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The Sartan Upper Paleolithic Assemblages of the Northwestern Altai

This article highlights the results of comprehensive studies at Sartan cave and open-air sites (MIS 2) in the northwestern Altai. Their stratigraphic profiles include loam layers, often with geest. Absolute dates are discussed, as well as the relative stratigraphic position of lithological layers within profiles of stratified Pleistocene sites, using available paleoenvironmental data. The Sartan sites of the region are base-camps with a complete sequence of raw material reduction. Such a combination of base-camp and workshop features indicates the proximity of raw material sources. The main hunting targets were animals inhabiting mosaic landscapes. Sites correlated with various stages of the Sartan glaciation have yielded stone and bone assemblages of the final stage of the regional Upper Paleolithic. Petrographic characteristics of lithic assemblages and sources of raw material are evaluated. Typological and technological properties of industries are listed. The Late Upper Paleolithic of southern Siberia reveals a combination of Upper and Middle Paleolithic features, evidencing cultural conservatism. These industries are rather similar to those of central, southeastern, and northeastern Altai and to contemporaneous industries of southern Siberia.

Keywords: *Sartan glaciation, Final Upper Paleolithic, northwestern Altai, lithic assemblages, bone assemblages, petrographic composition, artifact typology.*

Introduction

Many sites of the Final Upper Paleolithic are known from the Altai. Unfortunately, most of them do not have reliable chronological attribution (Pavlenok, 2018), except for the sites in the northwestern Altai: their relationship with various climatic and stratigraphic units of the Sartan period has been established (Fig. 1). These are multilayered sites in caves (layers 9, 9.1, 6, 5 in the central chamber and in the entrance zone to Denisova Cave, layers 14b–11a in Kaminnaya Cave, and layers 5b, 4c in Iskra Cave) and on open spaces (layers 4–2 at Ust-Karakol I, horizons 5–3 at Anuy-2) in the Anuy River basin. In the profiles of Denisova and Kaminnaya caves, the Sartan materials occur above the technocomplexes of various stages of the Paleolithic and underlie materials from the Neolithic to the period when the traditional culture of the modern ethnic groups emerged. In Iskra Cave, the Final Paleolithic industries, embedded in the base of the loose stratum, include material complexes of Neolithic and Paleometal cultures. At the site of Ust-Karakol I, in the Sartan culture-bearing deposits which were underlain by lithological bodies, technocomplexes have been discovered pertaining to the period starting from the Early Paleolithic. At the site of Anuy-2, Karga cultural deposits occur below the Sartan deposits. The sites of the region, including multilayered sites of the Lower and Middle Paleolithic, constitute the basis for reconstructing the sequential peopling of the territory of the Russian Altai by early and late hominids, and establishing the boundaries of spatial and temporal transformation of traditions on the initial and final stages of the cultural development (Derevianko, 2012).

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Fig. 1. Upper Paleolithic sites in the northwestern Altai.

The Sartan deposits in caves are loams enriched with the products of limestone disintegration. Sometimes, cave deposits are filled with products of diverse mineralogical composition, which enter the caverns from the outer surface (Derevianko et al., 1995; Arkheologiya…, 1998; Prirodnaya sreda…, 2003). The loose strata of open sites include loess loams slightly enriched with detrital material that resulted from the destruction of closely located outcrops of bedrock, and sometimes forms block and gravel fragments in the profiles of slopes and low terraces (Prirodnaya sreda…, 2003).

The chronology of the sites is based on the results of absolute dating and evidence of the relative occurrence of loose rocks in the profiles for which the climatic sequence of the Pleistocene has been established (Arkheologiya…, 1998; Prirodnaya sreda…, 2003; Bolikhovskaya et al., 2011; Derevianko, Shunkov, Markin, 2008). It should be mentioned that considering sedimentation gaps in the deposits at some sites, the correlation of a number of sites with climatic and stratigraphic stages of the Sartan period, proposed by N.V. Kind (1974), shows some degree of conventionality (see *Table*). For example, the Gothenburg Magnetic Excursion (11–13 ka BP) established at layer 2 and set of data indicating the accumulation of deposits in relatively cold conditions may point to the Nyapan stage of layers 4 and 3 covering the Karga soil at Ust-Karakol I. Two layers of the entrance zone of Denisova Cave have also been conventionally attributed to the interstadial warming between the cooling waves of the Sartan glaciation—the Gydan and Nyapan stages. The reason for this attribution was interpretation of sediments covering layer 5 containing developed block and gravel deposits of the maximally cold stage of the Sartan glaciation, the

Chronology of cultural deposits at the sites

Climato-stratigraphic unit	Denisova Cave			Kaminnaya Cave			Iskra
	Stratigraphic unit	OSL-date, BP	Source	Stratigraphic unit	^{14}C-date, BP	Source	Stratigraphic unit
Norilsk stage (≈11,500–10,500 BP)	–	–	–	11a 11b	10,310 ± 330 10,860 ± 360	Derevianko, Markin, 2003	4c ? 5b ?
Taymyr warming (≈11,800–11,500 BP) похолодание ?	–	–	–	–	–	–	–
Kokorevo warming (≈13,000–12,000 BP)	–	–	–	11c	12,160 ± 225	Derevianko, Markin, 2003	–
Nyapan stage (≈15,000–13,000 BP)	–	–	–	11d 12 13 14a	13,550 ± 140 13,870 ± 390 14,120 ± 95 14,550 ± 230	"	–
Interstadial (≈16,000–15,000 BP)	5 ? 6 ?	–	Prirodnaya sreda…, 2003	14b	15,350 ± 240	"	–
Gydan stage (≈22,000–16,000 BP)	9.1 9	21,000 ± 800	Jacobs et al., 2019; Shunkov, Kozlikin, 2014	–	–	–	–

roof of which was dated to less than 11 ka BP. Two layers at the base of the profile in Iskra Cave, comparable to the Norilsk stage and containing abundant large detrital rocks resulting from intensification of weathering processes, were covered by other deposits with Neolithic materials.

