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A traceological study of lithic points in the Epipaleolithic of the North Caucasus

Gebrauchsspuren an lithischen Spitzen im Epipaläolithikum des Nordkaukasus

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Abstract - The aim of this research is to study the relationship between formal typological types of lithic points and their functions. We applied a detailed typology of the analyzed points. The Epipaleolithic industries of the Caucasus, characterized by similar technical and typological characteristics, contain also a specific set of lithic points, which includes mainly symmetrically retouched points, Gravette and microgravette points, and Vachons points, as well as rarer shouldered points and some other diverse forms. The results of the functional (traceological) analysis of lithic points from several Epipaleolithic sites (ca. 17–10 ka calBP) in the North Caucasus, which we report in this paper, indicate that most of the tools show traces of hafting in a haft, mainly made of wood and rarely of bone/antler. All the analyzed symmetrically retouched and shouldered points are identified as projectile tips, probably used for hunting. Most backed points, including Gravette, microgravette and Vachons points, were also used as projectile tips. Some backed points are identified as awls, meat knives and tools for butchering meat/skin. Also, evidence of reuse as meat knives or awls is found on several lithic points that were originally used as projectile tips.

Zusammenfassung - *Das Ziel dieser Forschung ist es, die Beziehung zwischen formalen Typen lithischer Spitzen und ihrer Funktionen zu untersuchen. Wir haben eine detaillierte typologische Aufteilung der analysierten Punkte angewendet. Die epipaläolithischen Industrien des Kaukasus, die durch ähnliche technische und typologische Merkmale gekennzeichnet sind, umfassen auch eine Reihe von spezifischen lithischen Spitzen: hauptsächlich symmetrisch retuschierte Spitzen, Gravette- und Mikrogravettespitzen sowie Vachonsspitzen und seltener Kerbspitzen, sowie einige weitere Formen. Die Ergebnisse der funktionalen (Gebrauchsspuren-)Analyse von lithischen Spitzen aus mehreren epipaläolithischen (ca. 17–10 ka calBP) Fundstellen im Nordkaukasus, über die wir in diesem Artikel berichten, weisen darauf hin, dass die meisten Werkzeuge Spuren einer Schäftung aufweisen, insbesondere in Schäften aus Holz und seltener aus Knochen oder Geweih. Alle analysierten symmetrisch retuschierten Spitzen und Kerbspitzen sind als Projektile zu identifizieren, die vermutlich für die Jagd verwendet wurden. Die meisten rückengestumpften Spitzen, einschließlich Gravette- und Microgravettespitzen und Vachonsspitzen, wurden ebenfalls als Projektilspitzen verwendet. Einige rückengespumpften Spitzen konnten als Ahlen, als Fleischmesser und als Werkzeuge zum Zerlegen von Fleisch und Häuten identifiziert werden. An mehreren lithischen Spitzen, die ursprünglich als Projektile verwendet wurden, finden sich zudem Hinweise auf eine Wiederverwendung als Messer oder Ahle.*

Keywords - North Caucasus, Epipaleolithic, traceology and typology, retouched points, backed points, shouldered points
Nordkaukasus, Epipaläolithikum, Gebrauchsspurenanalyse und Typologie, retuschierte Spitzen, rückengestumpfte Spitzen, Kerbspitzen

Introduction

In the North Caucasus (Russia), about 17 stratified Epipaleolithic sites documenting human occupation during the Late Glacial, between the Last Glacial Maximum (LGM) and the start of the Holocene, are known at present. They spread from the Pshekha River valley (Kuban River basin, northwestern Caucasus) in the west to the Baksan River valley (Terek River basin, north-central Caucasus) in the Elbrus region in the east (Fig. 1). More than half of these sites have radiocarbon dates (Tab. 1), which determine the

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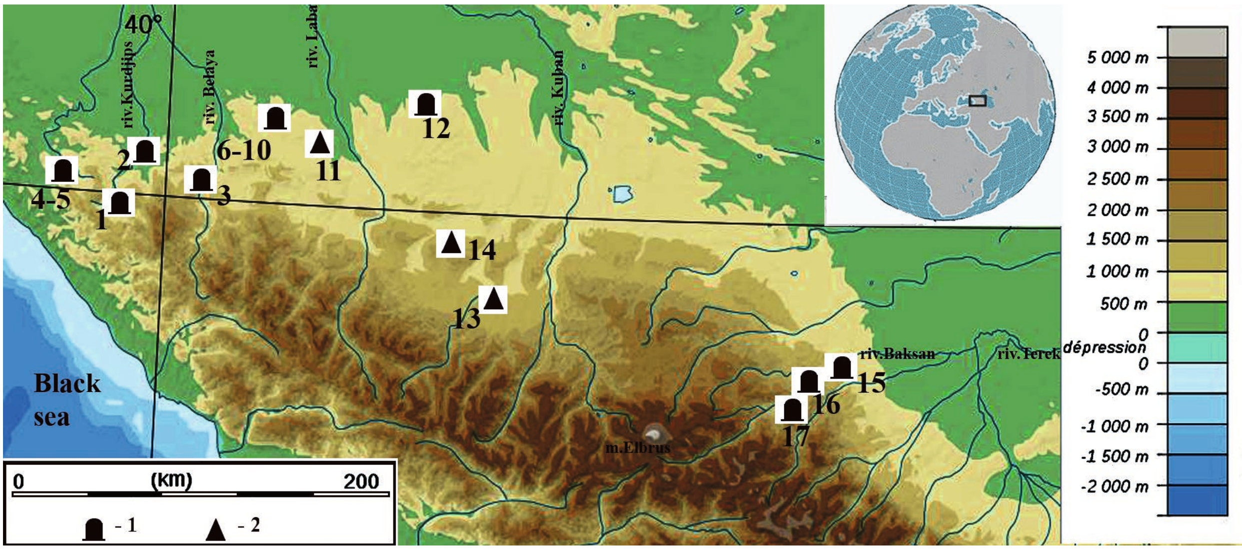

Fig. 1. Map showing positions of the Epipaleolithic sites known in the North Caucasus. Sites: 1 – Mezmayskaya Cave; 2 – Korotkaya 2 Rockshelter; 3 – Dakhovskaya 2 Cave; 4–5 – Medovaya 1 and Medovaya 2 caves; 6–10 – Gubs 1 Rockshelter, Gubs 5 (Chygai) Rockshelter, Gubs 7 (Satanai) Rockshelter, Kasozhskaya Cave, Dvoinaya Cave; 11 – Besleneevskaya, 12 – Ilyichevskaya Cave; 13 –Yavora; 14 – Baranakha 4; 15 – Badynoko Rockshelter; 16 – Sosruko Rockshelter; 17 – Psytuaje Rockshelter. Legend: 1 – cave sites, 2 – open-air sites.

Abb. 1. *Karte der im Nordkaukasus bekannten epipaläolithischen Fundstellen. Mezmayskaya Cave; 2 – Korotkaya 2 Rockshelter; 3 – Dakhovskaya 2 Höhle; 4–5 – Medovaya 1 und Medovaya 2 Höhle; 6–10 – Gubs 1 Rockshelter, Gubs 5 (Chygai) Rockshelter, Gubs 7 (Satanai) Rockshelter, Kasozhskaya Cave, Dvoinaya Höhle; 11 – Besleneevskaya, 12 – Ilyichevskaya Höhle; 13 –Yavora; 14 – Baranakha 4; 15 – Badynoko Rockshelter; 16 – Sosruko Rockshelter; 17 – Psytuaje Rockshelter. Legende: 1 – Höhlenfundstelle, 2 – Freilandfundstelle.*

age of the North Caucasus Epipaleolithic between ca. 17–11.5/10 ka calBP. We apply the term "Epipaleolithic" to the Caucasian Upper Paleolithic assemblages dating from the Late Glacial, following the Near Eastern scheme (Bar-Yosef 1970; Olszewski 2012, 2018; Belfer-Cohen & Goring-Morris 2014, 2020), because they show, like the Near Eastern Epipaleolithic, the early (ca. 24 ka ago in the South Caucasus and ca. 17 ka ago in the North Caucasus) appearance of variable geometric microlithic tools (Golovanova et al. 2014; Golovanova & Doronichev 2012, 2020).

The North Caucasus Epipaleolithic sites have been studied to varying degree, and virtually no Epipaleolithic sites (probably, except Chokh rockshelter in Dagestan) are known from the eastern North Caucasus (Golovanova & Doronichev 2020). The most systematically researched and well dated sites are Mezmaiskaya Cave in the Lago-Naky upland, Gubs 5 (Chygai) and Gubs 7: (Satanai) rockshelters, and Dvoinaya and Kasojskaya caves in the Gubs River valley (Kuban River basin), and Sosruko, Badynoko and Psytuaje rockshelters in the Elbrus region. Active contacts between the Epipaleolithic populations in the north-western and north-central Caucasus are confirmed by findings of obsidian artifacts originating from the Zayukovo (Baksan) obsidian source in the north-central Caucasus in Mezmaiskaya Cave (layer 1-3), Gubs Rockshelter 7 (horizon 4) and Kasojskaya Cave (horizons 2 and 5) in the northwestern Caucasus (about 250 km linear distance from the source) (Doronicheva & Shackley 2014). In the Elbrus region, obsidian studies indicate the use of local obsidian from the Zayukovo source in the Epipaleolithic sites of Sosruko and Psytuaje (Doronicheva et al. 2019).

The Epipaleolithic assemblages of the North Caucasus are characterized by a rich assortment of bone tools (awls, needles, smoothers, projectiles including composite projectiles with a groove for mounting lithic microliths) and personal ornaments (pendants made from ungulate incisors, stripe-beads made from terrestrial mollusk shells, and others). The lithic assemblages are distinguished by a highly developed microblade knapping technology. In most of the Epipaleolithic assemblages, end-scrapers outnumber burins and include simple end-scrapers made on blades, variable end-scrapers on flakes, and rarer rounded scrapers and microscrapers on bladelets. Burins are rare and comprise various types. Backed pieces are not numerous in most sites, but their percentage highly varies from 1.7 % to 63.7 % (Golovanova & Doronichev 2020: Tab. 3-39). The Epipaleolithic assemblages also contain some other types of retouched tools, such as retouched bladelets and oblique and straight truncations on bladelets. Like the Epipalaeolithic industries of the Near East, the Epipaleolithic industry of the North Caucasus is notable for the early appearance (starting from ca. 17 ka calBP in the North Caucasus) of a wide range of geometric microliths, including segments, low trapezes, rectangles and rare isosceles triangles (Golovanova & Doronichev 2020).

At the end of the Epipaleolithic (ca. 13–10 ka ago), the percentage of geometric microliths increases while the proportion of non-geometric backed pieces decreases (from 6.5 % and 63.7 % to 10.7–11.9 % and 17.9–20.1 % respectively at Mezmaiskaya), and rare notched (or so called "horned") trapezes and Helwan segments appear (Golovanova & Doronichev 2020: Tabs. 3-39 & 3-41). A study of the knapping technique in the North Caucasus

Assemblage	Age ^{14}C BP, yr	Lab. No	Method, Material	Mean Age cal BP, yr (1 sigma)
North-western Caucasus				
Mezmaiskaya, layer 1-3/hor. 1	10,400 ± 150	SPb–1117	^{14}C, bone	12,255 ± 278
	11,290 ± 100	LU–9900	^{14}C, bone	13,200 ± 90
Mezmaiskaya, layer 1-3/hor. 3	12,960 ± 60	GrA–25965	AMS, bone	15,782 ± 402
	13,860 ± 70	GIN–12900	^{14}C, bone	17,092 ± 190
Mezmaiskaya, layer 1-3/hor. 9	12,953 ± 150	SPb–1215	^{14}C, bone	15,773 ± 483
	13,820 ± 200	LU–9901	^{14}C, bone	16,750 ± 290
Mezmaiskaya, layer 1-4	16,260 ± 100	GIN–12901	^{14}C, bone	19,437 ± 325
Kasojskaya, layer 4/hor. 1	10,400 ± 340	LE–4987	^{14}C, bone	12,084 ± 507
Kasojskaya, layer 4/hor. 3	10,550 ± 130	SPb–130	^{14}C, bone	12,428 ± 222
Kasojskaya, layer 4/hor. 4	11,000 ± 150	SPb–128	^{14}C, bone	12,937 ± 142
Kasojskaya, layer 4/hor. 5	14,050 ± 100	SPb–129	^{14}C, bone	17,297 ± 229
Chygai, layer 4 base	9,560 ± 100	Ki–13465	^{14}C, bone	10,912 ± 167
Chygai, contact layers 4 and 5	10,545 ± 120	LE–8315	^{14}C, bone	12,431 ± 215
Chygai, layer 5	10,300 ± 130	LE–8313	^{14}C, bone	12,121 ± 308
Chygai, layers 4–7	11,060 ± 190	LE–8314	^{14}C, Helix shells	13,000 ± 186
Chygai, layer 9	12,983 ± 339	NskA–100	AMS, bone	15,716 ± 717
Chygai, layers 9–13	13,250 ± 500	LE–8317	^{14}C, bone	15,970 ± 809
Dvoinaya, layer 6	8,980 ± 280	GIN–14704	^{14}C, bone	10,100 ± 371
	10,020 ± 160	GIN–14706	^{14}C, charcoal	11,630 ± 291
	11,830 ± 160	GIN–14703	^{14}C, bone	13,761 ± 225
Satanai, hor. 3	9,950 ± 500*	SPb–254	^{14}C, human tibia	11,531 ± 747
	11,140 ± 100	SPb–132	^{14}C, bone	13,040 ±148
Satanai, layer 2b	11,200 ± 110	Ki–14280	^{14}C, bone	13,092 ± 142
Satanai, hor. 4 (= layer 2b)	11,200 ± 130	SPb–131	^{14}C, bone	13,094 ± 157
Besleneevskaya, layer 2B	13,200 ± 400	SPb–49313	^{14}C, humus	15,987 ± 689
North-central Caucasus				
Badynoko, layer 7/hor. 4	12,635 ± 150	SOAN–5896	^{14}C, bone	14,988 ± 368
Badynoko, layer 7/hor. 5	13,990 ± 340	SOAN–5897	^{14}C, bone	17,143 ± 485
Sosruko, layer 4 (M1)	8,170 ± 25*	IGANAMS7987b	AMS, tooth	9,108 ± 66
	8,780 ± 170	LU–9167	^{14}C, bone	9,860 ± 210
	8,940 ± 30	IGANAMS7987a	AMS, Helix shells	10,070 ± 89
	9,960 ± 140	LU–9477	^{14}C, Helix shells	11,520 ± 230
Sosruko, layer 5 (M2)	9,945 ± 35	IGANAMS 7988	AMS, bone	11,369 ± 92
Sosruko, layer 6 (M3)	11,440 ± 80	IGANAMS 7989	AMS, bone	13,316 ± 83
Sosruko, layer 7	11,880 ± 110	LU–9168	^{14}C, charcoal	13,720 ± 130
Sosruko, layer 8/hor. 6	12,720 ± 930*	LU–9708	^{14}C, bone	15,330 ± 1290
Sosruko, layer 8/hors. 10, 11	11,630 ± 280	LU–9709	^{14}C, bone	13,530 ± 320
Sosruko, layer 8/hor. 12	13,020 ± 490	LU–10208	^{14}C, charcoal	15,570 ± 780
	13,420 ± 230	LU–10206	^{14}C, charcoal	16,190 ± 340
Sosruko, layer 10/hor. 2	12,720 ± 380	LU–10207	^{14}C, charcoal	15,070 ± 610
Sosruko, layer 10	13,060 ± 260	LU–10225	^{14}C, bone	15,650 ± 400
Sosruko, layer 10/hor. 8	13,820 ± 290	LU–10229	^{14}C, charcoal	16,750 ± 420
Sosruko, layer 10/hor. 11	13,600 ± 270	LU–10230	^{14}C, charcoal	16,450 ± 390
Psytuaje, layer 2	9,790 ± 490	LU–9216	^{14}C, bone	11,340 ± 700
Psytuaje, layer 2/hors. 2, 3	10,150 ± 180	LU–9702	^{14}C, charcoal	11,810 ± 320
Psytuaje, layer 2/hor. 3	11,720 ± 320	LU–10114	^{14}C, bone	13,710 ± 420
	9,050 ± 200*	LU–10231	^{14}C, bone	10,170 ± 290

Tab. 1. Radiocarbon dating results for Epipaleolithic assemblages in the North Caucasus. Mean Age cal BP was calculated applying the IntCal20 dataset from OxCal 4.4.4 calibration program (available at: https://c14.arch.ox.ac.uk). Modified from: Golovanova & Doronichev (2020: 178–179) and the author's unpublished data, with additions from Leonova (2021); see text for details (* indicates deviating dates that are at odds with coherent dating results).

