaiskaya cave.

This overview of the Caucasian EPP provides some perspective on the advent of microlithic technologies in the region (Table 16). Asymmetric triangulars are found in many sites (Gvardjilas klde, Sakajia, Apiancha, and others), and in some industries segments (Gvardjilas klde, Chakhaty, and Devis Khvrely) or triangulars (Devis Khvrely) are present. In the Northern Caucasus, segments or lunates, simple low symmetric or asymmetric trapezes, and individual triangulars are found in Layer 1-3 at Mezmaiskaya. The same set of geometric micro-lithics is identified in EPP levels 3 and 4 at Gubs rockshelter 7 (Satanai). Geometric micro-lithics are reported in the EPP open-air sites of Yavora, Baranakha 4 and Baranakha 1. Based on these relatively limited data, and available radiocarbon dates, these types of geometric micro-lithics appear in the Epipaleolithic in Caucasus no earlier than 15-14 ka BP.

The following conclusions are drawn from this review of EPP industries in the Caucasus:

- Although homogeneous EPP assemblages are rare in the Caucasus, these assemblages contain tool types characteristic of EPP industries in Europe (Gravette and micro-Gravette points, Vashon points, and backed pieces) and geometric micro-lithics (lunates, low symmetric and asymmetric trapezoids, triangulars, and asymmetric triangulars) typical of EPP industries in the Near East.

Table 16
Distribution of geometrics in the Epipaleolithic sites in the Caucasus.

Site	Lunate or segment	Trapeze	Rectangle	Triangle	Asymmetric triangle or scalene bladelet	Total
Northern Caucasus						
Mezmaiskaya, Layer 1–3	49	6		4		59
Gubs Rocksh. 7, horizons 3–4	3	5		1		9
Yavora			3			3
Baranakha 4			1			1
Baranakha 1			1			1
Southern Caucasus						
Dzudzuana, B				+	+	10
Sakajia	+				+	
Devis Khvreli	+				+	
Gvardjilas klde	+		+		+	
Apiancha, Layer 4	+				+	

+ Means the tool type is reported but a number of tools is unknown.

Table 17
Distribution of point types in the Epipaleolithic sites in the Caucasus.

Site	Shouldered point		Gravette point (including micro-Gravette)	Vachons point	Symmetric. retouched point	Other points	Total
	Imeretian type	Other					
Northern Caucasus							
Mezmaiskaya, Layer 1–3 2006–2007 exc.	3 (7 in total material)		9	2	2		16
Gubs Rock. 1		1	6	1		2	10
Kasojskaya, horizons 3–6	8		15	4	2	4	33
Gubs Rock. 7, Horizon 3					2		2
Yavora		1		2			3
Baranakha 4	2		5		1		8
Baranakha 1	2		12	3			17
Southern Caucasus							
Dzudzuana, Unit B		10 à cran	2+84 micro-Gravette	+			96
Sakajia			+	+			
Devis Khvreli	+		+	+			
Gvardjilas klde	+	+	+	+	+	+	
Apiancha, Layer 4	+	+	+	+			
Apiancha, Layer 5			+			+	
Chakhati	+						
Akhshtyrskaya			+				

+ Means the tool type is reported but a number of tools is unknown.

- In a majority of Caucasian EPP sites, end-scrapers on blades predominate, thumbnail scrapers are reported in many sites, rounded or circular scrapers are very rare, and tools combining end-scrapers are also rare.
- Most burins are made on blades or blade fragments. The most common burin types are on a break, on truncation, and dihedral burins. Carinated or multiple burins are reported at some sites, but some of these are likely N-fronted cores on flakes.
- All EPP industries in the Caucasus contain variable bladelets with straight or oblique truncation, backed and truncated bladelets, end-scrapers on backed bladelets, and bladelets with ventral retouch on one or two laterals or ends. However, type lists of these tools are not well developed for the Caucasian EPP industries, and it is difficult now to make conclusions about temporal and geographic variability of the bladelet tools in the region.
- In all EPP sites in the Northern Caucasus and many sites in the Southern Caucasus, blades and bladelets with invasive denticulate retouch are reported, but statistics for these tools are lacking.
- One significant result of recent research in the Caucasian Upper Paleolithic is the recognition of a rich and variable bone industry (Golovanova et al., 2010a,b). This challenged earlier characterizations of the Caucasian UP industries as bone-poor. New excavations uncovered a variety of bone points, awls, needles with eye, polishers, and other bone tools, as well as pendants made from herbivore teeth, pierced beads from shells, and tools with geometric ornaments in the these industries.