The beginning of the Sartan period in the region was associated with a deteriorating natural environment which, according to the spore-pollen indicators of the Anuy-2 profile, caused a significant lowering of the upper boundary of dark coniferous forests. According to the palynological and faunal analysis of evidence from Denisova and Kaminnaya caves, cold and dry conditions prevailed in the next short period, which contributed to increased areas of nival and steppe biocenoses. At the subsequent Nyapan stage, the evidence from Kaminnaya Cave has shown that the climate became milder. The climatic oscillations associated with the Kokorevo interstadial caused the development of mountain-steppe biocenoses with some increase in climate humidity (according to the evidence from Ust-Karakol I) and development of periglacial forest-steppes (according to the evidence from the profile in Kaminnaya Cave). According to the evidence from Kaminnaya Cave, the Norilsk stage had several changes in landscape and climate. The beginning of cooling was the time when periglacial steppes were formed. Further, according to the palynospectra, there were two short-term substages differing in the degree of aridity—thermoxerotic with interstadial steppes and thermohygrotic, which accounts for the development of forest-steppes. At the end of the Norilsk stage, a belt of periglacial mountain-forest landscapes emerged in the region.

In the Sartan period, animals that were mostly adapted to the landscapes of cold steppes with little snow dominated among large mammals in the region (Prirodnaya sreda…, 2003; Vasiliev, Derevianko, Markin, 2006). Small mammals lived in dry steppificated landscapes (Arkheologiya…, 1998; Prirodnaya sreda…, 2003).

Archaeological evidence

Lithic industries of the Sartan period in the region were based on riverbed gravel of the Anuy River and its tributaries (Prirodnaya sreda…, 2003; Kulik, Markin, 2001, 2005). At Ust-Karakol I and in Iskra and Denisova caves, sedimentary rocks were mainly used—gray-colored aleurolites and sandstones of varying grain sizes, less often effusive and contact-altered varieties (corneous aleuropites, hornfelses). In Kaminnaya Cave, lithic resources were volcanic and sedimentary rocks and hornfelses occurring near the cavern. A small amount of jasper products (raw material of the highest quality)

of the Sartan period in the northwestern Altai

Cave	Anuy-2			Ust-Karakol I		Strashnaya Cave		
Source	Stratigraphic unit	^{14}C-date, BP	Source	Stratigraphic unit	Source	Stratigraphic unit	^{14}C-date, BP	Source
Markin, Antipov, 2012	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	2	Prirodnaya sreda…, 2003	–	–	–
–	–	–	–	3 ? 4 ?	"	–	–	–
–	–	–	–	–	–	–	–	–
–	3 (10.1) 4 (10.2) 5 (10.3)	21,280 ± 440 21,502 ± 584	Prirodnaya sreda…, 2003	–	–	3_{1a}	19,150 ± 80	Krivoshapkin et al., 2018

has been found at all sites. Most of the small elongated flakes in the collections from Kaminnaya Cave were made of it. The use of red jasperoids, absent from the pebble material of the Anuy River basin, indicates their purposeful selection. The nearest outcrops of these rocks, which form the Zasurye Cambrian-Ordovician suite, are located far away (up to 30 km) from the sites. Notably, Zasurye jasperoids were known to the Middle Paleolithic population of the Altai Mountains (Derevianko et al., 2015). Coarse artifacts made from porphyritic varieties of volcanic rocks constitute the majority of industries in Kaminnaya Cave. Although this raw material is characterized by excessive fracturing, it shows high hardness and viscosity.

Scarce evidence from the upper unit of the cultural deposits at Anuy-2, including horizons 5 (layer 10.3), 4 (layer 10.2), and 3 (layer 10.1), is associated with the Gydan stage of the Sartan period. It yielded a retouched backed knife, angle point, chisel-like and notched tools, as well as longitudinal and transverse chopping tools (Prirodnaya sreda…, 2003; Kolobova, 2006). The industry from layer 9.1 in the central chamber of Denisova Cave (Jacobs et al., 2019) is represented by flat single- and double-platform cores of longitudinal and longitudinal-transverse reduction, as well as radial cores with elevated flaking surface. Tools produced on short and elongated flakes are scrapers (end-scrapers, including carinated, double, and flake scrapers, retouched around the perimeter), burins (lateral, middle, and transverse), borers with a distinct working part, side-scrapers (longitudinal single and double, convergent, canted), artificially backed knives, beaked tools, notched-denticulate tools, a fragment of a leaf-shaped biface, and a tanged tool (Fig. 2, *3–5*, *7*, *9–11*). Bladelets with straight backed edges and an asymmetric crescent-shaped tool constitute the microinventory of the complex. Bone artifacts include fragments of eyed needles, points, a pendant made of tooth, deer tubular bones with biconical holes, and a fragment with symmetrical transverse incisions (Prirodnaya sreda…, 2003). The technocomplex of layer 9 in the eastern gallery of Denisova Cave reflects the parallel technology of lithic reduction. It contains flat single-platform varieties of cores, double-platform cores with bidirectional flaking of blanks, narrow-faced cores, and possibly subprismatic cores. Side-scrapers include single and double longitudinal varieties with plano-convex edges, front and ventral trimming, as well as transverse, diagonal, and canted side-scrapers. The Upper Paleolithic toolkit combines end-scrapers (whose edge is sometimes offset by the angle of the blank), angle burins, chisel-like tools, retouched blades and bladelets, and sporadic backed microblades. Combination artifacts with elements of side-scrapers, notches, and spurred tools occur rarely (Shunkov, Kozlikin, 2014). Scanty evidence from two horizons of layer 3_{1a} of Strashnaya Cave includes flat and subprismatic cores for bladelet and flake production, bladelets and microblades, flake scrapers and end-scrapers, as well as a bone ornamented point and a needle (Krivoshapkin, Zenin, Shalagina, 2014; Shalagina et al., 2018; Krivoshapkin et al., 2018).