Tab. 1. *Radiokarbondatierungen für epipaläolithische Inventare im Nordkaukasus. Mittelwerte der Altersbestimmungen wurden berechnet und mit OxCal 4.4.4 kalibriert unter Verwendung des IntCal20 Datensatzes (verfügbar unter: https://c14.arch.ox.ac.uk). Verändert nach Golovanova & Doronichev (2020: 178-179) und den unveröffentlichten Daten der Autoren, mit Ergänzungen aus Leonova (2021); siehe Text für weitere Informationen (* kennzeichnet abweichende Daten, die im Widerspruch zu kohärenten Datierungsergebnissen stehen).*

Epipaleolithic (Nedomolkin 2020) shows that mainly prismatic cores with a wide front were reduced, and the morphometric characteristics of laminar blanks (blades, bladelets and microbladelets) suggest either a combination of the direct percussion and pressure techniques, or the use of indirect percussion with mediator.

The Epipaleolithic assemblages in both the north-western and north-central Caucasus are characterized by the predominance of straight-backed points made on bladelets or microbladelets and more rarely on small blades, including Gravette and microgravette points Vachons points that became widespread throughout the region during the Epipaleolithic. Points with retouched symmetrically converging lateral sides, including rarer needle-like symmetrically retouched points, were also found. Also, the presence of a specific shouldered point called the “Imeretian-type” point (Golovanova et al. 2014) is a characteristic feature of these assemblages.

Backed and symmetrical retouched points are the most common stone point morphology for the Upper Paleolithic assemblages in West Eurasia, including during the Late Glacial. Numerous morphometric, experimental and functional studies have examined lithic point assemblages dated from the Upper Paleolithic in Europe and West Asia to identify tool functions (Fischer et al. 1984; Harrold 1993; Geneste & Plisson 1993; Cattelain & Perpère 1993, 1996; Cattelain 1997; Soriano 1998; O’Farrell 2004; Plisson 2005; Lemorini et al. 2006; Ziggiotti 2006, 2008; Nuzhnyj 2007; Borgia 2008a, 2008b; Márquez & Muñoz 2008; Pétillon 2009; Riede 2009, 2010; Yaroshevich et al. 2010, 2013; Pétillon et al. 2011; Sano 2009, 2012; Dev & Riede 2012; Kabacinski et al. 2014; Sano & Oba 2015; Serwatka & Riede 2016; Serwatka 2018; Antonin et al. 2018; Duches et al. 2018, 2019, 2020; Hilbert et al. 2021). These studies demonstrated that various types of lithic points known from different Upper Paleolithic chrono-cultural contexts most typically functioned as inserts that served as lateral cutting elements, lateral barbs or axial piercing tips of composite projectiles used as hunting weapons.

The aim and scope of this contribution involve the presentation of the results of use-wear analysis that we have performed for lithic points from the Epipaleolithic assemblages in the North Caucasus. The previous functional analysis of the Epipaleolithic assemblages from Dvoinaya Cave and Chygai Rockshelter in the north-western Caucasus did not involve the correlation between point types and their functional use (Alexandrova 2014). The research results presented in this publication show that there is a correlation between the design of different point types and their functions.

Materials

Lithic points from three Epipaleolithic assemblages were used for the analysis: Mezmaiskaya Cave (layer 1-3), and Sosruko (layers 4–10) and Psytuaje (layer 2) rockshelters.

Mezmaiskaya Cave is a widely known reference Middle and Upper Paleolithic site in the Caucasus, in which remains of three Neanderthal individuals were found in the Middle Paleolithic deposits. Mezmaiskaya Cave is in the Kurdjips River valley (a tributary of the Belaya River, Kuban River basin; the Sea of Azov basin) in the north-western Caucasus. Since 1987, when L. Golovanova started controlled excavations on the site, more than 20 Pleistocene strata have been identified over the excavation area. The Epipaleolithic layer 1-3 has a total thickness of about 40–50 cm and consists of overlapping horizons of ash and charcoal, and it was excavated by 11 arbitrary excavation horizons. Layer 1-3 was accumulated for a long period of time, according to radiocarbon dating results. The lower and middle horizons of layer 1-3 are dated to between ca. 17–15 ka calBP, while the upper horizons have dates of ca. 13–12 ka calBP (Golovanova & Doronichev 2020; Tab. 1). We analyzed in total 42 lithic points that were typologically identified from the 2009, 2014 and 2015 excavations (about 15 m^2 in total) of layer 1-3. They include five different point types: 15 Gravette points, eleven microgravettes, seven Vachons points, eight symmetrical retouched points, and one shouldered point made on bladelet.

Sosruko Rockshelter is in the Baksan River valley (Terek River basin; the Caspian Sea basin), in the Elbrus region in the north-central Caucasus. S. Zamyatnin and P. Akritas discovered the site in 1954 and excavated about 30 m^2 in 1955–1957. The stratigraphy of the site was divided into five geological strata, about 12.5 m in total depth, in which seven archaeological horizons (M1–M7 from top to bottom) assigned to the Mesolithic and a thick (about 1.4 m) Upper Paleolithic layer were identified (Zamyatnin & Akritas 1957). In 2016, the Sosruko Rockshelter was rediscovered and research of the site was resumed by L. Golovanova in 2017–2021. At present, ten geological strata (layers 1–10 from top to bottom) were identified and excavated to the total depth of about 6 m. The specific features of this site are a rapid process of sedimentation and that intact archaeological horizons alternate with sterile horizons (Golovanova & Doronichev 2018, 2020; Golovanova et al. 2019). Radiocarbon dating determines the age of the top Epipaleolithic layer 4 between ca. 11.5–9 ka calBP and the lower Epipaleolithic layer 10 between ca. 17–15 ka calBP (Tab. 1). We analyzed in total 29 lithic points that were typologically identified from the recent excavations in Sosruko Rockshelter. They include several point types: 20 Gravette points, two microgravettes, three shouldered points and four other points.

Psytuaje Rockshelter is in the Fanduko (or Saradj-Chuko) River valley (a small tributary of Kishpek River – tributary of Baksan River, Terek River basin; the Caspian Sea basin) in the Elbrus region in the north-central Caucasus. E. Doronicheva discovered the site in 2018 and excavated about 24 m^2 of the Epipaleolithic layer 2 in 2018–2021 (Doronicheva et al. 2020). Layer 2 has thickness about 20–30 and is dated by three radiocarbon dates (excluding an aberrant estimate LU–10231) to between ca. 14–11 ka calBP (Tab. 1). Layer 2 has yielded a large (more than 2,000 pieces) and diverse collection of lithic artifacts, of which we typologically identified twelve lithic points that were analyzed in this study. They include five Gravette points, six microgravettes, and one symmetrical retouched point.

Methods

The traceological studies were performed on a MS-2ZOOM microscope (LOMO, Russia) with magnification up to 80x, and an MSP-2 microscope (LOMO, Russia) with magnification up to 160x, using a TOUPCAM video-eyepiece and a MS-12 digital camera. The identification and interpretation of diagnostic impact fractures (DIFs) and microscopic use-wear traces on the analyzed lithic points is based both on the method of use-wear analysis (called "traceology" by Semenov, 1957) and diagnostic criteria developed in the Laboratory for Experimental-Traceological Studies in the Institute for the History of Material Culture of the Russian Academy of Sciences, St. Petersburg (Semenov 1957, 1964; Korobkova & Shchelinsky 1996; Poplevko 2007). We also apply criteria defined in the scientific literature by other researchers (Keeley 1977; Moss 1983, 1987; Fischer et al. 1984; Plisson 1985; Lombard 2005; Nuzhnyj 2007; Rots 2002, 2003, 2008, 2010; Sano & Oba, 2015). To study the relationship between formal typological types of lithic points and their functions, we applied a detailed typology of the analyzed points, following the typological definitions after Golovanova & Doroniche (2020).

Results

Mezmaiskaya Cave

Projectile tips. In the analyzed tool sample from the Epipaleolithic layer 1-3 at Mezmaiskaya Cave, we identified in total 29 lithic points as projectile tips, including all symmetrical retouched points (eight pieces), eight Gravette and six microgravette points, six Vachons points, and one shouldered point (Tab. 2). These lithic points exhibit distal impact tractures (DIFs) localized on the tool tip (distal end), such as small bending fractures with step and hinge terminations, large (>6 mm) and small spin-off fractures, and impact burinations, which provide proxies to indicate potential use of the lithic points as the tips of composite projectiles (Fischer et al. 1984; Geneste & Plisson 1993; Lombard 2005; Sano 2009; Yaroshevich et al. 2010; Pétillon et al. 2011; Sano & Oba 2015; and references therein).

The basal parts are preserved on 15 tools. They exhibit crushing areas along the lateral and basal edges, which look like a uniform flat micro-scarring at magnification. These are diagnostic hafting traces (DHTs) of the tool contact (friction and motion) with a haft (Moss 1987; Rots 2003, 2008, 2010). Almost half (14 pieces) of the points are fragmented. Most of them demonstrate a transverse counter-strike fracture (CSF) with small spin-offs along the ridge created by primary fracturing. Below we provide descriptions of characteristic samples.

Sample 1 (layer 1-3, hor. 8; Fig. 2). Dimensions (length x width x thickness): 3.0x0.6x0.4 cm. Typological definition: Gravette point with broken tip. Functional identification: projectile tip (lithic insert). The tool is made on a bladelet from gray flint with light inclusions.

Typological definition of lithic point type	Preservation	Functional definition				Total
		Projectile tip	Awl	Meat knife	Tool for butchering meat/skin	
Gravette point	complete	3	1	1	-	5
	distal fragment	1	1	2	1	5
	medial fragment	1	-	-	-	1
	proximal fragment	3	-	-	1	4
Microgravette	complete	1	-	2	-	3
	distal fragment	4	1	-	1	6
	proximal fragment	1	-	-	1	2
Vachons point	complete	1	-	-	-	1
	distal fragment	5	1	-	-	6
Symmetrical retouched point	complete	3	-	-	-	3
	distal fragment	4	-	-	-	4
	proximal fragment	1	-	-	-	1
Shouldered point	proximal fragment	1	-	-	-	1
Total		29	4	5	4	42

Tab. 2. The correlation of typological and functional (traceological) definitions of lithic points from the Epipaleolithic layer 1-3 in Mezmaiskaya Cave.

Tab. 2. *Die Korrelation von typologischen und funktionalen Bestimmungen der lithischen Spitzen aus den epipaläolithischen Schichten 1-3 der Mezmaiskaya-Höhle.*

The right side is straightened by dorsal abrupt retouch that forms a back. On the dorsal and ventral surfaces along the tool edge, there are micro-fractures and a single-row micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. The side is straight in plan view and finely denticulated in profile. The tool edge is straight, with micro-crushing areas on protruding ridges. Polishing going mainly along the retouch facets ridges can be traced along the tool edge. The polishing is bright and not spread to the tool surfaces.

On the left side, there are mainly fine single-row micro-retouching and micro-fractures from both the dorsal and ventral surfaces, and only near the tool tip there is an area of ventral flat retouch. The side is almost straight both in plan view and in profile. There is bright polishing on protruding ridges along the tool edge, forming continuous strips in some areas (Fig. 2: 1 & 2).

In the proximal part of the right side, there is crushing along the tool edge and from the dorsal surface, which looks like uniform, flat micro-scarring in magnification. These DHTs are likely the result of tool contact (friction and motion) with a haft. On the tool base, there are several flat micro-scars and micro-fracture surfaces along the tool edge from both the dorsal and ventral surfaces, with several dim polished spots on protruding ridges (Fig. 2: 3 & 4). These traces of the tool edge micro-abrasion, with areas of bright (mirror-type) and dim polishing, localized on the tool basal edge indicate that the tool was likely hafted in a wood haft.

Sample 2 (layer 1-3, hor. 9; Fig. 3). Dimensions: 2.5x0.7x0.3 cm. Typological definition: symmetrical retouched point, with opposite retouch along lateral converging edges and ventral retouch on the tool tip and base. Functional identification: projectile tip (lithic insert). The tool is made on a gable bladelet from gray flint with red-brown spots.

The tool tip bears bifacial micro-scars and several impact micro-fracture surfaces on the edge. There are several dim polishing spots on protruding ridges (Fig. 3: 1).

The right side is straightened by dorsal abrupt retouch. The side is straight in plan view and finely denticulated in profile. On the dorsal and ventral surfaces along the tool edge, there are micro-fractures and mainly single-row micro-retouch, with two-row micro-retouch in some areas. The retouch facets are clearly outlined. Polishing going mainly along the retouch facets ridges and inside retouch facets is traced along the tool edge. The polishing is bright and not spread to the tool surfaces. The tool edge is straight, with micro-crushing areas on protruding ridges (Fig. 3: 2). The crushing along the right and partially left tool edge looks like uniform, flat micro-scarring in magnification. These DHTs are likely the result of the tool contact (friction and motion) with a wood haft.