13. Conclusion

Moving toward a more synthetic understanding of the Epipaleolithic of the Caucasus, the most critical research goals are the development of detailed chronologies and environmental reconstructions, the use of modern zooarchaeological techniques in the investigation of human behavior and site formation processes, and most importantly, the application of modern excavation and recovery techniques at key archaeological sites. Only once lithic assemblages are comparably recovered and well-dated, can detailed type lists of lithic artifacts characteristic of various EPP stages be developed, to create a modern chronostratigraphy of Upper Paleolithic development in the Caucasus.

Another future research goal is the substantiation of cultural specificity of EPP industries in different areas of the Caucasus. Bader (1984: 287) attempted to prove co-existence of Imeretian culture in the Southern Caucasus and Gubs culture in the Northern Caucasus. This study shows that many "specific" features of both "cultures" are indeed the result of admixture of not securely excavated materials in most of EPP sites. There are only a few notable differences in geometric micro-lithics between these two regions (Table 16). For example, only EPP sites in West Georgia contain asymmetric triangulars, but rectangles are found only in EPP sites located in the eastern part of the Northwestern Caucasus.

The analysis of point type distribution in Caucasus (Table 17) shows that specific shouldered points (called Imeretian points in this paper) occur in many EPP sites in both the Southern and Northern Caucasus. Gravette and Vashon points are found in most of these sites. Some point types appear specific to a region, such as Sakajia points in West Georgia or symmetric retouched points

Table 18
Elemental concentrations for obsidian artifacts from Layer 1-3 at Mezmaiskaya (Mzm) and three source standards. All measurements in parts per million (ppm).

Sample	Ti	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Ba	Th	Source
Mzm-2001, 1-3, L-16	1095	412	8798	57	127	85	16	104	21	884	17	Kojun Dagi
Mzm-2001, 1-3, N-16	1260	470	9010	104	133	74	16	84	20	680	12	Kojun Dagi[a]
Mzm-2006, 1-3, P-13	840	512	9306	89	297	58	30	75	12	233	29	Zayukovo
Zayukovo source	880	436	9310	54	284	51	26	76	16	229	22	Zayukovo source
Kojun Dagi source		719	7210		119	98	15	100	16	858		Kojun Dagi source[b]
RGM1-S4	1685	296	13,676	36	143	104	26	220	10	799	13	Standard
RGM1-S4	1571	279	13,274	38	147	107	24	218	9	821	15	Standard
RGM1-S4	1610	284	13,292	40	146	108	23	218	7	857	22	Standard

[a] This sample is under the minimum size required for confident source assignment by EDXRF, but appear similar to the source standard data (Davis et al., 1998).
[b] Data from Poidevin (1998).

defined as a characteristic point type for the Gubs culture (Bader, 1984), are represented by single specimens, often tool fragments, and thus require additional substantiation.

Similarly, there are isolated fragmented points with very long tangs or humpbacked points in Gubs rockshelter 1, and Hambourgienne points (characteristic for late Magdalenian of Europe [Sonneville-Bordes, 1950, p. 359, Fig. 189 – 23–24; Demars and Laurent, 1992, p.148]) in Gvardjilas klde and Yavora. These finds might suggest that the later UP assemblages from Gubs rockshelter 1 and Yavora, which are undated, belong to the later stage (12–10 ka) of the Epipaleolithic, while Gvardjilas klde contains admixture of lithics from various EPP stages, and even intrusive Mesolithic artifacts.