The industries from the upper part of deposits of the entrance zone of Denisova Cave and from one of the layers in Kaminnaya Cave might have belonged to the interstadial (Derevianko, Shunkov, Anoikin, 1998; Prirodnaya sreda…, 2003; Derevianko, Markin, 2003). Tools from layer 6 of Denisova Cave include narrow-faced and wedge-shaped cores, numerous elongated blanks with parallel trimming (including microblade spalls) and suggest widespread laminar lithic reduction. End-scrapers, flake scrapers, as well as pointed and carinated end-scrapers, dominate among the artifacts resulting from secondary reduction, two thirds of which were made on flakes. Borers, beaked and spurred items, rare transverse burins, longitudinal, diagonal, and convergent side-scrapers, parts of points, knives with smooth backs, truncated and retouched flakes, notched-denticulate implements, and a fragment of an oval biface (Fig. 2, *1*, *13*, *15*, *18*) have been found. The collection of tools is complemented by micro-products in the form of bladelets with a blunt edge, sometimes with a skew-shaped end of the blank. The bone inventory consists of fragments of eyed needles, tubular beads made of bird bones, and rings manufactured from the shell of ostrich eggs. The toolkit from layer 5 of Denisova Cave includes end-scrapers, flake scrapers, numerous notched-denticulate tools, retouched flakes, beaked and spurred artifacts, as well as knives with natural and smooth backs. A transversal burin, transverse side-scraper, and chopping tool (Fig. 2, *2, 6*, *8*) have been found. Noteworthy are bladelets with arched, backed edges. Bone artifacts from layer 5 include needles, a borer, a fragment of a biconvex slotted item, and a large straight tool with pointed end and thick base, made of the tubular bone of a large mammal. The toolkit from layer 14b in Kaminnaya Cave contains expressive parallel cores, including flat single- and double-platform two-sided cores with traces of longitudinal-transverse flaking, and expressive massive narrow-faced cores. Technical spalls include a steeply curved flake removed from the working surface of a wedge-shaped core, indicating the use of microblade reduction techniques. The set of tools made on blades and flakes contains end-scrapers (sometimes with the edge of the blank retouched), angle burins with the edge retouched, a chisel-like tool, blades and bladelets with frontal and ventral retouching, longitudinal side-scrapers, as well as notched-denticulate tools. A truncated artifact and bladelets with backed and convex ends have been found.

Evidence similar to technocomplexes 14a, 13, 12, and 11g from Kaminnaya Cave belongs to the Nyapan