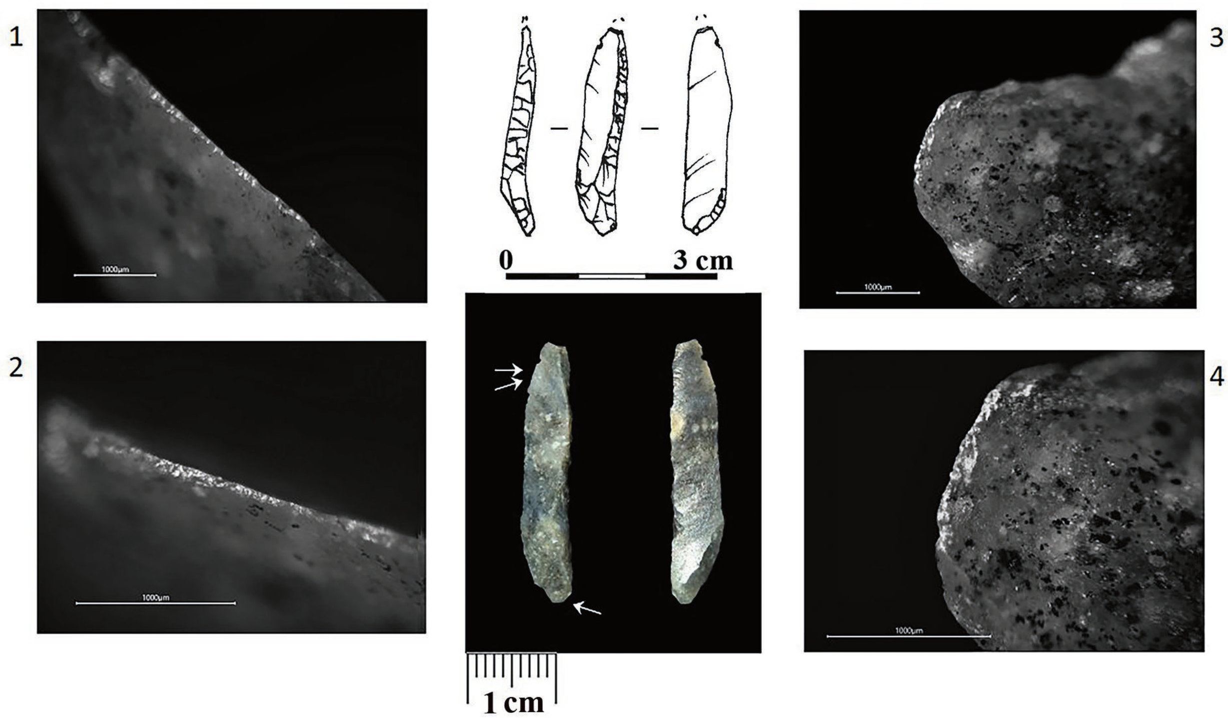

Fig. 2. Mezmaiskaya Cave, layer 1-3. Sample 1: projectile tip (lithic insert). 1, 2 – polishing on the tool edge; 3, 4 – polishing and micro-scarring on the tool edge.

Abb. 2. *Mezmaiskaya-Höhle, Schicht 1-3. Probe 1: Projektilspitze (lithischer Einsatz). 1, 2 – Polituren an der Kante des Werkzeugs; 3, 4 – Polituren und Micro-Aussplitterungen an der Kante des Werkzeugs.*

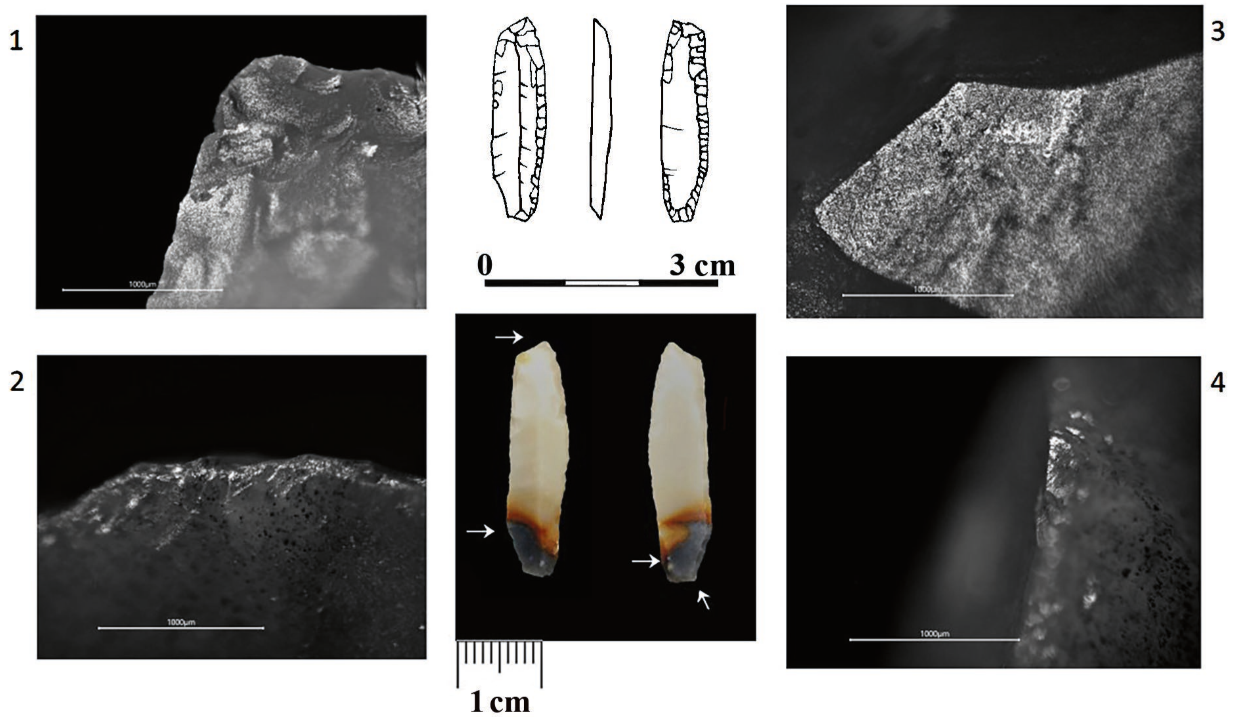

Fig. 3. Mezmaiskaya Cave, layer 1-3. Sample 2: projectile tip (lithic insert). 1 – polishing and micro-scarring on the tool edge near the tip; 2 – crushing on the tool edge; 3 – polishing on the tool edge from the ventral surface; 4 – polishing on the tool base edge.

Abb. 3. *Mezmaiskaya-Höhle, Schicht 1-3. Probe 2: Projektilspitze (lithischer Einsatz). 1 – Polituren und Micro-scarring an der Kante des Werkzeugs in der Nähe der Spitze; 2 – Crushing an der Werkzeugkante; 3 – Polituren der Werkzeugkante ausgehend von der Ventralseite; 4 – Polituren an der Kante an der Basis des Werkzeugs.*

On the left side, there are micro-fractures and areas of flat ventral retouch on both ends. The side is almost straight in plan view and sparsely denticulate in profile. On the protruding angle of the left side, there are areas with smoothed tool edge and bright polishing along the retouch facets edges that sometimes enters the retouch facets (Fig. 3: 3 & 4).

Sample 3 (layer 1-3, hor. 2, square N-10; Fig. 4). Dimensions: 1.7 x 0.9 x 0.2 cm. Typological definition: basal part of a shouldered point. Functional identification: projectile tip (lithic insert to bone/antler haft). The tool is made on a three-ridged bladelet from light brown, translucent flint. This is the only one lithic point in the analyzed tool sample that shows DHTs associated with hafting to a bone/antler haft. The point exhibits the characteristic distinctly spotted polish as well as roundness of ridges, with transverse microcracks on protruding ridges. This "bone polish" (after Antonin et al. 2018) is the DHT indicating that the tool edges were worn in a bone or antler haft due to prolonged use.

On the tool base (proximal end), there are dorsal flat retouch and micro-fractures. Several micro-abrasion areas are traced along the tool basal edge (Fig. 4: 4).

In the proximal part of the left side, there is a notch formed by dorsal abrupt and semi-abrupt retouch. There are micro-fracture surfaces and single-row micro-retouch, with areas of two-row retouch, along the notch edge. The retouch facets are clearly outlined. Above the notch, the left side is straight in plan view and finely denticulated in profile. There is bright, spotty polishing on the retouch facets ridges and along the tool edge (Fig. 4: 3). The polishing spreads mainly along the facet's ridges and inside facets, not spreading much over the tool surface. The tool edge is straight, with micro-crushing areas on protruding ridges.

On the right side, there is an area of dorsal micro-retouch. The side is almost straight in plan view and finely denticulated in profile. The tool edge is smoothed, with linear transverse abrasion marks (Fig. 4: 2). There are areas of bright polishing with greasy sheen on retouch facet ridges and protruding areas along the tool edge (Fig. 4: 1).

Awls. We identified four tools as awls for skin/meat in the analyzed sample. The awl tips and lateral sides near the tip exhibit smoothed edges, especially on protruding areas. Such surface smoothing occurs due to the tool use for piercing soft, abrasive materials, such as skins and meat (Semenov 1964; Moss 1983; Poplevko 2007). Below we provide a brief description of the most illustrative sample.

Sample 4 (layer 1-3, hor. 3, square L-10; Fig. 5). Dimensions: 2.2 x 0.5 x 0.4 cm. Typological definition: distal fragment (tip) of Gravette point. Functional identification: awl for meat/skin. The tool is made on a bladelet from light gray, translucent flint.

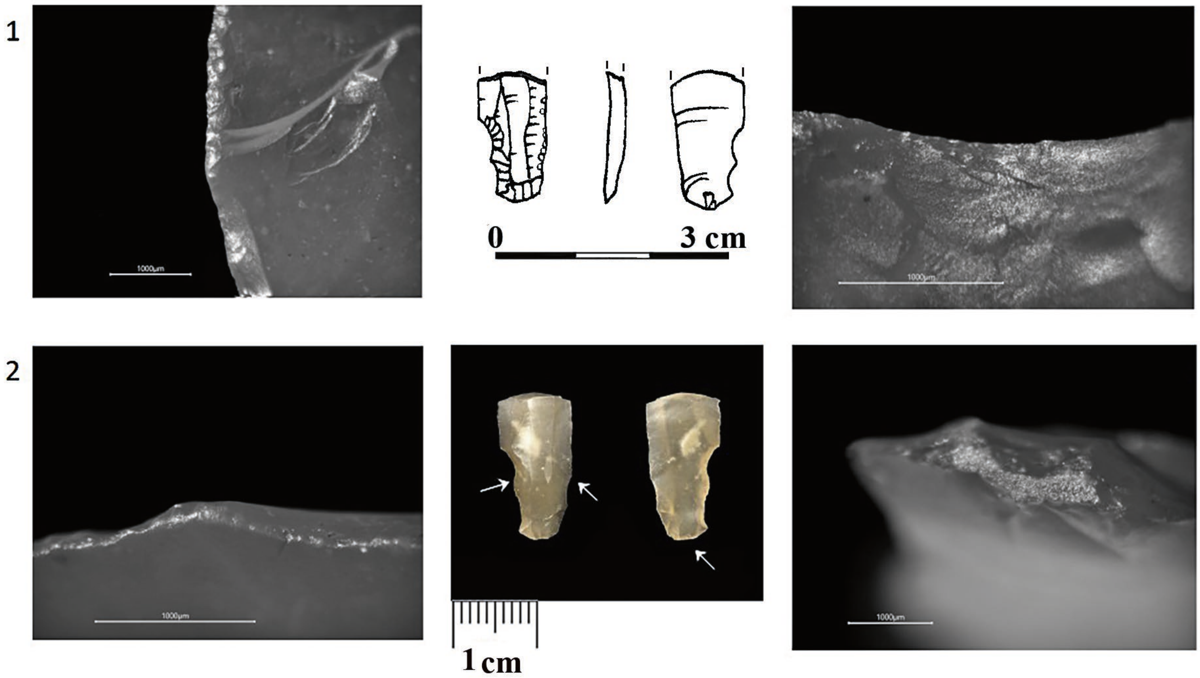

Fig. 4. Mezmaiskaya Cave, layer 1-3. Sample 3: projectile tip (lithic insert to a bone/antler haft). 1, 2 – polishing on the tool edge; 3 – polishing on retouch facets within the retouched notch; 4 – micro-crushing on the tool base edge.

Abb. 4. *Mezmaiskaya Höhle, Schicht 1-3. Probe 3: Projektilspitze (lithischer Einsatz in einer Knochen/Geweih Schäftung). 1, 2 – Polituren an der Kante des Werkzeugs; 3 – Polituren auf den Retuschiernegativen innerhalb der retuschierten Kerbe; 4 – Micro-crushing der Werkzeugbasis.*

On the tool tip, there is spot polishing along the tool edge. The polishing is dull, with a greasy sheen (Fig. 5: 1 & 2). Along the narrow fracture surface, there is dorsal micro-retouch. The retouch facets edges are partially smoothed, and there are polished areas on protruding ridges and the tool edges.

The right side is worked by dorsal abrupt retouch forming a back. The side is straight in plan view and denticulated in profile. There are micro-fracture surfaces and single-row micro-retouch, with areas of two-row retouch, represented on both the dorsal and ventral surfaces along the edge. The retouch facets are clearly outlined. Along the tool edge, bright polishing is traced on some retouch facets, going mainly along the facets edges, as well as locally on protruding ridges and inside retouch facets (Fig. 5: 3 & 4).

On the left side, there are areas of mainly dorsal, rarely ventral, micro-retouch and micro-fractures. The side is slightly wavy in plan view and partially finely denticulated in profile.

Meat knives. We identified five meat knives. All knives have bifacial flat irregular micro-retouch on working edges. The retouch facet ridges and some parts of the tool working edge are partially smoothed. In the analyzed tool sample, the most pronounced difference between meat knives and projectile tips relies on the fact that a knife typically has a smoothed tip a without micro-fracture surfaces and spin-offs, while showing a partial polishing along the working edge and micro-retouch on the tool tip that is the continuation of the retouch on the working edge. Below we provide a brief description of the most illustrative sample.

Sample 5 (layer 1-3, hor. 9, square L-10; Fig. 6). Dimensions: 3.3 x 0.5 x 0.2 cm. Typological definition: microgravette point with broken tip. Functional identification: meat knife (lithic insert). The tool is made on a microbladelet from light brown-gray, translucent flint.

The right side is straightened by dorsal abrupt retouch that forms a back. The side is straight in plan view and finely denticulated in profile. There are micro-fractures and mainly single-row micro-retouch, with some areas of two-row micro-retouch, from both the dorsal and ventral surfaces along the tool edge. The retouch facets are clearly outlined. Polishing is traced on protruding ridges and on edges of several facets (Fig. 6: 3 & 4). The polishing is bright, not spreading deep over the tool surface, sometimes forming continuous stripes. The tool edge is straight, with micro-scarring on several protruding ridges. The crushing along the tool edge looks like uniform, flat micro-scarring in magnification. These features are DHTs indicating that this wear is likely a result of the tool hafting in a wood haft.