For many years, scholars have applied the term "Imeretian culture" to widespread and asynchronic lithic assemblages dating from the early Upper Paleolithic through the Epipaleolithic. Leonova (1994, p. 204) also drew a comparison between the Imeretian culture assemblages and those of Kamennobalkovskaya culture in the northern cost of Sea of Azov. However, materials of the latter are not published in sufficient detail to make any precise conclusions about the similarity or differences of EPP industries across these regions. Preliminary publications of some categories of the inventory (Vinogradova, 2011) only allow conclusions about numerous analogies, but also to note some important differences in the inventory of these industries.

This review of the available data and a critical approach to treating Epipaleolithic variability in the Caucasus recognizes that only several EPP occurrences in the southern and northern Caucasus might represent a specific Epipaleolithic industry that existed from ca. 17/16 to ca. 13/12 ka BP (cal) in the region. Contacts between the inhabitants of these EPP occupations are shown by new data about the EPP obsidian transport networks from sources located in the southwest of the Caucasus and in the central part of the northern Caucasus to EPP sites in the northwestern Caucasus (Table 18). The results suggest that a high mobility of human groups in the Epipaleolithic was one of the most significant factors providing affinity of the EPP industries across the Caucasus. The old term "Imeretian Culture" may be applied to only this industry type, as characterized by a highly developed bladelet flaking technique, bladelet points typical of the European Gravettian and Epi-Gravettian, geometric micro-lithics similar to those widespread in the EPP industries of the Near East, the characteristic Imeretian shouldered point, and including a rich assortment of bone tools and ornaments.

Acknowledgements

This project is sponsored by the National Geographic Society/CRE research grant 8603-09, "The Dynamics of Environment and Society in the Upper Paleolithic in Northern Caucasus". We wish to thank the Wenner-Gren Foundation and the L.S.B. Leakey Foundation for the long-term financial support of excavations at Mezmaiskaya Cave. We are grateful to the Management for Preservation, Restoration and Exploitation of History-Cultural Heritage of the Culture Department of Krasnodar Krai and Krasnodar State History-Archaeological Museum-Reservation for the long-term financial and organizational support for our Paleolithic studies in the Northwestern Caucasus. We also appreciate support provided by the Fulbright Scholar Exchange Program, the Glassman Holland Foundation, the W.F. Albright Institute of Archaeological Research and the National Science Foundation for our research.

References

Aleksandrovskiy, A.L., Aleksandrovskaya, E.I., Beliaeva, E.V., Golovanova, L.V. Sediments and cultural layers of caves in the Northwestern Caucasus. In: Collection of Papers of Institute of Geography RAN. Moscow, in press (in Russian).

Amirkhanov, H.A., 1986. The Upper Paleolithic of the Kuban River, Moscow, 113 pp. (in Russian).

Amirkhanov, H.A., 1994. To a problem of evolution and periodization of the Upper Paleolithic of Western Caucasus. Rossiiskaya Arheologiya 1, 9–24 (in Russian).

Autlev, P.U., 1988. Raboti Adigeyskoy ekspedisii. Arheologicheskie otritiya 1986. M., pp. 108–109 (in Russian).

Autlev, P.U., Liubin, V.P., 1994. Istoria issledovania paleolite Gubskogo basseina. Neandertalsi Gubskogo ushelia. Maikop, 12–21 (in Russian).

Bader, N.O., 1965. Cultural variability at the end of the Upper Palaeolithic and Mesolithic of the Caucasus. Sovetskaya Arheologiya 4, 3–16 (in Russian).

Bader, N.O., 1966. Differences among the Upper Paleolithic cultures of the Transcaucasus and the Near East. In: Archaeology of Old and New World. Moscow (in Russian).

Bader, N.O., 1984. The Upper Paleolithic of the Caucasus. In: Paleolithic of SSSR. Archeologie of SSSR, Moscow, pp. 272–301 (in Russian).