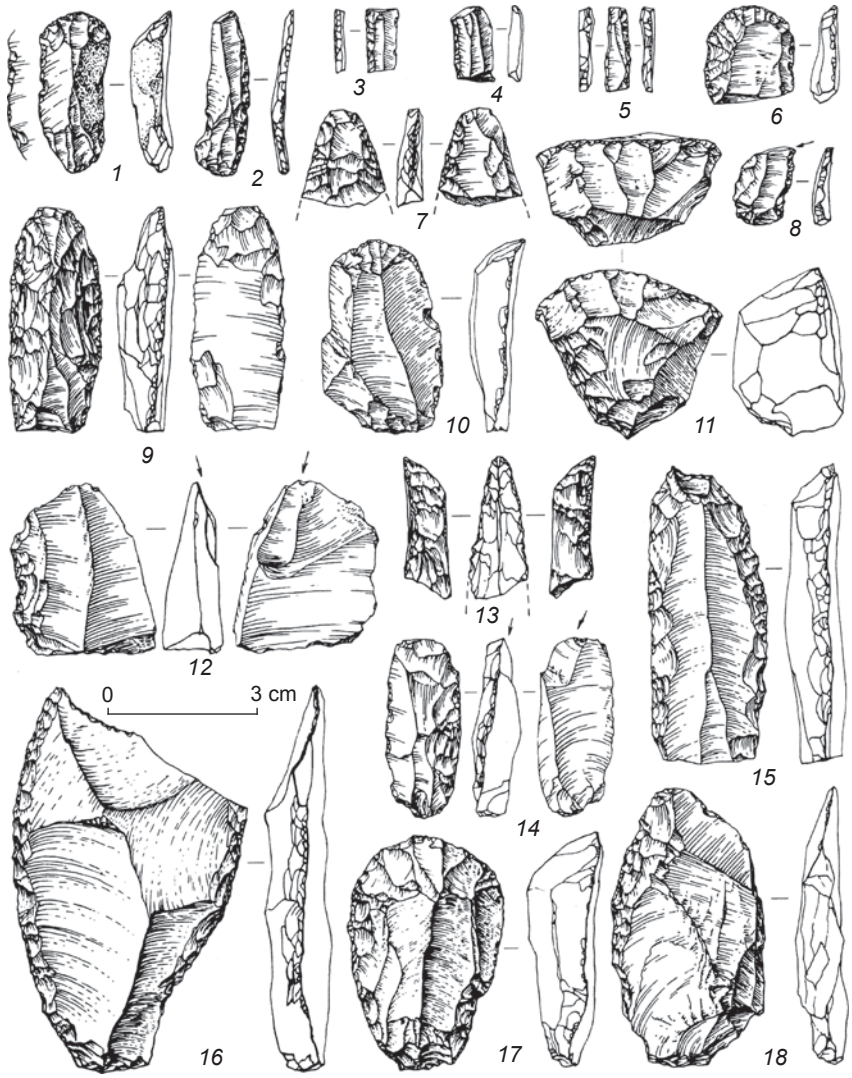

Fig. 2. Artifacts from layer 9 (*3–5*, *7*, *9–11*) in the central chamber, layer 5 (*2*, *6*, *8*) and layer 6 (*1*, *13*, *15*, *18*) of the entrance zone of Denisova Cave, and layer 2 (*12*, *14*) and layer 3 (*16*, *17*) of the Ust-Karakol I site (Prirodnaya sreda…, 2003).
1, *6*, *10*, *11*, *13*, *15*, *17* – scrapers; *8*, *12*, *14* – burins; *2–5* – backed bladelets; *7* – biface; *9*, *16*, *18* – side-scrapers.

stage of the Sartan period (Derevianko, Markin, 2003; Markin, 2005). Parallel methods of lithic reduction are represented by flat single-platform one-sided and two-sided longitudinal-transverse cores, massive narrow-faced cores, as well as shortened flakes similar to blades in trimming and size. The radial technique is reflected in discoid one-sided cores and canted flakes. Microblade techniques resulted in producing bladelets and microblades with parallel edges and facets, as well as technical spalls from the frontal surface of wedge-shaped cores. Blades and flakes, and in rare cases pebble nodules, were used as blanks for tool production. Spalls were numerous among the tools, and were primarily represented by blades with frontal, ventral, or two-sided retouching of edges, less often of the ends of blanks, sometimes with thinning of the lower surface. Noteworthy are end-scrapers and flake scrapers on wide, triangular, and elongated spalls and on rounded flakes, as well as angle and lateral atypical burins, angle borers, and chisel-like tools on triangular spalls. Side-scrapers include transverse, longitudinal, and diagonal varieties; some of the diagonal side-scrapers show retouch on lower surface, forming straight and arched edges. Notched implements were formed by retouching or deep single frontal removal; some tools with denticulated edges have thickened backs. Knives with artificial stops, points with retouched edges, pebble one-sided tools, as well as rare oval and sub-triangular bifaces, have been discovered. Materials from layers 4 and 3 of Ust-Karakol I have been preliminarily attributed to the Nyapan stage (Fig. 2, *16*, *17*). An end-

scraper with wide convex blade formed on a flake with retouched edges, medial burin, blades with retouched edges, single side-scraper, and naturally backed knife stand out from among the tools.

Scarce finds from layer 2 of Ust-Karakol I (Prirodnaya sreda…, 2003) have been preliminarily correlated with the Kokorevo interstadial. They include small one-sided cores, a scraper on flake, and spurred tool with a distinctive pointed end at the corner of a wide spall (Fig. 2, *12*, *14*). More representative is the industry from layer 11c of Kaminnaya Cave (Markin, 2005). Among parallel cores, there are massive flat one-sided single-platform cores for producing large, narrow and wide blades. Double-platform two-sided cores include those with adjoining platforms and traces of longitudinal-transverse reduction, and those with opposing platforms and traces of bidirectional flaking of blanks. The collection includes prismatic residual products with smooth platforms, covered with negative scars of bladelet and microblade removals, as well as narrow-faced cores and blanks of wedge-shaped cores. Expressive bladelets and microblades testify to the use of prismatic and microprismatic techniques. Several cores reflect the radial methods of lithic reduction resulting in angle spalls. The Upper Paleolithic tools stand out among the artifacts with traces of secondary processing. These are end-scrapers on blades, including those with diverging retouched longitudinal edges, as well as end-scrapers on flakes with retouching along the perimeter of the blank. The group of burins consists of angle varieties, some of which have a retouched edge. There are borers on blades and points with an oblique base on bladelets, the ends of which were modeled by converging the retouched and natural edges of the blank; chisel-like tools; retouched spalls, including narrow, naturally pointed and wide blades with edges formed by frontal and bidirectional retouching; and backed bladelets. The collection of tools includes naturally backed knives, large side-scrapers (longitudinal, diagonal, convergent, and with ventral retouching), and small raclettes. There are truncated artifacts made on wide blades with a beveled end and retouch along the longitudinal edge, as well as notches, denticulate tools, and a chopping tool. Bone products consist of fragments of needles.

The evidence from layers 11b, 11a of Kaminnaya Cave and possibly from the lower part of the profile in Iskra Cave belongs to the Norilsk stage of the Sartan period (Ibid.; Markin, Antipov, 2012). Complexes from Kaminnaya Cave indicate the widespread use of parallel lithic reduction. Flat single-platform cores, double-platform two-sided cores with traces of blank removals in the longitudinal and transverse directions, triple-platform cores with traces of bidirectional and transverse removals of blanks on different working surfaces have been found. There are small prismatic quadrangular cores with direct platforms; wedge-shaped cores, usually fragmented; and narrow-faced cores made on spalls. The toolkit contains an expressive group of scrapers on blades and flakes (Fig. 3): end-scrapers with retouched edges, including carinated varieties, flake scrapers with diagonal working edges. One of the artifacts combines the elements of an end-scraper and borer. Processed flakes and blades with parallel and diverging edges, covered with frontal, less often ventral, or bidirectional retouching have been discovered; these include single artifacts with a thinned lower surface in the bulbar area. Noteworthy is a group of end- and side-borers with an elongated working part. There are not many spurred tools made on the corner of blanks, points on triangular spalls with ventral retouching of edges, and chisel-like tools on flakes. The group of microinventory includes backed bladelets with opposite retouched working edges and atypical microburins. The toolkit also includes longitudinal, transverse, and canted three-blade side-scrapers, some with a trimmed lower surface of the blank, denticulate and notched tools, and naturally backed knives. A fragmented leaf-shaped plano-convex biface, fragment of a Levallois point, and a chopping tool are spectacular finds. Bone artifacts consist of the lower left incisor of an adult marmot with numerous parallel incisions along the great curvature of the tooth, and a fragment of a needle tip, round in cross-section.