On the left side, there is an area of flat ventral retouch that spreads along the left side and enters to the tool distal end. The side is almost straight in plan view and wavy in profile. Almost along the entire tool edge, there is irregular one- or two-row retouch from the dorsal and ventral surfaces. Several areas along the tool edge are rounded, and several retouch facets also

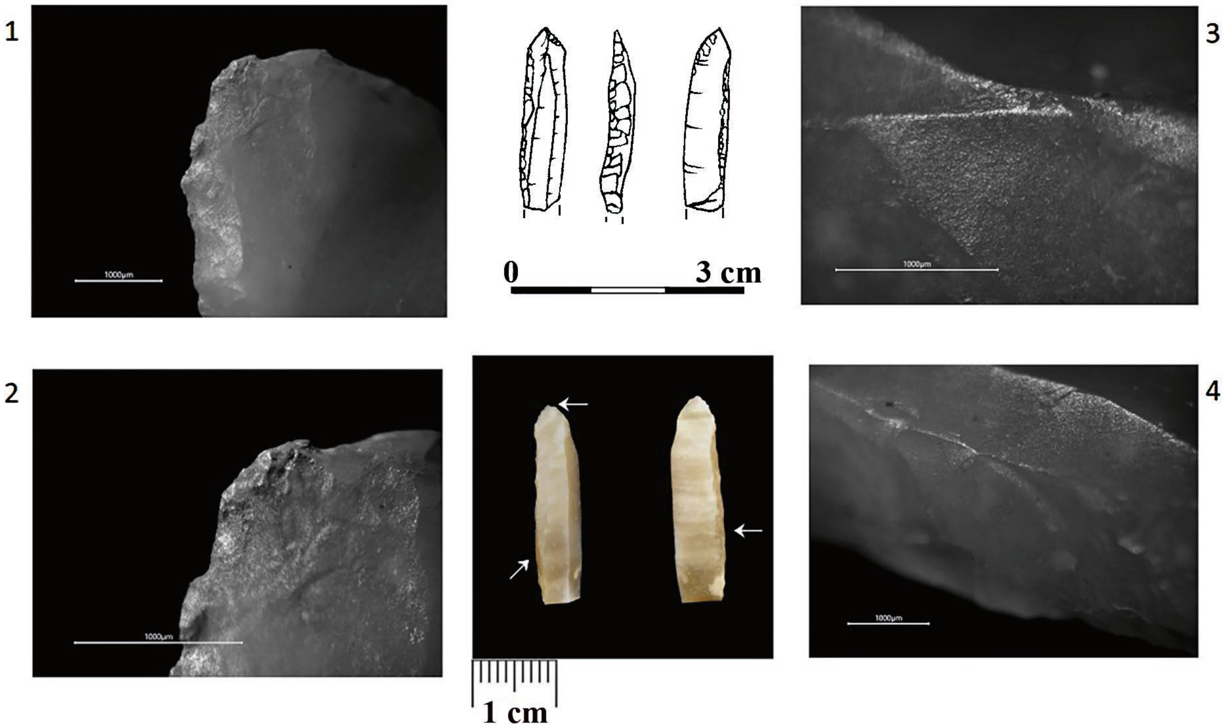

Fig. 5. Mezmaiskaya Cave, layer 1-3. Sample 4: awl for meat/skin. 1, 2 – polishing on the tool tip; 3, 4 – polishing on retouch facets along the tool edges.

Abb. 5. *Mezmaiskaya-Höhle, Schicht 1-3. Probe 4: Ahle für Fleisch/Haut. 1, 2 – Polituren an der Werkzeugspitze; 3, 4 – Polituren auf den Retuschiernegativen entlang der Werkzeugkanten.*

have rounded edges. There are areas of spot polishing along the tool edge (Fig. 6: 1 & 2). The polishing does not spread to the tool surfaces and has a greasy sheen typical of tools used as meat knives. The tool base has indicative traces of wear from contact with bone, indicating that the tool was used as an insert into a bone/antler haft.

From the results of the traceological (use-wear) analysis of the 42 lithic points from layer 1-3 in Mezmaiskaya Cave (Tab. 2), we can draw the following conclusions. All the analyzed points are associated with large game hunting or processing meat/hides/leather of killed animals. Most points (29 pieces; 66.7 %) are hunting projectile tips or their fragments. Five points were used as meat knives in butchering, four points were used as awls for piercing leather/hides, and four points are defined as other tools that were used for butchering meat/skins. One lithic point shows indicative traces of wear indicating that the tool was hafted into a bone/antler haft. Most of the analyzed lithic points are lithic inserts to wooden hafts or shafts, which is evidenced by characteristic wear traces: areas of bright, mirror-type polishing covering edges of retouch facets on the tool's lateral edges and the tool bases. Also, residues of probable organic matter (not analyzed in this study), which could be related to hafting, are found on two lithic points.

In our study, we applied a detailed typology of the analyzed lithic points that were separated into distinct point types. As a result, the traceological identification of tool function for each type showed that there is a correlation between the defined point types and their functions (Tab. 2). All symmetrical retouched points (eight) were used as projectile tips. The Gravette points were used mainly as projectile tips (eight) as well as awls (two), meat knives (three), and tools for butchering meat/skins (two). The microgravette points show a similar trend in their functional use mainly as projectile tips (six) as well as awls (one), meat knives (two), and tools for butchering meat/skins (two). The Vachons points were predominantly used as projectile tips (six) and only very episodically as awls (one). The only shouldered point is a lithic insert to a hunting projectile made from bone or antler. The majority of other lithic points exhibit wear traces and DHTs indicating that these points were used as lithic inserts into wooden hafts/shafts.

In the analyzed assemblage from Mezmaiskaya Cave, most of the lithic points are represented by fragments. Complete lithic points used as projectile tips are rare: three Gravette points, one microgravette, and one Vachons point. Also, three complete lithic points (one Gravette point and two microgravettes) were identified as meat knives. Finally, we identified the use as projectile tips for 58.8 % (20 pieces) of the analyzed backed points, including Gravette, microgravette and Vachons points, as well as the some of them were also use of as meat knives (five), awls (four),

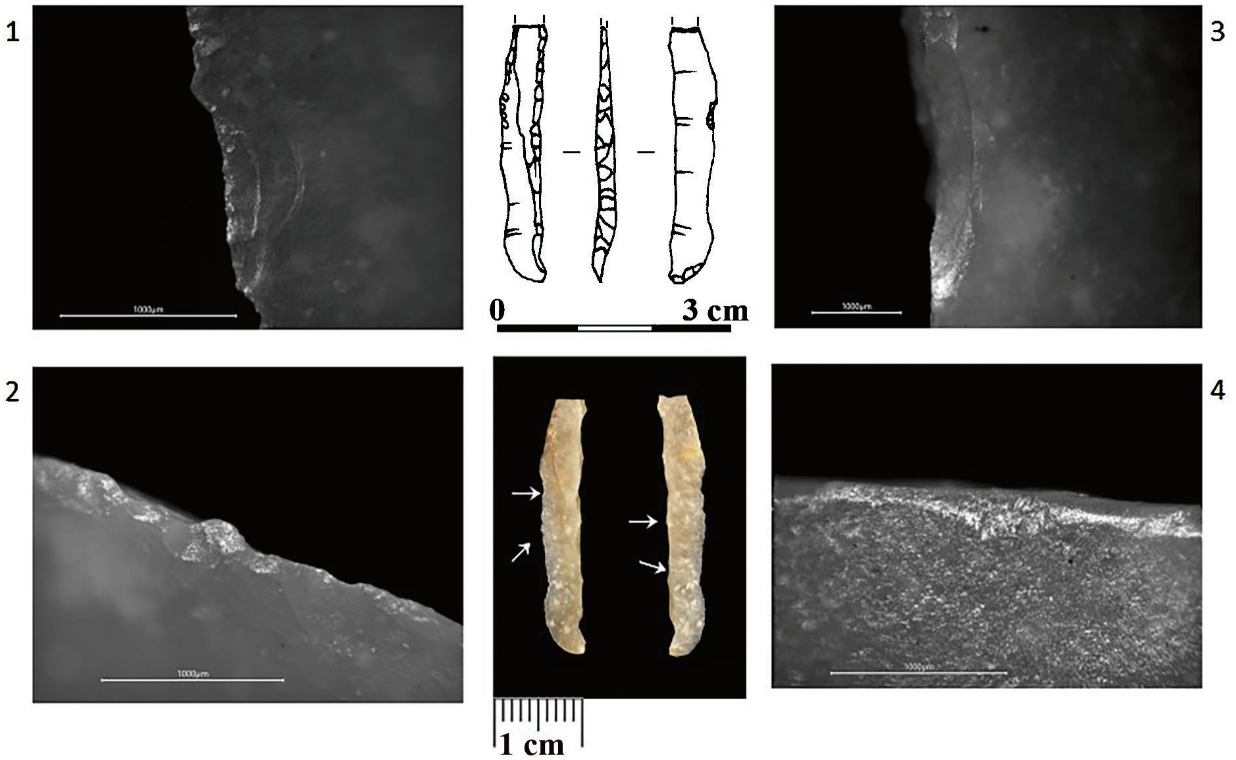

Fig. 6. Mezmaiskaya Cave, layer 1-3. Sample 5: meat knife (lithic insert). 1, 2 – polishing on protruding ridges along the tool edge; 3 – polishing inside a retouch facet; 4 – polished and rounded area on the tool edge.

Abb. 6. *Mezmaiskaya-Höhle, Schicht 1-3. Probe 5: Fleischmesser (lithischer Einsatz). 1, 2 – Polituren auf vorstehenden Graten entlang der Werkzeugkante; 3 – Polituren innerhalb der Retuschiernegative; 4 – polierter und abgerundeter Bereich an der Werkzeugkante.*

and tools for butchering meat/skin (four) (Tab. 2). It could be assumed that butchering/skin-working is the secondary or alternate function of backed points.

Sosruko Rockshelter

In the analyzed tool sample from the Epipaleolithic layers in Sosruko Rockshelter, we typologically identified in total 28 lithic points, including 20 Gravette points, as well as three microgravettes, one atypical Gravette point on bladelet, one Vachons point, one basal fragment of a shouldered point, and two basal fragments of tanged points (Tab. 3). The typologically defined lithic points are unevenly represented in the Epipaleolithic layers: one in layer 7, 25 in layer 8, and three in layer 10. Symmetrical retouched points are not found.

The traceological analysis indicates that tips (distal ends) of nine points exhibit DIFs, such as small bending fractures with step and hinge terminations, and impact burinations, which provide proxies to indicate potential use of the lithic points as composite projectile tips. The 15 points also exhibit crushing along the tool lateral edges and bases, which looks like a uniform flat micro-scarring in magnification, that represents the DHT of the tool contact (friction and motion) with a wooden haft. The 14 points are fragmented, and most of them demonstrate the CSF with small spin-offs along the ridge created by primary fracturing. Based on results of the traceological analysis, 19 lithic points were identified as projectile tips. Below we provide more detailed descriptions of several characteristic samples.

Projectile tips. Sample 1 (layer 7, hor. 1; Fig. 7). Dimensions: 5.4 x 1.1 x 0.3 cm. Typological definition: Gravette point. Functional identification: projectile tip (lithic insert). The tool is made on a three-ridged narrow blade from transparent obsidian with gray dot inclusions and a red-brown inclusion at the tool tip.

The tool tip bears dorsal and ventral micro-scars. On the ventral surface, longitudinal micro linear impact traces (Moss 1983) running from the tool tip (Fig. 7: 1 & 2) indicate that the tool was likely used as a projectile tip.

The right side is straightened by dorsal abrupt retouch that forms a back. On the dorsal surface along the tool edge, there are micro-fractures and single-row micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. The tool edge is straight in plan view and finely denticulated in profile. There are crushing areas on protruding ridges, as well as some areas with linear striations along the tool edge.

The left side has a flat micro-retouch and several micro-fractures from the dorsal and ventral surfaces. The tool edge is slightly wavy in plan view and

Typological definition of lithic point type	Preservation	Functional definition				Total
		Projectile tip	Awl	Meat knife	Tool for butchering meat/skin	
Gravette point	complete	4	-	-	-	4
	distal fragment	3	1	1	1	6
	proximal fragment	7	-	3	-	10
Microgravette	complete	-	-	2	-	2
	distal fragment	1	-	-	-	1
Vachons point	complete	1	-	-	-	1
Shouldered point	proximal fragment	1	-	-	-	1
Tanged point	proximal fragment	2	-	-	-	2
Atypical Gravette point on bladelet	complete	-	-	1	-	1
Total		19	1	7	1	28

Tab. 3. The correlation of typological and functional (traceological) definitions of lithic points from the Epipaleolithic layers 7, 8 and 10 in Sosruko Rockshelter.

Tab. 3. *Die Korrelation von typologischen und funktionalen Bestimmungen der lithischen Spitzen aus den epipaläolithischen Schichten 7, 8 und 10 des Sosruko Rockshelters.*

sparsely denticulated in profile. There are linear longitudinal abrasion marks in some areas near the tool edge (Fig. 7: 3) and several partially smoothed areas along the tool edge.

On the tool base, the presence of micro-fracture and micro-crushing areas as well as worn and smoothed areas on the tool edge (Fig. 7: 4) indicates that the point was hafted in a wooden haft.

Sample 2 (layer 8, hor. 12; Fig. 8). Dimensions: 2.8 x 0.8 x 0.5 cm. Typological definition: Gravette point. Functional identification: projectile tip (lithic insert). The tool is made on a bladelet from gray flint.

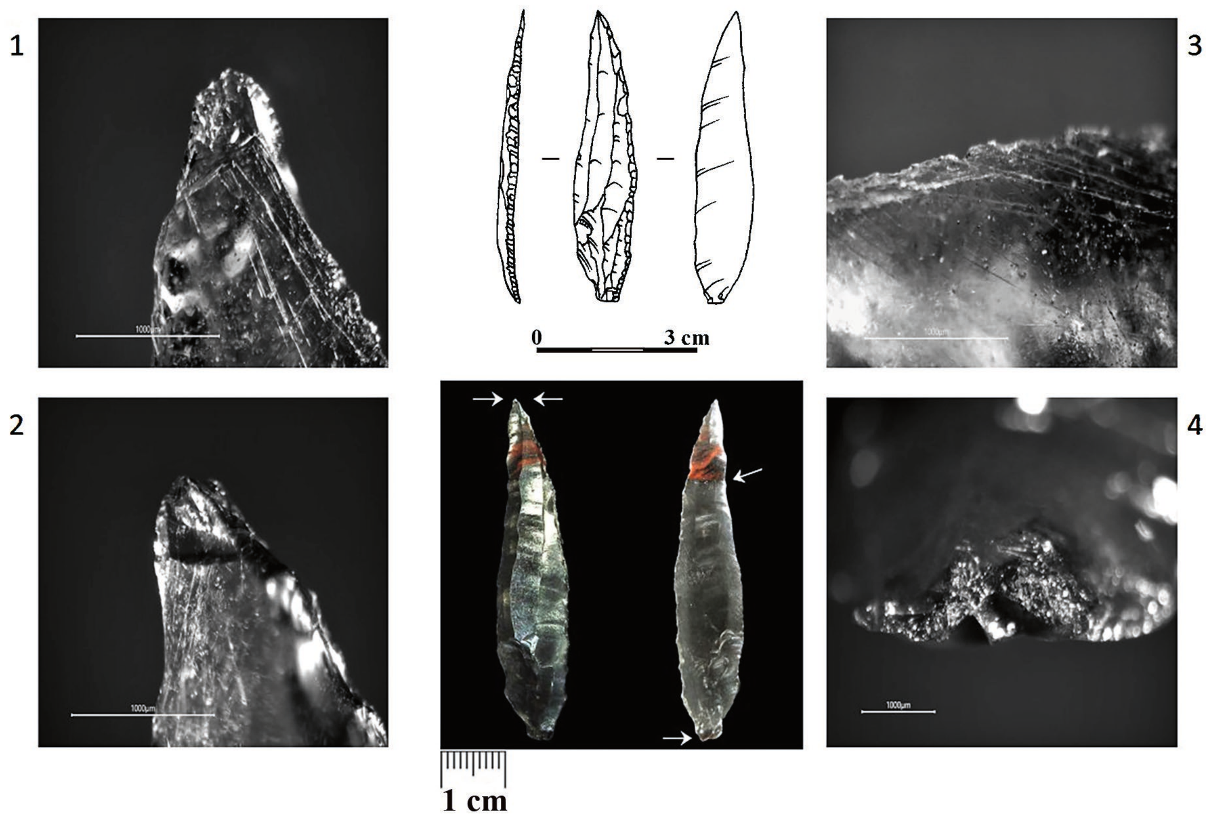

Fig. 7. Sosruko Rockshelter, layer 7. Sample 1: projectile tip (lithic insert). 1,2 – polishing along the tool edge; 3, 4 – polishing on the proximal (basal) end of the tool.