Bader, N.O., Tsereteli, L.D., 1989. The Mezolithic of the Caucasus. In: Mezolithic of SSSR. Archeologie of SSSR, Moscow, pp. 93–105 (in Russian).

Bar-Yosef, O., 1970. The Epi-Palaeolithic Cultures of Palestine. Unpublished Ph.D. thesis, Hebrew University, Jerusalem.

Bar-Yosef, O., Belfer-Cohen, A., 2010. The Levantine Upper Pelaeolithic and Epipalaeolithic. In: Garcea, E.A.A. (Ed.), An Offprint from South-Eastern Mediterranean Peoples between 130,000 and 10,000 Years Ago, pp. 144–167.

Bar-Yosef, O., Belfer-Cohen, A., Mesheviliani, T., Jakeli, N., Bar-Oz, G., Boaretto, E., Goldberg, P., Kvavadze, E., Matskevich, Z., 2011. Dzudzuana: an Upper Palaeolithic cave site in the Caucasus foothills (Georgia). Antuquity 85, 331–349.

Belfer-Cohen, A., Gorring-Morris, N., 2003. Current issues in Levantine Upper Paleolithic Research. In: Gorring-Morris, N., Belfer-Cohen, A. (Eds.), More than Meets the Eye. Studies on Upper Paleolithic Diversity in the Near East. Oxbow Books, pp. 1–12.

Berdzenishvili, N.Z., 1964. A new Stone Age site in the Tskhaltsitela Gorge. In: The VIIth International Congress of Ethnographic and Archaeological Sciences. Tbilisi (in Russian).

Blajko, A.V., 2001. Study of Korotkaya cave in the Northwestern Caucasus. In: Archaeological Discoveries of 2000, pp. 121–122. Moscow (in Russian).

Bolikhovskaya, N.S., 2007. Space-time trends of the vegetation and climate development in Northern Eurasia in the NeoPleistocene. Archaeology, Ethnography and Anthropology of Eurasia 4 (32), 2–25 (in Russian).

Cleghorn, N., Marean, C.W., 2006. The destruction of skeletal elements by carnivores: the growth of a general model for skeletal element destruction and survival in zooarchaeological assemblages. In: Pickering, T.R., Schick, K., Toth, N. (Eds.), African Taphonomy: A Tribute to the Career of C.K. "Bob" Brain. Stone Age Institute Press, Bloomington, Indiana.

Davis, M.K., Jackson, T.L., Shackley, M.S., Teague, T., Hampel, J., 1998. Factors Affecting the Energy-Dispersive X-Ray Fluorescence (EDXRF) analysis of archaeological Obsidian. In: Shackley, M.S. (Ed.), Archaeological Obsidian Studies: Method and Theory. Springer/Plenum Press, New York, pp. 159–180.

Demars, P.-Y., Laurent, P., 1992. Types d'outils lithiques du Paleolithique superieur en Europe. Presses du CNRS, Paris.

Doronichev, V.B., 1987. The Paleolithic of the Karachaevo-Cherkess Republic. Problems of the Anthropology and Archaeology of the Stone Age of Eurasia. Irkutsk, 48–49 (in Rusian).

Doronichev, V.B., 1995. The Paleolithic of the Karachaevo-Cherkess Republic. Thesis of Ph.D. dissertation. Sankt-Petersburg. 15 p. (In Russian).

Formozov, A.A., 1959. Etnocultural Areas in the Territory of European Part of USSR in the Stone Age. Moscow (in Russian).

Formozov, A.A., 1965. Stone Age and Eneolithic of Prikubania, Moscow, 160 pp. (in Russian).

Gabunia, M.K., Tsereteli, L.D., 1977. Mezolitic of Georgia. Shot review of the Institut of archeologie. 149, pp. 34–41 (in Russian).

Garrod, D.A.E., 1930. The Palaeolithic of Southwestern Kurdistan: excavations in the caves of Zarzi and Hazar Merd. Bulletin of the American School of Prehistoric Research 6, 8–43.