In the collection from layer 5b of Iskra Cave, the parallel technique of lithic reduction is represented by a double-platform three-sided core with traces of longitudinal-transverse removals of blanks, and a single-platform two-sided core. Wide use of narrow-faced cores is evidenced by technical steeply curved elongated spalls. The tools include expressive retouched blades and bladelets, as well as blades with thinned ends of the blank, and bladelets with a backed straight and slightly convex edge. Individual end-scrapers and flake scrapers, notched-denticulate tools, and a fragment of a longitudinal side-scraper have been identified. Bone products consist of the half-dissected tubular bone of an ungulate, with a polished straight end, and a fragment of a blade with oblique incisions.

The industry from layer 4c of Iskra Cave is characterized by flat and slightly convex cores (Fig. 4). Single-platform one- and two-sided cores and double-platform three-sided cores also occur. Massive plunging removals suggest the use of narrow-faced varieties of cores. In addition to flakes, blades, and bladelets, the collection of spalls contains oval flakes with radial trimming and canted artifacts. The tool part of the collection includes end-scrapers on wide blades, some of which with completely processed diverging edges, isolated angle burins, chisel-like tools, flakes with shallow ventral retouching, and notched tools on blades. The group of processed blades and bladelets is diverse and

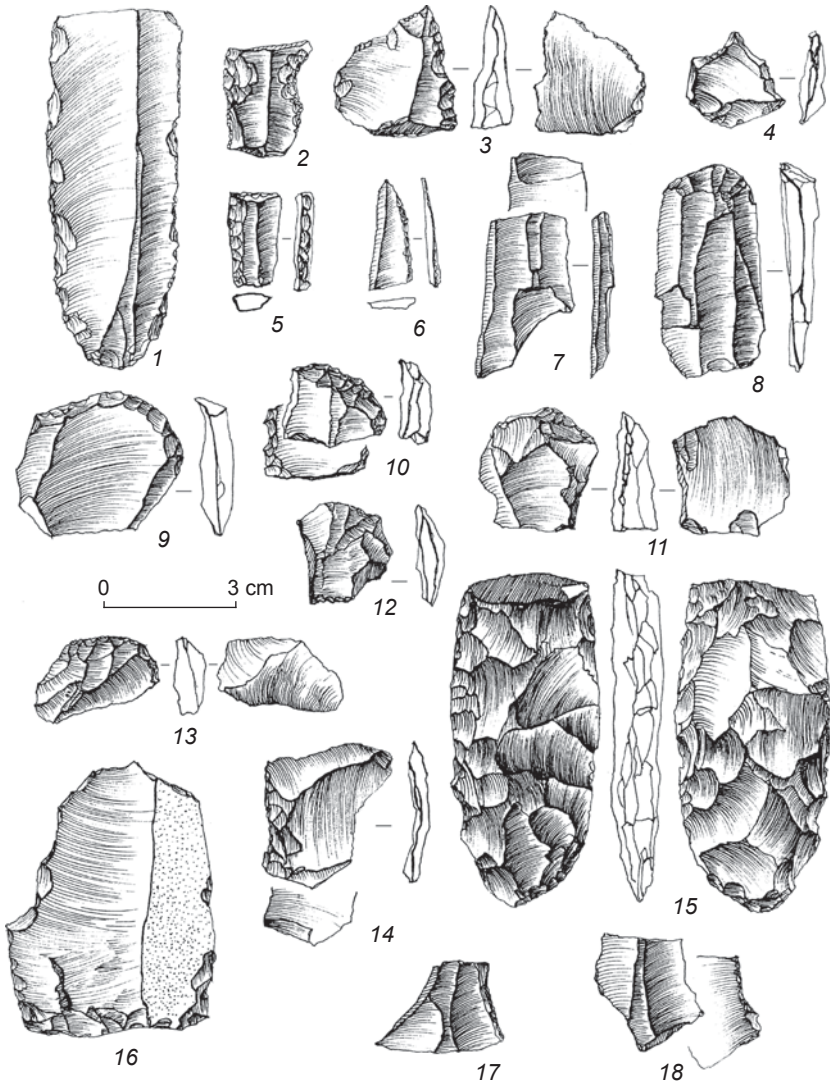

Fig. 3. Artifacts from layer 11b of Kaminnaya Cave.
1, *5*, *17*, *18* – retouched blades; *2*, *14* – notched tools; *3* – point; *4* – borer; *6* – backed bladelet; *7* – blade; *8–10*, *12* – scrapers; *11* – retouched flake; *13* – chisel-like tool; *15* – biface; *16* – side-scraper.

contains items with frontal and bidirectional retouching, and with backed edges and ends of the blank. There is a carefully modeled leaf-shaped biface with a convex base. Microtools include a micropoint and bladelets with one, less often two, backed edges. The collection also contains longitudinal, transverse, diagonal, and convergent side-scrapers, as well as those with ventral retouching. Bone products include two pendants: one is a drilled fox fang, decorated with parallel incisions at its ends; another is with a biconical hole, made of a fox molar.