Abb. 7. *Sosruko Rockshelter, Schicht 7. Probe 1: Projektilspitze (lithischer Einsatz). 1,2 – Polituren entlang der Werkzeugkante; 3, 4 – Polituren am proximalen (basalen) Ende des Werkzeugs.*

The tool tip bears dorsal and ventral micro-scars and micro-fractures going to lateral sides. There are several polishing areas on protruding ridges near the tip (Fig. 8: 1 & 2) and smoothed areas along the tool edges.

The right side is straightened by dorsal abrupt retouch that forms a back. The side is straight in plan view and finely denticulated in profile. On the dorsal surface along the tool edge, there are numerous micro-fractures and single-row micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. Bright polishing going mainly along the facets ridges and partially entering facets can be traced along the right tool edge. There are micro-crushing areas on protruding ridges along the tool edge.

On the left side, there are areas of flat micro-retouch and micro-fractures on both the dorsal and ventral surfaces. The side is almost straight both in plan view and in profile.

The tool base is worked by flat retouch from the ventral surface, and semi-abrupt and locally flat retouch from the dorsal surface. There are micro-scars and micro-fractures on the edge of the tool base. Bright, mirror-type polishing going mainly along the retouch facets ridges and partially entering the retouch facets is traced along the tool base (Fig. 8: 3 & 4). The micro-scars and micro-crushing areas along the tool base edge look like a uniform, flat micro-scarring in magnification. These damages are DHTs of the tool contact (friction and motion) with a wooden haft.

Sample 3 (layer 10, hor. 2, square B-11; Fig. 9). Dimensions: 2.6 x 0.6 x 0.2 cm. Typological definition: microgravette point. Functional identification: projectile tip (lithic insert) secondary used as a meat knife. The tool is made on a three-ridged bladelet from honey-colored translucent flint.

The point tip is broken. Near the transverse fracture surface, there are lateral small spin-offs along the small edge created by primary fracturing and the area with several spin-off micro-fractures that initiate from the same transverse fracture on the corner between the fracture surface and the right tool side. These DIFs identifying hunting projectile weapons (Lombard 2005) suggest that the lithic point originally functioned as a projectile tip and that the tool tip was broken due to impact.

The right side is straightened by dorsal abrupt retouch that forms a back. On the dorsal surface along the tool edge, there are micro-fractures and single-row micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. The side is straight in plan view and finely denticulated in profile. The tool edge is straight, with micro-crushing areas on protruding ridges. Polishing going mainly along the retouch facets ridges

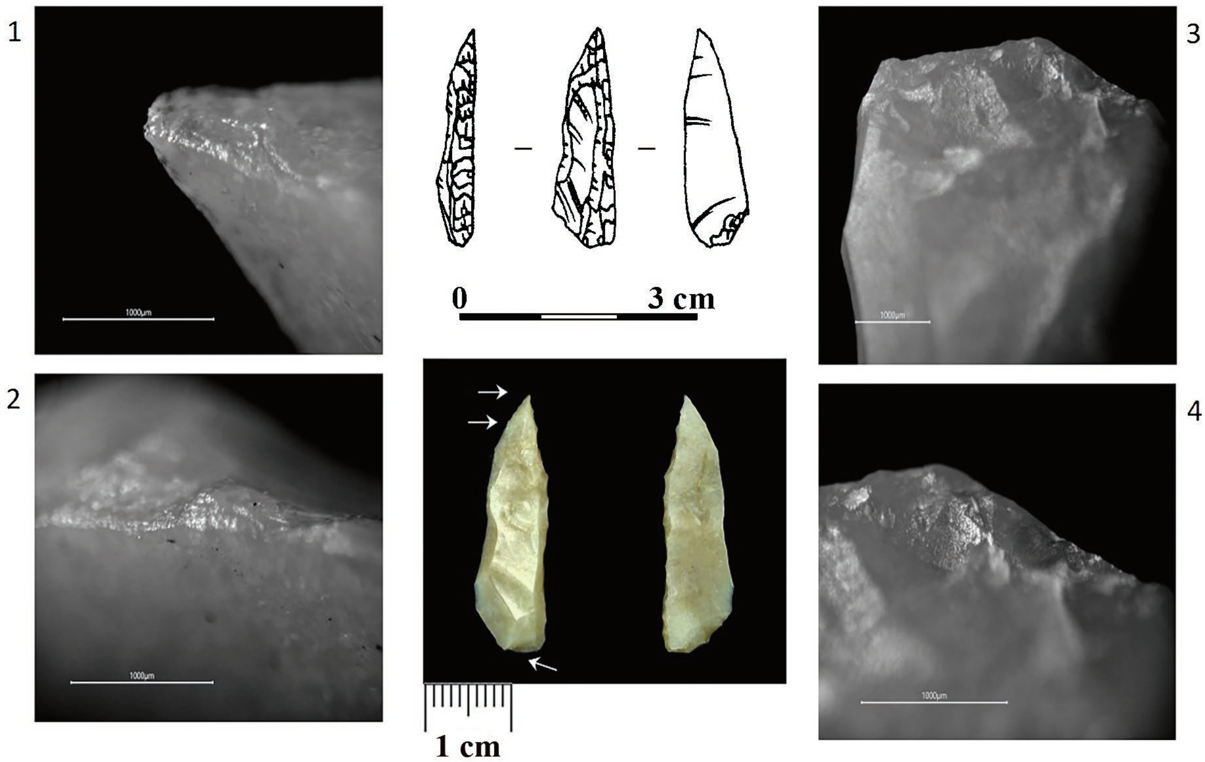

Fig. 8. Sosruko Rockshelter, layer 8, hor. 12. Sample 2: projectile tip (lithic insert). 1 – polishing on the tool tip; 2 – polishing on a protruding ridge on the tool edge; 3, 4 – polishing inside a retouch facet on the tool base edge.

Abb. 8. *Sosruko Rockshelter, Schicht 8, Horizont 12. Probe 2: Projektilspitze (lithischer Einsatz). 1 – Polituren an der Werkzeugspitze; 2 – Polituren auf einem vorstehenden Grat an der Werkzeugkante; 3, 4 – Polituren innerhalb eines Retuschiernegatives an der basalen Kante des Werkzeugs.*

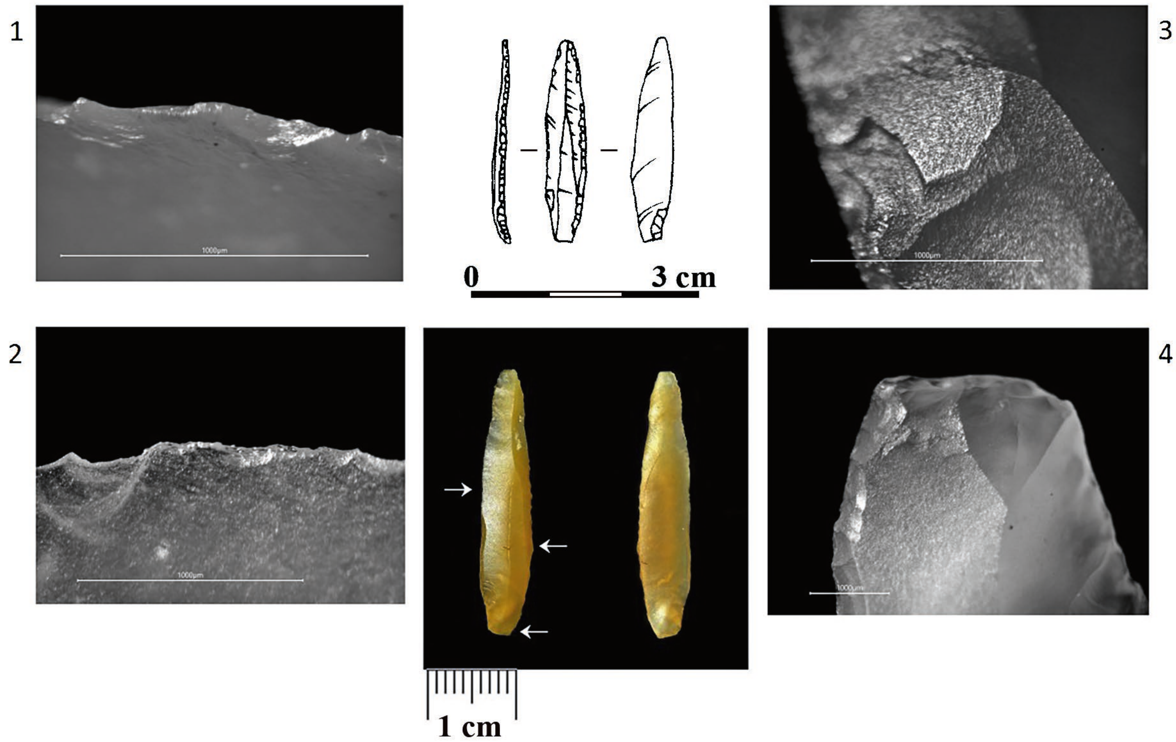

Fig. 9. Sosruko Rockshelter, layer 10, hor. 2. Sample 3: projectile tip (lithic insert). 1, 2 – flat scars and linear traces on the tool tip; 3 – longitudinal linear traces near the tool edge; 4 – micro-crushing of the tool base.

Abb. 9. *Sosruko Rockshelter, Schicht 10, Horizont 2. Probe 3: Projektilspitze (lithischer Einsatz). 1, 2 – flache Kerben und lineare Spuren an der Werkzeugspitze; 3 – lineare Längsspuren in der Nähe der Werkzeugkante; 4 – Micro-crushing der Werkzeugbasis.*

and partially entering facets can be traced along the tool edge (Fig. 9: 3). The polishing is bright, does not spreads deep over the tool surfaces, and rarely forms continuous strips.

On the left side, there are mainly flat micro-retouch with micro-fracture areas on both the dorsal and ventral surfaces; only near the tool tip (proximal end) there is an area of ventral flat retouch. The side is slightly wavy in plan view and sparsely denticulate in profile. On the tool edge, areas of spot polishing with greasy sheen are visible in magnification on protruding ridges closer to the tool tip (Fig. 9: 1 & 2); in addition, the tool edge is partially smoothed in several areas. These wear features suggest that the left tool side was secondarily used as a meat knife, as evidenced by the localization of the wear traces along the entire edge and not only at the tool tip.

On the tool base, areas of weak micro-abrasion, basal edge smoothing as well as spots of greasy polishing (Fig. 9: 4) localized on protruding ridges and partially entering retouch facets indicate probable hafting of the lithic point in a bone/antler haft.

Awls. In the analyzed lithic assemblage from Sosruko Rockshelter, we identified only one tool that exhibits wear traces indicating the tool was used as a stone awl.

Sample 4 (layer 8, hor. 11, square D-10; Fig. 10). Dimensions: 2.2 x 0.6 x 0.2 cm. Typological definition: Gravette point distal fragment. Functional identification: stone awl. The tool is made on a three-ridged bladelet from dark brown, partially transparent obsidian.

The tool tip is partially smoothed, and there are micro-abrasion areas along the tool edge (Fig. 10: 1 & 2). There are longitudinal linear striations on the ventral surface near the tool tip (Fig. 10: 3).

The right side is straightened by dorsal abrupt retouch that forms a back. On the dorsal surface along the tool edge, there are micro-fractures and single-row micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. The tool edge is straight in plan view and finely denticulate in profile.

The left side has an area of semi-abrupt fine retouch on the dorsal surface. The tool edge is partially rounded (Fig. 10: 4), and linear transverse striations are visible in magnification on protruding areas.

The smoothing of the tool tip and the rounding of the tool lateral edges occur due to working on soft materials. These wear traces are typical for stone awls (Semenov 1964; Moss 1983; Poplevko 2007).

Meat knives. The use-wear analysis showed that four Gravette points, one atypical Gravette point made on bladelet, and two microgravettes can be identified as meat knives. They exhibit several diagnostic wear features: the tool edge has bifacial flat irregular micro-retouch; retouch facets edges and the tool edge sections are partially smoothed; retouch facets edges

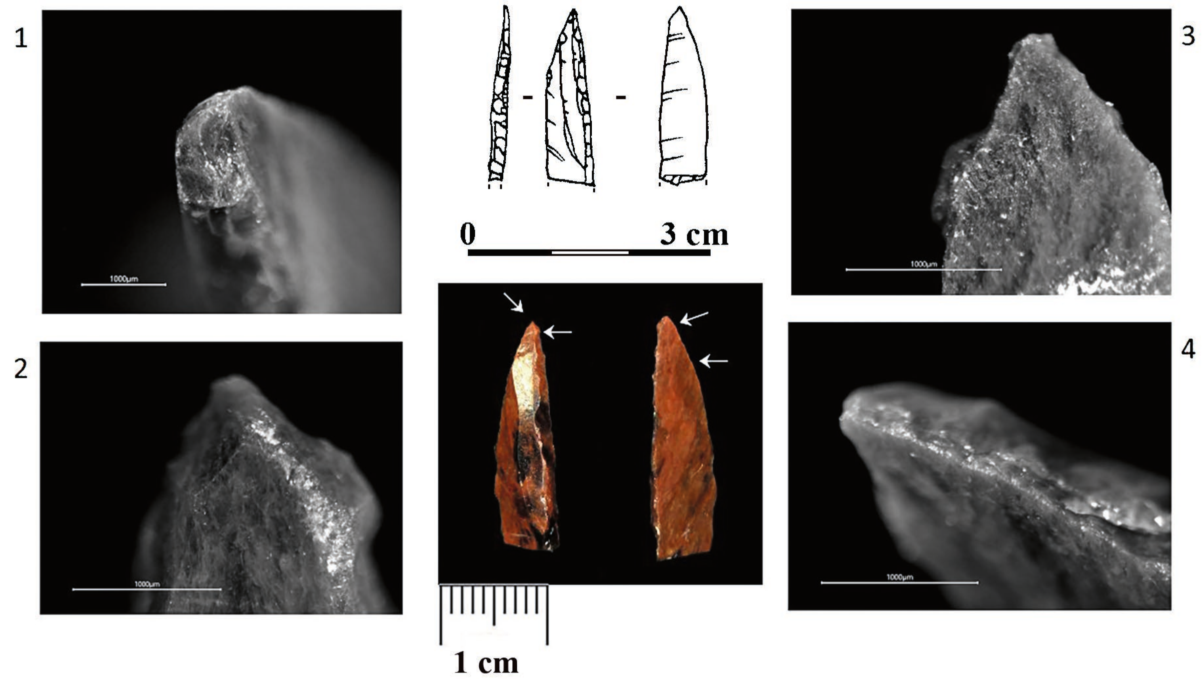

Fig. 10. Sosruko Rockshelter, layer 8, hor. 11. Sample 4: stone awl. 1 – smoothing on the tool tip; 2 – micro-crushing on the tool tip; 3 – micro-abrasion on the ventral surface near the tool tip; 4 – rounding the tool edge near the tip.

***Abb. 10.** Sosruko Rockshelter, Schicht 8, Horizont 11. Probe 4: Steinahle. 1 – Glättungen an der Werkzeugspitze; 2 – Micro-crushing an der Werkzeugspitze; 3 – Mikro-Abrieb auf der ventralen Oberfläche in der Nähe der Werkzeugspitze; 4 – Abrundungen der Werkzeugkante in der Nähe der Spitze.*

and the tool edge there are areas of the form-fitting type polish. Below we provide one example.