Golovanova, L.V., 1988. Works of the North Caucasian Paleolithic Crew. In: Archeological Discoveries of 1986, pp. 120–122. Moscow (in Russian).

Golovanova, L.V., Hoffecker, J.F., Nesmeyanov, S.A., Levkovskaya, G.M., Kharitonov, V.M., Romanova, G.P., Svejenceve, Yu, 1998. Un site Micoquien Est-Europeen du Caucase du nord (Résultats préliminaires de l'étude de la grotte Mezmaiskaya, les fouilles des années 1987–1993). L'Anthropologie 102 (1), 45–66.

Golovanova, L.V., Hoffecker, J.F., Kharitonov, V.M., Romanova, G.P., 1999. Mezmaiskaya cave: a Neanderthal occupation in the Northern Caucasus. Current Anthropology 40 (1), 77–86.

Golovanova, L.V., Cleghorn, N.E., Doronichev, V.B., Hoffecker, J.F., Burr, G.S., Sulergizkiy, L.D., 2006. The Early Upper Paleolithic in the Northern Caucasus (New Data from Mezmaiskaya Cave, 1997 Excavation). Eurasian Prehistory 4 (1–2), 43–78.

Golovanova, L., Doronichev, V., 2003. The Middle Paleolithic of Caucasus. Journal of World Prehistory 17 (1), 71–140.

Golovanova, L.V., Doronichev, V.B., Cleghorn, N.E., Kulkova, M.A., Sapelko, T.V., Shackley, M.S., 2010a. Significance of ecological factors in the Middle to Upper Paleolithic transition. Current Anthropology 51 (5), 655–691.

Golovanova, L.V., Doronichev, V.B., Cleghorn, N.E., 2010b. The emergence of bone-working and ornamental art in the Caucasian Upper Palaeolithic. Antiquity 84, 299–320.

Gopher, A., 1994. Arrowheads of the Neolithic Levant. Eisenbrauns, 325 pp.

Goring-Morris, N., Hovers, E., Belfer-Cohen, A., 2009. The dynamics of Pleistocene and early Holocene settlement patterns and human adaptations in the Levant: an overview. In: Shea, J.J., Lieberman, D.E. (Eds.), Transitions in Prehistory. Essays in Honor of Ofer Bar-Yosef, pp. 185–252. Cambridge.

Grigoriev, G.P., 1970. The Upper Paleolithic. Stone Age in the Territory of USSR (in Russian).

Grimm, E., 1992. TILIA and TILIA-graph: Pollen spreadsheet and graphics programs. Programs and Abstracts, 8th International Palynological Congress, Aix-en-Provence, September 6–12, 1992, p. 56 (in Russian).

Haour, A.C., 2003. One Hundred Years of Archaeology in Niger. Journal of World Prehistory 17 (2), 181–234.

Korkia, L.O., 1990. Apiancha. New Finds. In: Paleolithic of the Caucasus and Adjacent Territories, pp. 84–86. Tbilisi (in Russian).

Kozlowsky, J.K., 1970. The Upper Palaeolithic of Transcaucasus and the Near East. Part I. Prace Komisy archeologiczney PAN 9, 14–124.

Kozlowsky, J.K., 1972a. Gorny paleolit w krajach zakaukazskich I na bliskim Wschdzie. Cz.2: Periodizacja gornego paleolitu zachdnich krajov zakaukazskich. Swiatowit, t. 33.

Kozlowsky, J.K., 1972b. Gorny paleolit w krajach zakaukazskich I na bliskim Wschdzie. Cz. 1: Geochronologia i zagednienie pochatkov gornego paleolitu. Prace komisji archeologichnej Polska AN (odolzial w Krakowie). №9.

Kozlowski, J., 1998. The Middle and the Early Upper Paleolithic around the Black Sea. In: Akazawa, T., Aoki, K., Bar-Yosef, O. (Eds.), Neandertals and Modern Humans in Western Asia. Plenum Press, New York, pp. 461–482.