Discussion

The industries of the Sartan sites described above are similar to the technocomplexes from the sites in other regions of the Altai, for example sites in the Central Altai (Ust-Sema (lower layer), Ust-Kuyum (layer 4), Tytkesken-3 (layer 6), Karaturuk, etc.) and in the foothills of the Northern Altai (Srostki (layers 2 and 3), Urozhaynaya, Maima (lower layer), Kuyuk-5, etc.) (Derevianko, Petrin, Rybin, 1992; Kadikov, Lapshin, 1978; Kungurov, 1993, 1995; Kungurov, Kadikov, 1985; Lapshin, Kadikov, 1981; Okladnikov, Vladykin, 1967; Sosnovsky, 1941). They are characterized by the technique of parallel removals of blanks from massive pebble cores. Radial and other techniques of lithic reduction were rare. Methods for producing microblades are manifested by narrow-faced and wedge-shaped cores. Flakes prevail among the spalls; blades are rare. Various side-scrapers, sometimes with partial double-sided trimming, are abundant among the tools. Expressive

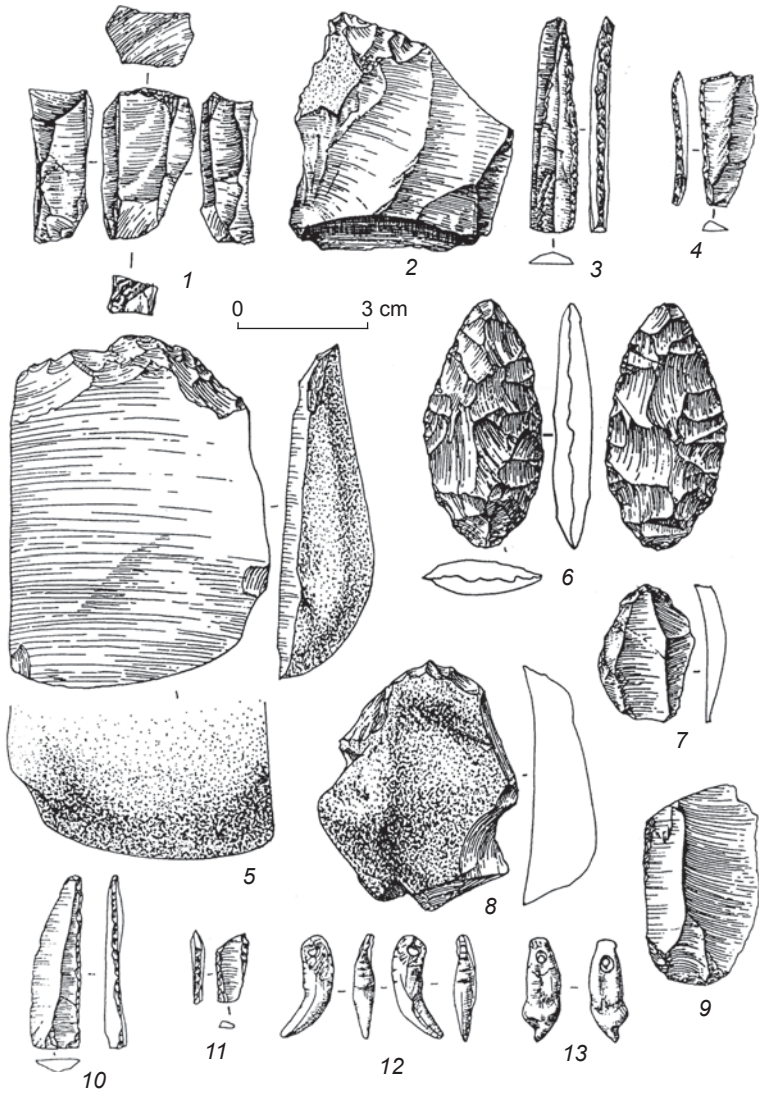

Fig. 4. Stone (*1–11*) and bone (*12*, *13*) artifacts from horizons 1 (*1–4*) and 2 (*5–13*) of layer 4c in Iskra Cave.
1 – core; *2* – side-scraper in the initial stage of production; *3*, *4*, *10*, *11* – backed bladelets; *5* – side-scraper with ventral retouching; *6* – biface; *7*, *8* – scrapers; *9* – retouched blade; *12*, *13* – bone pendants.

scrapers (rounded, oval, fan-shaped, core-like, as well as end-scrapers and microscrapers) and angle borers with massive or thin protrusion, burins, points, chisel-like tools, notched-denticulate tools, knives, and rare triangular bifaces with a convex base have been found. Materials from Ust-Sema and Ust-Kuyum include pebble tools. Surface finds include a dagger, slotted spearheads, and harpoons made of bison bones; a bone tool has been found at the site of Tytkesken-3 (layer 6).

Combinations of the toolkit similar to those under study occurred in the industries of the buried sites of Yustyd I (layers 1–4) and Yustyd II, in the southeastern Altai (Derevianko, Markin, 1987). These include flat parallel, wedge-shaped, pencil-shaped cores; retouched blades; scrapers (end-scrapers and flake scrapers, scrapers on rounded flakes); angle burins; denticulate and pebble tools; longitudinal and canted side-scrapers; and sporadic Levallois flakes.

Materials from the sites in the northeastern Altai (Ushlep-2–6, Shkolnaya Gora I, Dmitrievka, etc.) show parallels to the region under study. The industries in this part of the Altai contain flat parallel, prismatic, and wedge-shaped cores. Toolkits include notched-denticulate tools, end-scrapers, angle burins, chisel-like tools, side-scrapers, points, and chopping tools. At a number of sites, retouched blades and bladelets, microtools in the form of backed bladelets with an oblique truncated retouched end, as well as micropoints have been found (Baryshnikov et al., 2005).