Sample 5 (layer 8, hor. 14, square D-10; Fig. 11). Dimensions: 3.9 x 0.9 x 0.3 cm. Typological definition: atypical Gravette point on bladelet (the tool is defined as atypical, because only the tool distal part on the right side is fabricated by blunting retouch). Functional identification: meat knife (lithic insert). The tool is made on blade from light gray flint.

The tool base (proximal end) edge has a micro-crushing area and fractures on the dorsal surface and bright polish smoothing the striking platform edge on the ventral surface (Fig. 11: 3). Bright polishing is also traced on the protruding area of the impact bulb and partially on the tool edge on the right side (Fig. 11: 4). On the ventral surface of the tool proximal end, polishing spreads over a large area, is distinctly spotty, hugging the micro relief of the ventral surface, which is characteristic of "wood polishing" (Semenov 1964; Poplevko 2007).

The tool right side is partially straightened by dorsal abrupt and semi-abrupt retouch that forms a back. On the dorsal and ventral surfaces along the tool edge, there are micro-fractures and single-row micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. The tool edge is straight in plan view and finely denticulate in profile. Bright polishing going mainly along the retouch facets ridges and partially entering facets is traced along the tool edge from the dorsal surface. The protruding area of the tool edge is rounded and there are areas of bright polish, forming continuous stripes in some parts from the dorsal surface. There are micro-crushing areas on protruding ridges along the tool edge. This complex of microwear traces on the tool edge and polishing at the tool proximal end are DHTs indicating that the tool was hafted in a wood haft.

On the left side, there are areas of flat micro-retouch and micro-fractures on both the dorsal and ventral surfaces. The tool edge is wavy in plan view and finely denticulate in profile, and smoothed in several areas (Fig. 11: 2). On protruding ridges, there are polishing spots that not spread on the tool surface (Fig. 11: 1). The polishing is not very bright and has greasy sheen.

The traceological study indicates that most (19 pieces; 69 %) of typologically defined Epipaleolithic points in Sosruko Rockshelter were served as projectile tips, including 14 Gravette points, one Vachons point, one microgravette, one shouldered point, and two fragments of tanged points (Tab. 3). Also, four Gravette points, two microgravettes and one atypical Gravette point were used as meat knives, as well as one Gravette point fragment is identified as a tool for butchering meat/skin and one distal fragment of Gravette point is identified as a stone awl. The three shouldered and tanged points were used exclusively as projectile tips. Only one tool (microgravette point; sample 3) provides evidence of secondary use: the reuse of a projectile tip as a meat knife in this case.

In the analyzed collection, most lithic points are fragmented. Complete backed points include four Gravette points and one Vachons point; all complete

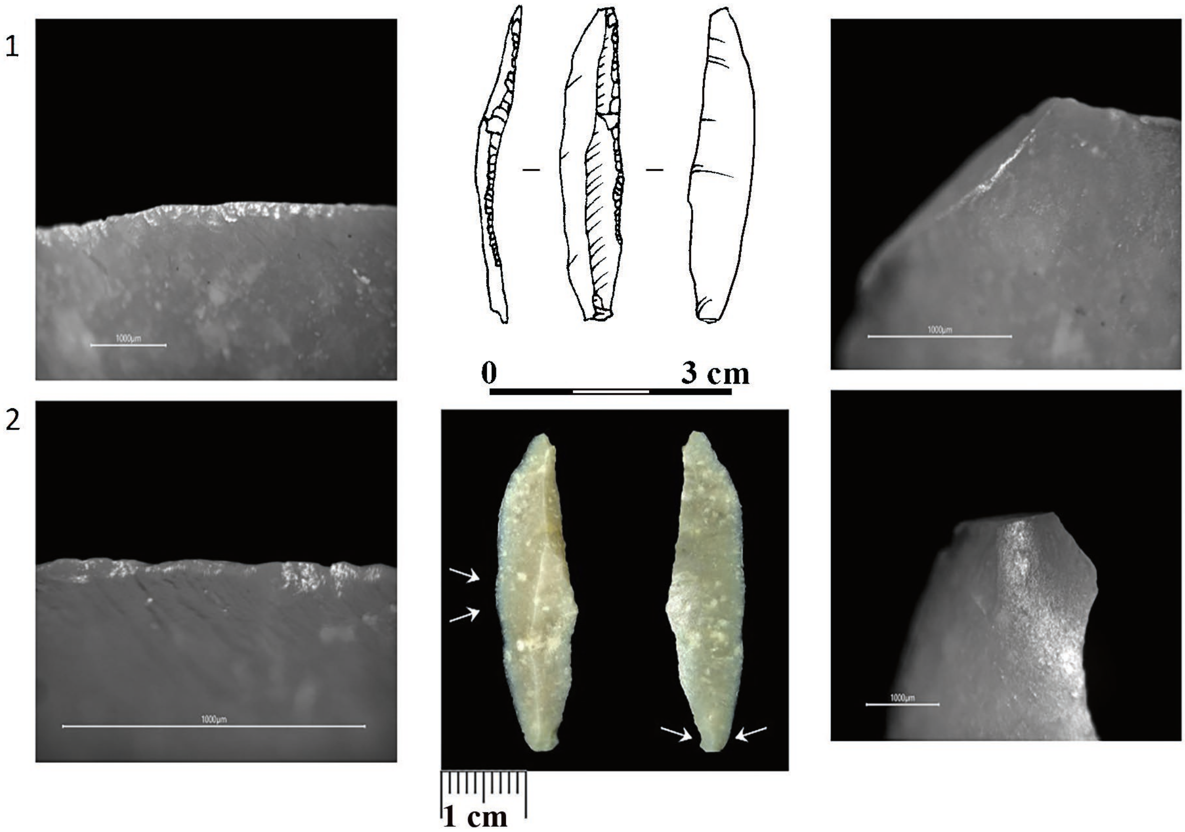

Fig. 11. Sosruko Rockshelter, Layer 8, hor. 14. Sample 5: meat knife (lithic insert). 1, 2 – polishing on ridges along the tool edge; 3 – polishing on retouch facets edges; 4 – polishing near the tool base.

Abb. 11. *Sosruko Rockshelter, Schicht 8, Horizont 14. Probe 5: Fleischmesser (lithischer Einsatz). 1, 2 – Polituren auf Graten entlang der Werkzeugkante; 3 – Polituren an den Kanten der Retuschiernegative; 4 – Polituren in der Nähe der Basis des Werkzeugs.*

points were identified as projectile tips. The overwhelming majority of the analyzed lithic points exhibits DHTs, such as the presence of bright, mirror-type polishing localized on retouch facets along the tool lateral edge and at the tool base edge, indicating that these tools were hafted in wood hafts. Only one tool (microgravette point; sample 3) has diagnostic traces of hafting in a bone/antler haft.

Psytuaje Rockshelter

In the Epipaleolithic assemblage from layer 2 in Psytuaje Rockshelter, numbering more than three thousand artifacts in total, we typologically identified only twelve lithic points, including four Gravette and six microgravette backed points, and two retouched points (Tab. 4). The traceological analysis identified that a symmetrical retouched point was used as a projectile tip and an asymmetrical retouched point served as a stone awl. Among backed points, all four Gravette points and most of microgravettes (four) served as projectile tips, as well as two microgravettes were used as a meat knife and a tool for butchering meat/skin.

Projectile tips. The lithic points defined as projectile tips are characterized by the presence of step terminating bending micro-fractures (spin-offs) at the tool tip, as well as hinge terminating micro-scars on the tool tip and impact burinations on the lateral edge near the tip are defined on three complete points and three distal fragments. On bases of three complete points and two proximal fragments, we defined the presence of crushing along the tool base edge, which looks like a uniform, flat micro-scarring in magnification, that we interpreted as DHTs associated to the tool friction and motion in a haft. Based on the characteristic polishing, it can be assumed that the tools were hafted in wood hafts. Of the nine lithic points defined as projectile tips, five are represented by fragments that exhibit the characteristic transverse CSF. Below are some examples.

Sample 1 (layer 2, hor. 3, square P-1; Fig. 12). Dimensions: 3.6 x 0.9 x 0.4 cm. Typological definition: symmetrical retouched point. Functional identification: projectile tip (lithic insert). The tool is made on a three-ridged bladelet from gray, locally almost white flint.

At the tool tip, there is a small fracture and several micro-scars on the dorsal and ventral surfaces. On tool edges near the tip, there are micro-retouch areas and several micro-fractures on the dorsal and ventral surfaces. The tool edge has areas of spotty, not very bright, and non–spreading polishing, having a greasy sheen (Fig. 12: 3).

The right side is straightened by dorsal abrupt retouch. The side is straight in plan view and finely denticulate in profile. On the dorsal surface along the tool edge, there are micro-fractures and single-row

Typological definition of lithic point type	Preservation	Functional definition				Total
		Projectile tip	Awl	Meat knife	Tool for butchering meat/skin	
Gravette point	complete	1	-	-	-	-
	distal fragment	2	-	-	-	-
	proximal fragment	1	-	-	-	-
Microgravette	complete	2	-	1	-	-
	distal fragment	1	-	-	1	-
	proximal fragment	1	-	-	-	-
Retouched point	complete	1	-	-	-	-
	distal fragment	-	1	-	-	-
Total		9	1	1	1	12

Tab. 4. The correlation of typological and functional (traceological) definitions of lithic points from the Epipaleolithic layer 2 in Psytuaje Rockshelter.

Tab. 4. *Die Korrelation von typologischen und funktionalen Bestimmungen der lithischen Spitzen aus der epipaläolithischen Schicht 2 des Psytuaje Rockshelters.*

micro-retouch, with two-row micro-retouch in some areas. The micro-retouch facets are clearly outlined. The tool edge is straight, partially rounded, with micro-crushing areas on protruding ridges. There are several areas of bright polishing along the tool edge.

The left side has irregular single-row and two-row micro-retouch from both the dorsal and ventral surfaces. The side is almost straight both in plan view and in profile. Along the tool edge and near the edge, there are areas of bright polishing from the ventral surface (Fig. 12: 4).

The tool base is worked by a dorsal abrupt retouch, with micro-abrasion areas on protruding ridges. The tool edge is partially rounded and has polishing areas. The polishing is quite bright, not spreading and rarely forming continuous stripes, and is represented mainly

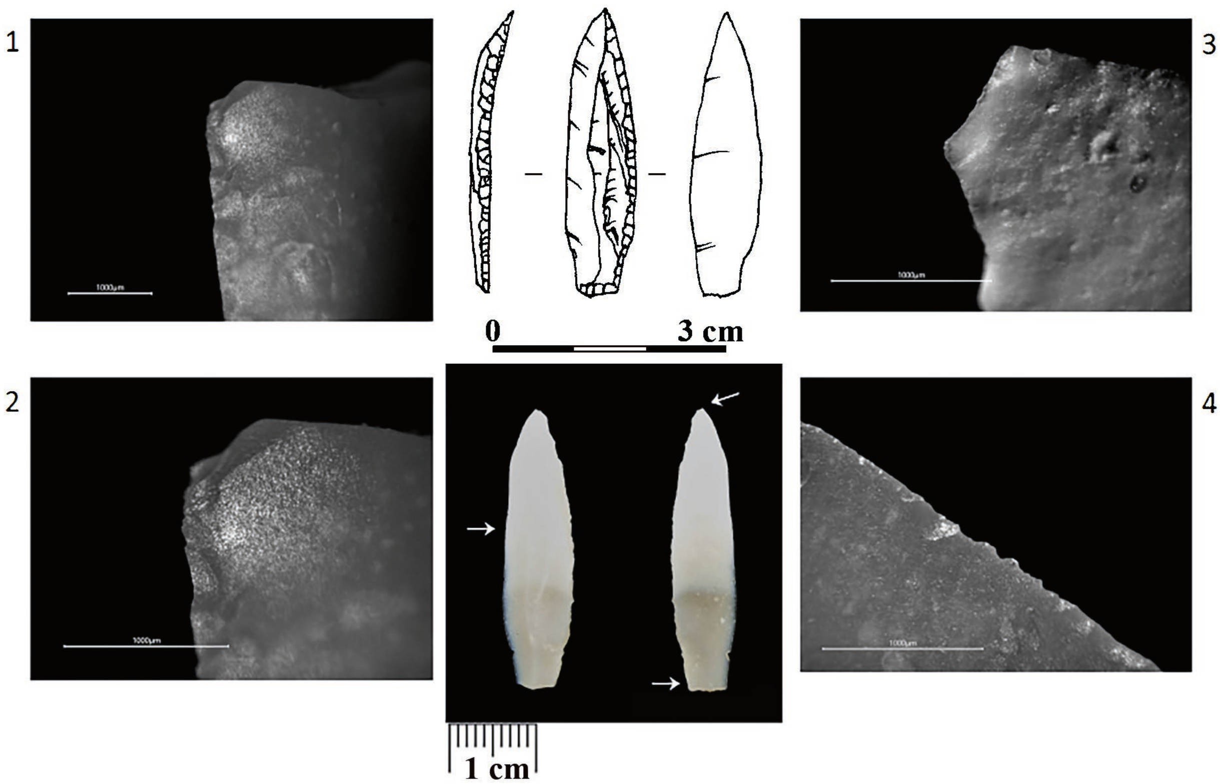

Fig. 12. Psytuaje Rockshelter, layer 2, hor. 3. Sample 1: projectile tip (lithic insert). 1 – polishing along the tool edge; 2 – polishing in retouch facets; 3, 4 – polishing on the ventral surface near the tool tip.

Abb. 12. *Psytuaje Rockshelter, Schicht 2, Horizont 3. Probe 1: Projektilspitze (lithischer Einsatz). 1 – Polituren entlang der Werkzeugkante; 2 – Polituren auf den Negativflächen der Retusche; 3, 4 – Polituren auf der ventralen Fläche in der Nähe der Werkzeugspitze.*

on protruding areas near the tool edge (Fig. 12: 1 & 2). This polishing type indicates that the tool was probably hafted in a wood haft.

Sample 2 (layer 2, hor. 1, square P-3; Fig. 13). Dimensions: 3.7 x 0.7 x 0.4 cm. Typological definition: Gravette point with broken tip. Functional identification: projectile tip (lithic insert). The tool is made on bladelet from gray lint.

The tool tip is broken. Along the transverse fracture there are areas of dorsal and ventral micro-retouch and several spin-offs micro-fractures. On the tool edge near the fracture, there are areas of bright, non-spreading polishing that has a little greasy sheen (Fig. 13: 1).

The right side is straight in plan view and finely denticulated in profile. A dorsal abrupt retouch covers the area from the tool base to half of this side, and a fine dorsal retouch covers the upper half of the right side. Along the tool edge from the dorsal surface, there are micro-fractures, single-row micro-retouch, and two-row micro-retouch in some areas. Micro-retouch facets are clearly outlined. The tool edge is straight, partially rounded, with micro-crushing areas on protruding ridges. Along the tool edge there are areas of bright polishing, covering mainly the retouch facets ridges and sometimes entering the facets.

On the left side, there is irregular single-row and double-row microretouch from the dorsal and ventral surfaces. The side is slightly wavy in plan view and sparsely denticulated in profile. Along the tool edge from the ventral surface, there are areas of bright polishing (Fig. 13: 2 & 3).

The tool base is partially smoothed, with micro-abrasion areas on protruding ridges. Along the striking platform edge, there are areas of bright polishing (Fig. 13: 4), presumably resulted from the tool hafting in a wood haft.