Kuprianova, L.A., Alyoshina, L.A., 1972. Pollen and Spoors of the Flora of European Part of USSR. Nauka, Leningrad, 171 pp. (in Russian).

Kvavadze, E.V., Connor, S.E., 2005. Zelkova carpinifolia (Pallas) K.Koch in Holocene sediments of Georgia – an indicator of climatic optima. Review of Palaeobotany and Palynology 133, 69–89.

Lam, Y.M., Pearson, O.M., 2005. Bone density studies and the interpretation of the faunal record. Evolutionary Anthropology 14, 99–108.

Liubin, V.P., 1989. Paleolithic of the Caucasus. In: Paleolithic of Caucasus and North Asia, Series: Paleolithic of the World, Leningrad, pp. 8–142 (in Russian).

Leonova, E.V., 2009. New Mesolithic–Upper Paleolithic sites in the Gubs Gorge. In: The Fifth Cuban Archaeological Conference, pp. 210–213. Krasnodar (in Russian).

Leonova, N.B., 1994. The Upper Paleolithic of the Russian Steppe Zone. Journal of World Prehistory 8 (2), 169–210.

Marean, C.W., Abe, Y., Frey, C.J., Randall, R.C., 2000. Zooarchaeological and taphonomic analysis of the Die Kelders Cave 1 Layers 10 and 11 Middle Stone Age larger mammal fauna. Journal of Human Evolution 38 (1), 197–233.

Marean, C.W., Cleghorn, N.E., 2003. Large mammal skeletal element transport: applying foraging theory in a complex taphonomic system. Journal of Taphonomy 1 (1), 15–42.

Meshveliani, T., 1986. About the early stage of Upper Paleolithic of Western Georgia. Works of State Museum of Georgia. Tbilisi (in Russian).

Meshveliani, T., Bar-Yosef, O., Belfer-Cohen, A., 2004. The Upper Paleolithic in Western Georgia. In: Brantingham, P.J., Kuhn, S.L., Kerry, K.W. (Eds.), The Early Upper Paleolithic beyond Western Europe. University of California Press, Berkeley, pp. 129–143.

Meshveliani, T., Bar-Oz, G., Bar-Yosef, O., Belfer-Cohen, A., Boaretto, E., Jakeli, N., Koridze, I., Matskevich, Z., 2007. Mesolithic hunters at Kotias Klde, Western Georgia: preliminary results. Paleorient 33.2, 47–58.

Moore, P.D., Webb, J.A., Collinson, M.E., 1991. Pollen Analysis, second ed. Blackwell Scientific Publications, Oxford. 1–216.

Neuville, R., 1934. Le Pre. historique de Palestine. Revue Biblique 43, 237–259.

Nioradze, M.G., 1992. The Old Stone Age Cave sites in the Tskaltsitela River Canion. Metsniereba, Tbilisi, 286 pp. (in Russian).

Nioradze, M.G., Otte, M., . Paleolithique superieur de Georgie. L'Anthropologie 104, 265–300.

Olszewski, D., 1993. The Zarzian occupation at Warwasi Rockshelter, Iran. In: Olzewski, D.I., Dibble, H.L. (Eds.), The Paleolithic Prehistory of the Zagros-Taurus. The University Museum, University of Pennsylvania, pp. 207–217. University Museum Monograph 83.

Olszewski, D., 2008. 'Ihe Palaeolithic Period, including the Epipalaeolithic Jordan. In: Adams, R.B. (Ed.), An Archaeological Reader, pp. 35–69. London.

Panichkina, M.Z., 1948. To a question about the Upper Paleolithic in Armenia. Izvestiya AN Arm.SSR. Obshestvennie nauki 7 (in Russian).

Perrot, J., 1968. La prehistoire Palestinienne. Supplement au Dictionaire de la Bible 8, Letougey et Ane, Paris, 286–446.

Pinhasi, R., Higham, T.F.G., Golovanova, L.V., Doronichev, V.B., 2011. Revised age of late Neanderthal occupation and the end of the Middle Paleolithic in the northern Caucasus. Proceedings of the National Academy of Sciences of the United States of America 108 (21), 8611–8616.