The industries of the Altai show parallels with technocomplexes from various regions of Southern

Siberia. Collections from the Upper Paleolithic sites of the western part of Central Asia, primarily the sites of Kulbulak (layer 2.1), Dodekatym-2 (layers 5–2), and Shugnou (layer 1), demonstrate stadial similarity with the Altai evidence. Carinated items recorded in the assemblage of the Anuy-2 site sporadically occur in many Siberian collections (Kolobova et al., 2013; Kolobova, Krivoshapkin, Shnaider, 2019).

The Final Upper Paleolithic of the Kuznetsk Basin and Mountainous Shoria is represented by evidence from the sites of Bedarevo II, Ilyinka II, Shorokhovo I, Shumikha I, etc., showing the predominance of products of parallel reduction—single- and double-platform one- and two-sided flat cores. Narrow-faced microcores and rare wedge-shaped cores have also been found. Some artifacts reflect Levallois and radial methods of lithic reduction. The main blanks for production of tools were elongated flakes; microblades are numerous. The toolkit is dominated by blades and bladelets with retouching at the edges and sometimes at the ends. Blades with a backed edge are rare. Noteworthy are groups of notched-denticulate tools, scrapers (end-scrapers and flake scrapers, scrapers retouched around the entire or part of the perimeter, double, pointed, nosed scrapers, and micro-scrapers) made on blades and flakes, as well as burins (dihedral, angle). Side-scrapers (longitudinal, transverse, and canted), backed knives, and pebble tools occur in smaller numbers. Chisel-like tools, borers, points, and oval bifaces are few (Markin, 1986).

A large number of Sartan sites with the inventory reflecting two varieties of the culture, primarily differing in the methods of lithic reduction (Paleolit Yeniseya, 1991), are concentrated in the basin of the Upper and Middle Yenisei. In the Afontova variant (Afontova Gora II, Kokorevo II, III; Tashtyk I, II; Maina, Kantegir, Listvenka (layers 14, 4–1)), amorphous cores and microcores (wedge-shaped, celt-like, pencil-like, narrow-faced on spalls, etc.) have been recorded. Flakes served as the main blanks for tool production. The Kokorevo variant (Kokorevo I, Novoselovo VI, VII, XII, Listvenka (layers 5–13)) is characterized by large parallel single- and double-platform cores for blade production and microcores similar to the Afontova artifacts. Most of the artifacts were made on blades. The difference between the Afontova and Kokorevo tools is manifested by their percentage ratio. Various retouched blades, including bladelets backed by retouching at the edges, occur in different proportions. There have been found burins (dihedral, lateral, and transverse); scrapers (end-scrapers on blades and flakes; flake scrapers and crescent-shaped, with retouching around the entire perimeter or on half of it, double scrapers, micro-scrapers, rare pointed or tanged end-scrapers, or end-scrapers with a notch at the base); micro-chisel-like and chisel-like tools, some with retouching of longitudinal edges; borers and micro-borers; and beak-shaped artifacts. Numerous side-scrapers on flakes and blades (single lateral, double, convergent and transverse side-scrapers, those processed along the perimeter, less often angle side-scrapers, made on pebbles or cores); less numerous points (elongated, wide and shortened), and pebble tools (choppers, axes, and adzes) occur. A large group of tools consists of notched-denticulate artifacts. Sets of bone and horn tools include points (slotted, non-slotted, needle-shaped), insert tools, hoes made of deer antler, hammers, tips, awls, needles, batons, and other items. The collection of adornments contains pendants made of animal teeth or soft stone, and fragments of forehead diadems. In one of the layers at the Maina site, an anthropomorphic figurine made of burnt clay was discovered.

Materials from the sites in the Angara region, associated with the end of the Upper Paleolithic show some similarities with the Sartan industries of the Altai. A small collection from the Fedyaevo site on the Angara River includes wedge-shaped cores, longitudinal and transverse side-scrapers on flakes, and chisel-like tools (Astakhov, 1963). The industries of the Kulakovo I and Cheremushnik II sites on the Angara River (cultural horizon 2) are more representative. The methods of lithic reduction are revealed by one- and two-platform prismatic and wedge-shaped cores. Tools made on flakes and blades include scrapers (end-scrapers and flake scrapers, retouched on a part of the perimeter, and microscrapers), chisel-like tools, diagonal burins, and double-sided points. Noteworthy are side-scrapers (single, double, convergent, retouched around the perimeter), backed knives, and pebble tools. The bone inventory of Cheremushnik II contains a fragment of an awl, pendant made of deer tooth, and fragments of bones with transverse incisions (Lezhnenko, 1974).

The Final Upper Paleolithic of the Trans-Baikal region is represented by a series of sites located in the western and eastern parts of the region. Flat single-platform cores, microcores, including wedge-shaped varieties, are typical of the lithic inventory from the Oshurkovo site (Western Trans-Baikal region). Tools consist of scrapers on flakes and blades (end-scrapers and flake scrapers, carinated scrapers, and scrapers retouched along the entire or part of the perimeter), burins (on an oblique retouched truncation, transverse burins), retouched flakes, as well as arched side-scrapers and pebble tools (Abramova, 1989). Bone artifacts include bases of insert tools, a flat harpoon, and a fragment of a needle.