Sample 3 (layer 2, hor. 3, square P-3; Fig. 14). Dimensions: 3.3 x 0.7 x 0.4 cm. Typological definition: Gravette point. Functional identification: projectile tip (lithic insert) secondary used as a stone awl. The tool is made on bladelet from gray lint.

On the tool tip, there are two scars and spin-off micro-fracture areas. On the right and left tool edges near the tip, there are micro-retouch and micro-fracture areas from mainly dorsal and rarely ventral surface. Spot polishing is traced along the tool edges and on protruding ridges. The polishing is dull, does not spread from the tool edge, and has a greasy sheen. The retouch facets ridges and tool edges are smoothed on some areas. There are lateral flat burin-like impact fractures (impact burinations) coming from the tool tip that are DIFs used to identify projectile tips (Lombard 2005). The secondary use of the tool as an awl is indicated by the presence of a polished area on the edge of the lateral impact burination and

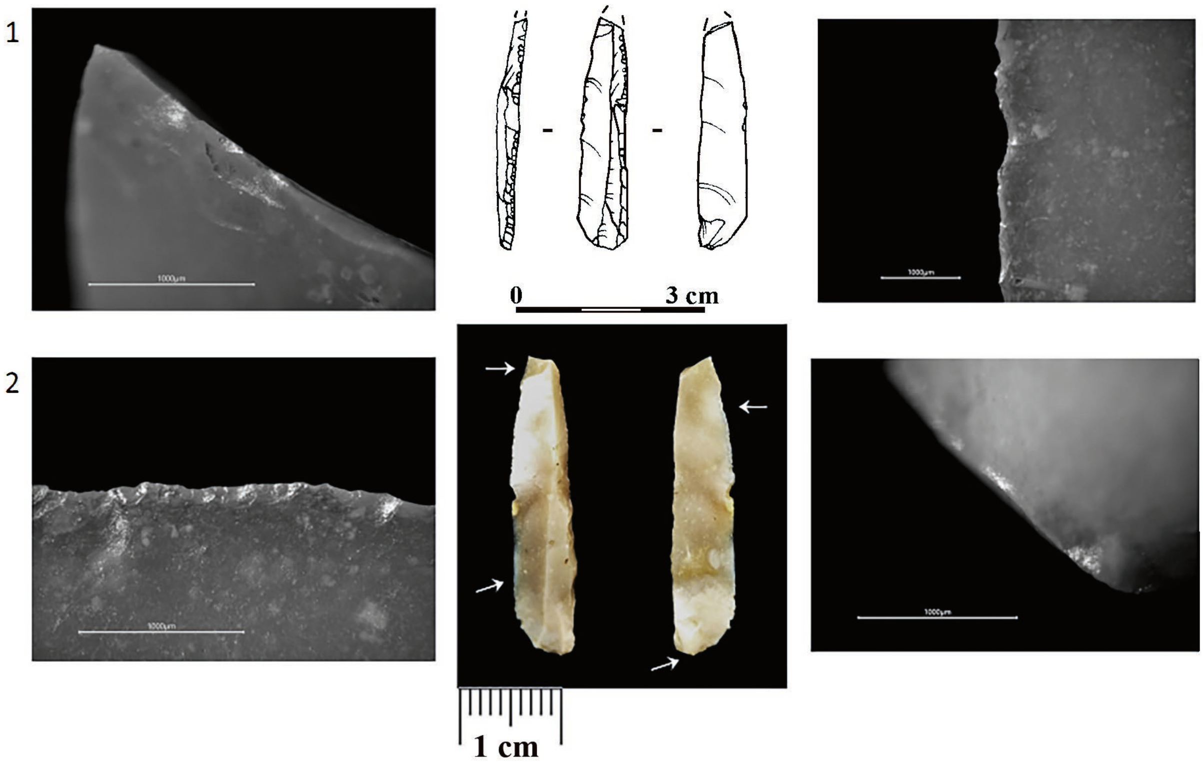

Fig. 13. Psytuaje Rockshelter, layer 2, hor. 1. Sample 2: projectile tip (lithic insert).1 – polishing on the tool base (proximal end); 2 – polishing in retouch facets; 3, 4 – polishing on the tool edge.

Abb. 13. *Psytuaje Rockshelter, Schicht 2, Horizont 1. Probe 2: Projektilspitze (lithischer Einsatz). 1 – Polituren an der Werkzeugbasis (proximales Ende); 2 – Polituren auf den Negativflächen der Retusche; 3, 4 – Polituren an der Werkzeugkante.*

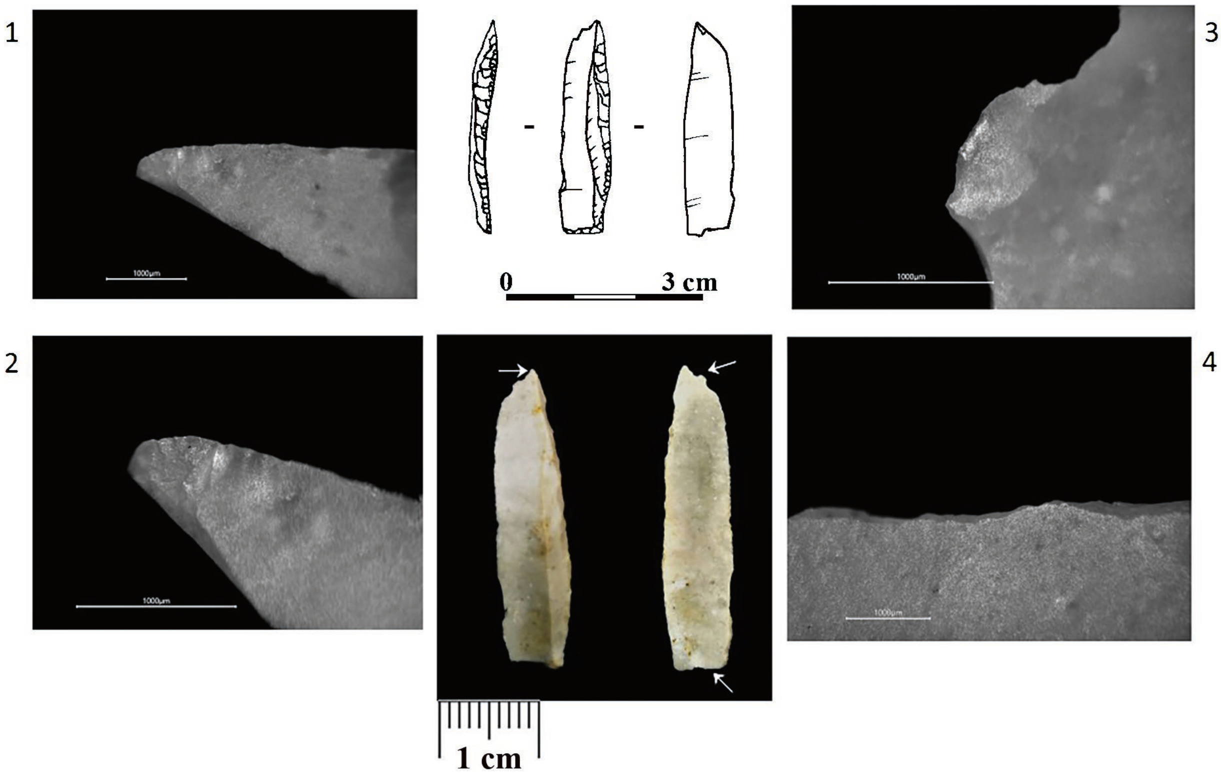

Fig. 14. Psytuaje Rockshelter, layer 2, hor. 1. Sample 3: projectile tip (lithic insert) secondary used as a stone awl. 1, 2 – polishing on the edge of a flat burin-like scar ('lateral impact burination', following Lombard 2005); 3 – polishing on the tool lateral edge; 3, 4 – polishing on the tool base edge.

***Abb. 14.** Psytuaje Rockshelter, Schicht 2, Horizont 1. Probe 3: Projektilspitze (lithischer Einsatz), sekundär als Ahle verwendet. 1, 2 – Polituren am Rand eines flachen, stichelartigen Negativs (seitlicher Stichelschlag); 3 – Polituren an der lateralen Kante des Werkzeugs; 3, 4 – Polituren an der Kante der Basis des Werkzeugs.*

micro-scars that initiate from the same fracture on the dorsal surface (Fig. 14: 1 & 2).

The right side is partially straightened by dorsal abrupt retouch that forms a back. Along the tool edge from the dorsal surface, there are micro-fractures and single-row micro-retouch, with areas of two-row micro-retouch. The retouch facets are clearly outlined. The side is straight in plan view and finely denticulate in profile. The tool edge is straight, with micro-crushing areas on protruding ridges.

The left side has irregular single-row and double-row micro-retouch from the dorsal and ventral surfaces. The side is almost straight in the plan view and in profile. The proximal end of the tool edge on the left side is partially smoothed, and spot polishing is traced in some areas (Fig. 14: 3).

The tool base is worked by a dorsal abrupt retouch. On the tool base edge, there are micro-scarring and micro-fracture areas. On protruding ridges and retouch facets along the tool base edge, there is a bright spot polishing, forming thin stripes in some areas (Fig. 14: 4). These features indicate that the tool was hafted in a wood haft.

Awl. The smoothing of tool edges and the presence of micro-scarring along tool edges near the tip are characteristic wear traces used to identify awls (Semenov 1964; Poplevko 2007).

Sample 4 (layer 2, hor. 4, square P-3; Fig. 15). Dimensions: 3.5 x 1.1 x 0.5 cm. Typological definition: the distal fragment of atypical asymmetric retouched point. Functional identification: stone awl. The tool is made on bladelet with cortex areas from gray translucent lint with whitish inclusions. The tool base is broken from the ventral surface.

At the tool tip, there are micro-scars and three flat burin-like scars going from the tip on the dorsal surface. On the ventral surface near the tool tip, there are areas of spotty polishing along the tool edge (Fig. 15: 3 & 4). Micro-fractures on protruding ridges and areas of abrupt and semi-abrupt micro-retouch are present along the tool edges from the dorsal surface. There is bright polishing, with a greasy sheen (Fig. 15: 1 & 2), along the tool edges and the retouch facets ridges near the tip. The smoothness of tool edges near the tip and on adjacent lateral sides indicate that the tool was used for piercing soft material.

The left and right sides of the tool are almost straight in plan view and wavy in profile. Areas of irregular, flat micro-retouch are traced on both sides from the dorsal and ventral surfaces. The tool edges are partially smoothed, while micro-retouch facets are clearly outlined. There are spots of bright, mirror-type polishing, partially entering the retouch facets, on several protruding areas and on retouching ridges.

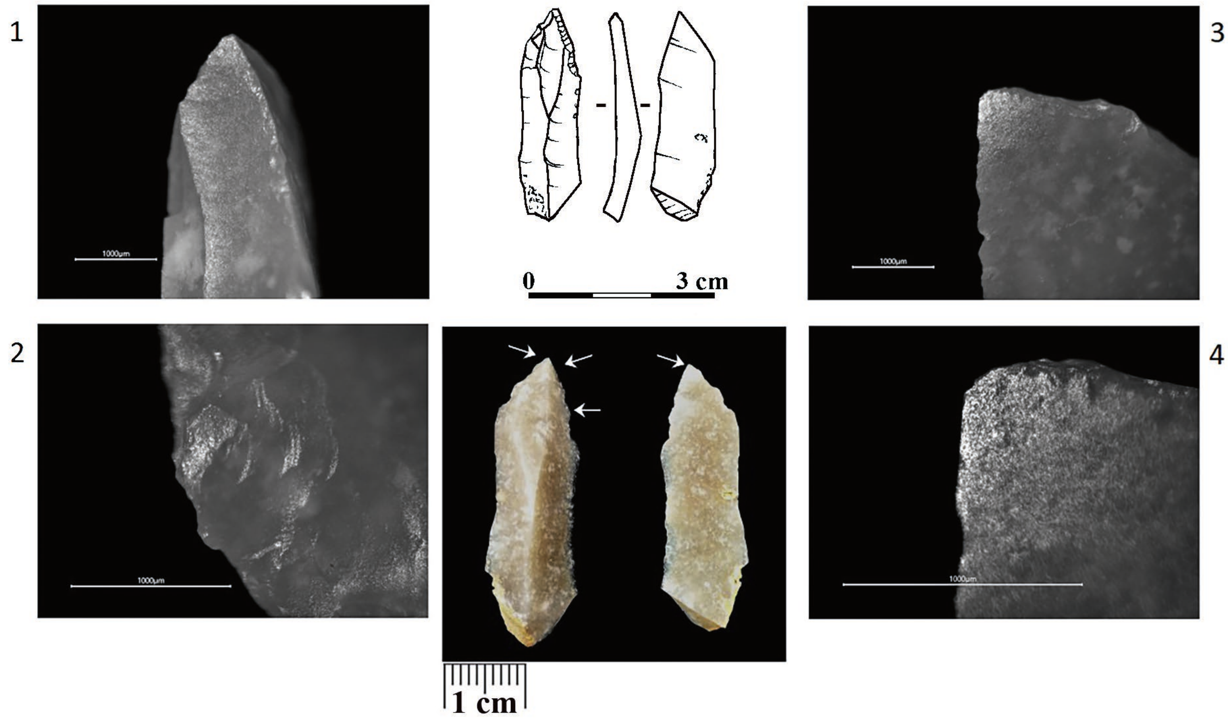

Fig. 15. Psytuaje Rockshelter, layer 2, hor. 4. Sample 4: stone awl. 1 – polishing near the fracture surface; 2, 3 – polishing on the tool edge; 3, 4 – polishing on the tool base edge.

Abb. 15. *Psytuaje Rockshelter, Schicht 2, Horizont 4. Probe 4: Steinahle. 1 – Polituren in der Nähe der Fraktur; 2, 3 – Polituren an der Werkzeugkante; 3, 4 – Polituren an der Kante der Basis des Werkzeugs.*

Meat knife. Sample 5 (layer 2, hor. 4, square P-3; Fig. 16). Dimensions: 1.9 x 0.5 x 0.2 cm. Typological definition: microgravette point with broken tip. Functional identification: meat knife. The tool is made on microbladelet from light brown flint with areas of faint bluish-white patina on the ventral surface.

The tool distal end (tip) has flat micro-scars and micro-fractures from the dorsal surface.

At the proximal end, there are micro-scars and micro-fractures from the dorsal surface. At the point tip (distal end), there are micro-scarring and micro-fracture areas along tool edges from mainly the dorsal and more rarely ventral surface. Spot polishing is traced along the tool edges and on retouch ridges (Fig. 16: 1). The polishing is dull, not spreading from the edge to the tool surfaces, and has a greasy sheen. Retouch ridges and tool edges are smoothed in some areas.

The right side is straightened by a dorsal abrupt retouch that forms a back. The side is straight in plan view and finely denticulate in profile. Along the tool edge from the dorsal surface, there are micro-fractures, single-row micro-retouch, with double-row micro-retouch in some areas, and regular micro-crushing. The retouch facets are clearly outlined. Polishing spots are traced in several retouch facets (Fig. 16: 2). These wear traces on the tool edge are the DHTs associated to the tool friction and motion in a haft.

On the left side, there are several flat scars and micro-retouch areas on the dorsal and ventral surfaces. The side is almost straight in plan view and sparsely denticulated in profile. Areas of bright polishing entering retouch facets are traced along the retouch facets ridges (Fig. 16: 3 & 4). The wear features described above indicate this small stone insert was used for cutting meat, probably as a cutting side element of a composite tool.