Poidevin, J.-L., 1998. Les Gisements d'Obsidienne de Turquie et de Transcaucasie: Géologie, Géochemie et Chronométrie. In: Cauvin, M.-C., Gourgaud, A., Gratuze, B., Arnaud, N., Poupeau, G., Poidevin, J.L., Chataigner, C. (Eds.), L'Obsidienne au Proche et Moyen Orient: Du Volcan al'outil. BAR International Series, vol. 738. Archaeopress, Oxford, pp. 105–203.

Sardarian, S.A., 1954. Paleolithic of Armenia. Yerevan, 201 p. (in Russian).

Smith, P., 1986. Paleolithic archaeology in Iran. In: The American Institute of Iranian Studies. Monographs, vol. I. The University Museum, University of Pennsylvania, Philadelphia.

Sonneville-Bordes, D., 1950. Le Paleolithique superieur en Perigord. T. 1, Bordeaux, 500 pp.

Sonneville-Bordes, D., Perrot, J., 1956. Lexique typologique du paleolithique superieur. Bulletin de la societe prehistorique fracaise Paris 53, 9.

Tchistiakov, D.A., 1996. Mousterian Sites of the North-Eastern part of the Black Sea Region. Evropeiskiy Dom, St. Petersburg, 255 pp. (in Russian).

Tortladze, G.O., 1990. The Upper Paleolithic open-air site of Sabelasuri. In: Paleolithic of the Caucasus and Adjust Territories, Tbilisi, pp. 81–83 (in Russian).

Tsereteli, L.D., Klopotovskaya, N.B., Kurenkova, E.I., 1982. Multilayer Site of Apiancha. Chetvertichnaya sistema Gruzii, Tbilisi.

Tushabramishvili, D.M., 1960. Paleolithic Remains in Gvardjilas-klde Cave, Tbilisi, 214 pp. (in Georgian, abstract in Russian).

Tushabramishvili, D.M., 1981. Paleolithic in Georgia. Caves of Georgia. № 9 Tbilisi (in Russian).

Villa, P., Mahieu, E., 1991. Breakage patterns of human long bones. Journal of Human Evolution 21 (1), 27–48.

Vinogradova, E.A., 2011. Backed mikro bladellets in Kamennaya Balka II inventory. In: Archeological источники and Culturogenez. Sankt-Petersburg, pp. 24–28 (in Russian).

Wahida, G., 1981. The re-excavation of Zarzi, 1971. Proceedings of the Prehistoric Society 47, 19–40.

Zamiatnin, S.N., 1935. New data on the Paleolithic in the Transcaucasus. Soviet Ethnography 2. Moscow (in Russian).

Zamiatnin, S.N., 1957. Paleolithic of the Western Transcaucasus. In: Paleolithic Caves of Imeretia. Collection of Works of Museum of Archeology and Ethnography, vol. 17. Leningrad (in Russian).

Zamiatnin, S.N., 1958. Survey of Stone Age in Azerbaijan. Works of the Institute of history AN Az.SSR. Baku (in Russian).

Zamiatnin, S.N., 1961. Sketches on Paleolithic, Moscow-Leningrad, 176 pp. (in Russian).

Zamiatnin, S.N., Akritas, 1957. Archaeological investigations of 1957 year in the Baksan Gorge. In: Scholar Proceedings of Kabardino-Balkarskogo Research Institute. Nalchik, t. 13. (in Russian).

Zeder, M.A., 2006. Reconciling rates of long bone fusion and tooth eruption and wear. In: Ruscillo, D. (Ed.), Recent Advances in Ageing and Sexing Animal Bones. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxbow Books, pp. 87–118.

Zenin, V.N., Orlova, L.A., 2006. Stone Age of the Baksan Gorge (Chronological aspect). In: The XXIVth Krupnov's Readings on Archaeology of the Northern Caucasus. Nalchik, pp. 85–86 (in Russian).