A large group of sites dated to 18.0–10.8 ka BP is concentrated in the Eastern Trans-Baikal region (Studenoye I (layers 19–14), Studenoye II (layers 3 and 4), Ust-Menza I (layers 21–25), Ust-Menza II (layers 4–24), Ust-Menza III (layers 2–5), Ust-Menza IV (layers 2 and 3), Kosaya Shivera I (layer 14), and Altan (layers 16–19)) (Konstantinov, 1994). Their inventory

includes subprismatic, flat, and orthogonal cores, as well as wedge-shaped microcores. Tools include end-scrapers and flake scrapers, made on blades and flakes, micro-scrapers, retouched blades and microblades, burins (transverse with retouching on the edges, angle, lateral, and medial), borers, chisel-like tools, as well as side-scrapers (transverse, longitudinal single and double, with double-sided trimming), pebble artifacts (choppers, adzes), rare points and knives. Bone artifacts include a polisher, insert knife, awl, point, handle, and hammer made of horn.

Conclusions

The evidence of the Final Upper Paleolithic in the northwestern Altai indicates the continuity and consistent development of early technocomplexes, which existed in this part of the region 28–23 ka BP. In horizons 12–6 of the Anuy-2 site, flat, prismatic, and wedge-shaped cores, various side-scrapers, end-scrapers, burins, expressive series of micropoints and backed bladelets with the ends truncated by retouching have been found (Derevianko, Shunkov, Postnov, 1998).

As opposed to the Middle Paleolithic sites, the Sartan localities of the northwestern Altai were base-camps with a complete sequence of lithic reduction. They were characterized by more sophisticated strategies of using raw materials, which were acquired both in the immediate vicinity of the sites and at a significant distance. The distribution of archaeological materials in the unearthed areas of most sites in the region has not revealed concentration zones. Only in some layers of Kaminnaya Cave, clusters (?) of a few cores and more pronounced accumulations of very small spalls have been observed, suggesting the presence of specialized sites for lithic reduction and further processing of blanks (Markin, 2006). Structures in the form of simple oval hearths have been found only in horizons 4 and 3 at Anuy-2 (Prirodnaya sreda…, 2003).

Reconstruction of the hunting activities of the ancient humans inhabiting the region is anything but a simple task. Most megafaunal remains have been found in cave strata (Ibid.; Vasiliev, Derevianko, Markin, 2006). These were species of open landscapes—the horse, woolly rhinoceros, bison, argali, saiga, and others. In Kaminnaya Cave, a lot of bones of the Siberian mountain goat, which inhabited rock biotopes, have been found. Remains of taiga inhabitants (sable) were much fewer. The bones of megafauna representatives (elk, red deer, and roe deer), which preferred semi-open forest-steppe landscapes, are not numerous. Cave hyenas and cave lions played a notable role in cave taphocenosis. A high degree of bone fragmentation, presence of gnawing marks on bone fragments, large number of bones and teeth with traces of acid corrosion are the results of consumption by cave hyenas and other predators. Cuts have been observed on a number of tubular bone fragments, indicating participation of primitive humans in cave accumulation of bone remains. Apparently, their main hunting targets were species of animals typical of mountain landscapes (mountain goats, argalis, saigas, and horses), which widely occur in the deposits.

Paleolithic technocomplexes of the northwestern Altai, which belong to various climatic stages of the Sartan period, show many common features. Variability of the toolkit is mainly expressed only in the volume of artifact varieties. The methods of lithic reduction at all sites were based on parallel flaking, which resulted in flat, typologically simple, single- and double-platform, one-sided or two-sided, less often three-sided cores with traces of bidirectional or longitudinal-transverse reduction of blanks. All assemblages contain narrow-faced and sporadic wedge-shaped cores indicating the use of microblade techniques. Blades, bladelets, and flakes served as blanks; in some cases small boulders or pebbles were used. A laminar trend of the technocomplexes is typically manifested at the sites in the low-mountain part of the region (Iskra Cave, Denisova Cave, Ust-Karakol I), where the population mostly used sedimentary rocks (aleurolites, sandstones). Elongated blanks were less typical of the industries from Kaminnaya Cave, located among the Altai mountains of middle altitude. This can be explained by the predominant use of porphyrite varieties of volcanic rocks. Obviously, the raw material factor was behind the variability of the industries. The toolkits from all sites combine artifacts of the Upper Paleolithic typology and artifacts widely occurring in the Middle Paleolithic complexes. Various scrapers, retouched flakes, and burins constitute a significant share of all tools. Chisel-like tools, borers, sporadic bifaces, and tanged tools also occur. The microinventory, primarily in the form of backed bladelets with straight or arched edges, less often with backed ends, has been found in many technocomplexes of the Sartan sites. In layer 9 of Denisova Cave, a geometric microlith not typical of the Altai Paleolithic has been discovered. Industries of the sites contain side-scrapers of various typologies, denticulate tools, notches, sporadic points, pebble artifacts, backed knives, as well as spurred and beaked tools. Bone items include needles with oval and round cross-section, borers, pendants with holes made of the teeth of large animals, tubular beads made of the tubular bones of birds, rings made of ostrich egg shells, plates with notches, and tools with flattened bases (Prirodnaya sreda…, 2003; Krivoshapkin et al., 2018).

In general, the evidence of the Final Paleolithic in the Altai shows great similarities both in terms of lithic reduction and typology of secondarily processed artifacts. A.P. Okladnikov (1981) observed that according to the

outer appearance of the industry, the Altai sites are close to contemporaneous sites in southern Siberia (Kuznetsk Basin, Angara region, Trans-Baikal region, and Yenisei region). Thus, at the end of the Upper Paleolithic, technocomplexes of the Altai were a part of the single culture of the Late Paleolithic humans of southern Siberia.

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