Finalizing the analytical results, we note that the small assemblage of lithic points from Psytuaje Rockshelter is generally similar to the lithic point assemblages from Mezmaiskaya Cave and Sosruko Rockshelter both in the typological composition of points and their functional use (Tab. 4). A single complete symmetrical retouched point from Psytuaje was identified as a projectile tip, like symmetrical retouched points in Mezmayskaya. Another retouched point from Psytuaje, represented by the distal fragment of an atypical asymmetric point, is defined as an awl, and is rather an exception. Among backed points (Gravette and microgravette) most were functionally served as projectile tips. However, only in the Psytuaje assemblage we determined the secondary use as awls for lithic points that primary function was projectile tips. The use as a meat knife and a tool for butchering meat/skin was also defined for two microgravettes at Psytuaje. Such usage of both Gravette and microgravette points is also typical for the Epipaleolithic assemblages from Mezmaiskaya and Sosruko.

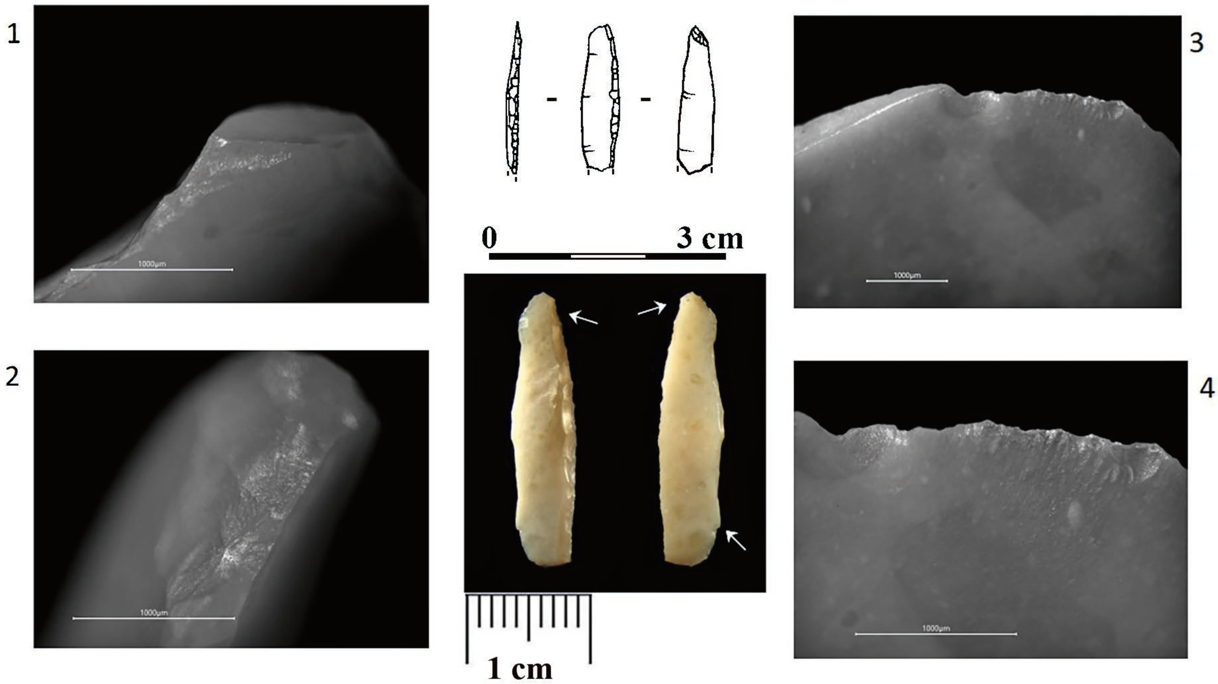

Fig. 16. Psytuaje Rockshelter, layer 2, hor. 4. Sample 5: meat knife. 1, 2 – polishing near the tool base; 3 – polishing near the fracture surface; 3, 4 – polishing on the tool edge.

Abb. 16. *Psytuaje Rockshelter, Schicht 2, Horizont 4. Probe 5: Fleischmesser.1, 2 – Polituren in der Nähe der Basis des Werkzeugs; 3 – Polituren in der Nähe der Fraktur; 3, 4 – Polituren an der Kante des Werkzeugs.*

Discussion

Previous morphometric, experimental and functional studies that examined lithic point assemblages dated from the Late Glacial in Europe and West Asia (Fischer et al. 1984; Plisson 2005; Lemorini et al. 2006; Ziggiotti 2006, 2008; Borgia 2008a, 2008b; Riede 2009, 2010; Pétillon et al. 2011; Dev & Riede 2012; Kabacinski et al. 2014; Sano & Oba 2015; Duches et al. 2018, 2020; Hilbert et al. 2021) have demonstrated that various types of lithic points known from different chrono-cultural contexts most typically functioned as inserts (lateral cutting elements, lateral barbs or axial piercing tips) into composite projectiles that most likely used for hunting. Some researchers noted the lack of direct correlation between the point morphological type and its function (Macdonald 2013), or proposed a bi-functional use of some points (Harrold 1993).

Many scholars assume that the bow-arrow system was widely applied to launch these projectiles in Europe during the Late Glacial (Cattelain 1997; Pelegrin 2000; Dev & Riede 2012; Serwatka 2018; Duches et al. 2018, 2020). In particular, functional morphometric analyses of Late Glacial lithic points assemblages from northern Europe provided indirect data that the small Hamburgian shouldered points, Federmesser arch-backed and Ahrensburgian small tanged points have ballistic characteristics suggesting they most likely were part of the bow-arrow system, while large tanged points most likely tipped throwing spears or darts propelled with the help of a spear-thrower/atlatl (Riede 2009, 2010; Dev & Riede 2012). However, a morphometric analysis does not reveal actual functions of archaeological lithic points and provides insights into only potential projectile capabilities of these points in the analyzed materials (Sano & Oba 2015). Besides, the oldest direct archaeological evidence of the bow-arrow technology in Europe are finds of bow fragments and arrowshafts from Stellmoor in Germany (12.6–11.5 ka calBP; Rust 1943; Litt & Stebich 1999) and probably an impact mark made by a lithic backed tool on a bear bone from Cornafessa rockshelter in Italy, dated from the same period (Younger Dryas, 12.2–11.4 ka calBP; Duches et al. 2019). Finds of spear-throwers are also known in Europe from the Late Glacial period (Cattelain 2004).

The projectile experiments aimed to the study of lithic points as projectile elements are primarily focused on analyzing patterns of diagnostic impact fractures (DIFs) on stone inserts in composite projectiles. Various controlled experiments have included the replication and use of Gravettian backed points (Cattelain & Perpère 1993, 1996; Soriano 1998; O'Farrell 2004; Borgia 2008b) and Font-Robert points (Lansac 2004), Solutrean shouldered points and tanged points (Geneste & Plisson 1993; Márquez & Muñoz 2008), and Azilian points (Plisson 2005). Some controlled projectile experiments involved osseous points with lithic inserts (Stodiek 2000; Nuzhnyj 2007; Pétillon 2009; Pétillon et al. 2011). In particular, the recent projectile experiments conducted with backed point replicas at four different projectile systems of thrusting, throwing, spearthrower, and bow exhibit a correlation with impact trace patterns (Sano & Oba, 2015). However, the researchers note that this correlation is dependent from several parameters, especially the points sample size and lithic raw materials.

And beyond that, there is not sufficiently extensive archaeological evidence that the Upper Paleolithic backed points were mounted on the top of a shaft similarly a metal spear/arrow tip, like in the projectile experiments conducted by Sano and Oba (2015: Fig. 2). Although scholars (e.g., Soriano 1998; Nuzhnyj 2007) proposed that some Upper Paleolithic lithic points could have served as axial tips of stone-tipped composite projectile weapons, the archaeological evidence in support of this hafting model, such as the finding of several lithic points with the damage and fractures suggesting an axial impact at the Gravettian occupation at Les Prés de Laure (Antonin et al. 2018), is still limited in Eurasia. Not without reason, Antonin et al. (2018) underline that this hypothesis needs to be further tested with a larger archaeological sample.

Backed points are the most common stone point morphology for the Upper Palaeolithic assemblages in West Eurasia, including during the Late Glacial. Functional analyses of backed points from different chrono-cultural contexts provide insights into the actual functions of these tools, and the results indicate that backed points were more diversely used in some cases. In particular, functional analyses carried out on Late Epigravettian assemblages of northeastern Italy (Lemorini et al. 2006; Ziggiotti 2006, 2008) indicate the exclusive use of lithic backed tools as elements in composite hunting projectiles, with a backed point functioned as a piercing element (projectile tip) and backed bladelets as lateral cutting elements. These conclusions are supported by experimental tests by Duches et al. (2018). The use-wear and residue analyses of eleven lithic backed points from a Gravettian layer dated to 25–23.5 ka calBP at Les Prés de Laure (France) supported by experimental tests using replicated barbed composite projectiles indicate that the Gravettian backed points served as side elements (barbs), mounted obliquely in a bone projectile (Antonin et al. 2018). However, clear evidence such as damage and DIFs to suggest an axial impact on the Upper Paleolithic backed points in Europe is limited. Archaeological findings known from the LGM and Late Glacial contexts in Europe indicate only the presence of composite projectiles with a backed point functioned as a lateral piercing element and backed bladelets as lateral cutting elements (Pétillon et al. 2011; Duches et al. 2018), as well as bone/antler barbed projectiles without lithic inserts (not composite) (Pétillon 2016).

In the two aforementioned Gravettian and Epigravettian contexts, researchers did not find any evidence of other use on the analyzed backed points, but only wear traces and DIFs related to the tools functional use as tips or barbs of composite projectiles (Duches et al. 2018; Antonin et al. 2018). However, the earlier study of a large sample (1,451 pieces) of Gravette points from ten Gravettian sites in southwestern France (Harrold 1993) showed that they were alternatively used as knives or as projectile tips. The analysis of tools dimensions, microwear traces and the design of tools bases indicated a continuum of shapes in regard to the functional variability from knives to projectile tips, and that typical tips and typical knives did not constitute separate morpho-functional clusters. Despite the results, the author noted that there was a tendency to use the longer and wider Gravette points as knives, not projectile tips. Also, the author proposed that in some cases the same tool could be alternatively used as knife or as a projectile tip.

In the Near East, the wear and residue analysis supported by experimental tests indicated a probable use as projectile barbs for Kebara points—the type of backed points known from the Kebaran and Geometric Kebaran Epipaleolithic industries in the Levant (Yaroshevich et al. 2010). In Iran, the functional analysis of lithic artifacts from Kaldar Cave (Tumung et al. 2020) has provided the first reliable data about the function of lithic points known from the Zagros Upper Paleolithic. Among the five analyzed points, one tanged point and one Arjeneh-type retouched point show DHTs on the base, and one pointed bladelet shows DIFs on the tip, indicating that the three tools were possibly used as projectile tips. Also, a functional analysis of several arch-backed points from Mutafah 1, a 30 ka old Upper Paleolithic site in Oman, in South Arabia, indicates that most of them served as projectile barbs, while some also could have an alternative function—to serve as cutting tools in processing soft organic materials (hides or food) (Hilbert et al. 2021).

In the North Caucasus Epipaleolithic, the only previous traceological study was carried out for the lithic assemblages from Gubs 5 (Chygai) Rockshelter and Dvoinaya Cave (Alexandrova 2014). Although different point types are known from these sites, including Gravette, symmetrical retouched and shouldered points (see Golovanova & Doronichev 2020), the functional study was performed without dividing the analyzed points into types. Alexandrova identified that lithic points had different functional applications: arrowhead, tool for woodworking, burin for solid organic material, awl, and others. She concluded that the overwhelming majority of analyzed points served as arrowheads: 20 from 24 points at Chygai (layers 10–14) and 61 from 63 points at Dvoinaya Cave (layer 7). However, Alexandrova (2014) did not report any results of relevant experiments to confirm her conclusion about the use of the bow-arrow system during the Late Glacial in the northwestern Caucasus.

In our study, we for the first time typologically separated all lithic points from three Epipaleolithic sites located in different regions of the North Caucasus into distinct tool types, following typological definitions after (Golovanova & Doronichev 2020). The typological analysis showed that the lithic points known in the North Caucasus Epipaleolithic comprise mainly symmetrical retouched points, varieties of backed points, such as Gravette, microgravette and Vachons points, and shouldered points. The subsequent traceological analysis indicated that symmetrical retouched points in all three sites were exclusively used as projectile tips. Backed points were also primarily served as projectile tips, and, like other Upper Paleolithic contexts in Europe and Asia, sometimes had other functional use as awls, meat knives, and tools for butchering meat/skins.

Backed points are the most common stone point morphology for the Epipaleolithic assemblages in the North Caucasus, dating from the Late Glacial. Among the analyzed 33 backed points from layer 1-3 at Mezmaiskaya Cave, 20 tools (58.8 %) are identified as projectile tips, and the rest as meat knives, awls, and tools for butchering meat/skin. In Sosruko Rockshelter, 66.7 % of backed points are identified as projectile tips. In layer 2 at Psytuaje Rockshelter, 8 out of 10 backed points are identified as projectile tips. Evidence of hafting in a wood haft is identified on most of the analyzed backed points, while DHTs indicating tool hafting in a bone/antler haft are found only on one backed point from Mezmaiskaya and one backed point from Sosruko. Shouldered and tanged points are represented by single specimens from Mezmaiskaya and Sosruko. All of them are identified as projectile tips. Only the shouldered point from Mezmaiskaya has DHTs indicating the tool hafting in a bone/antler haft.

The traceological analysis also detected three cases of reusing lithic points originally served as projectile tips for other actions. In Sosruko Rockshelter, a microgravette point originally used as projectile tip was reused as a meat knife. In Psytuaje Rockshelter, two lithic points originally used as projectile tip were reused as awls.

Finalizing the discussion, it is worth noting that we did attempt to identify weapon delivery (launching) modes for the analyzed lithic point assemblages. The archaeological samples that we have studied from each site are small and so numerically insufficient for such analysis. Modern projectile experiments using different types of stone tips, including backed points (see Sano & Oba 2015), indicate that there are no unequivocal, universal criteria for identifying launching modes of archaeological points. Despite the researchers note a correlation between impact trace patterns and different projectile launching modes, they underline that the definition of launching modes in archaeological samples requires a quantitatively sufficient sample size of points and is dependent from other parameters too, especially the lithic raw materials used for points. Moreover, any such investigation should refer to criteria resulting from relevant experiments with the same types of lithic points made from the same lithic raw materials.

Conclusions

The results of the traceological study of lithic points from three Epipaleolithic sites in the North Caucasus coincide in general with conclusions made by other researchers for the Upper Paleolithic/Epipaleolithic lithic point assemblages in Europe and the Near East. Our results indicate that most of the analyzed lithic points served as tips (lithic inserts) of composite weapons. Also, the rare usage as awls, meat knives and tools for butchering meat/skins was identified only for some backed points, including varieties of Gravette, microgravette and Vachons points. Similar functional use was also noted for backed points in some other sites in West Eurasia. In addition, evidence of reusing projectile tips in other actions (butchering and skin working) was found on several lithic points.

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Contributor roles: traceological analysis and visualization (ER, GP), conceptualization and lithic analysis (LG, ED, VD), funding acquisition (LG, ED), writing original draft (LG, ER, ED, VD).

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