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Excavations at Darvagchay-Zaliv-4: An Early Paleolithic Site in Dagestan

This article outlines the results of multidisciplinary research at Darvagchay-Zaliv-4—an Early Paleolithic site in northeastern Caucasus. We focus on lithics, which we compare with those from key Early Paleolithic sites in Dagestan and other regions of Caucasus. Based on the totality of typological and technological criteria, we identify the assemblage as Acheulean, characterized by a scarcity of distinct core-like forms and tools. The few functional types identified include side-scraper forms, spurs, notched, and combination tools. The most salient specimens are pebble tools (choppers) and bifacial tools such as handaxes and picks. Technologically, all specimens are very uniform and may be viewed as representing several camps, whose inhabitants shared a single lithic tradition. This might have been a workshop that was visited many times. The analysis of malacofauna and paleomagnetic analysis suggest that the site dates to 0.4–0.3 Ma BP (MIS 11–9).

Keywords: Dagestan, stone industry, Early Paleolithic, Pleistocene, sea level transgressions.

Introduction

The majority of known Paleolithic sites in Caucasus are concentrated in the central part of the region, in Transcaucasia or along the Black Sea coast. Until recently, the territory of northeastern Caucasus (especially the area adjacent to the Caspian Sea), was very poorly understood archaeologically. The first data on the Paleolithic in this region was obtained at the end of 1930s by M.Z. Panichkina, who studied finds near Gedzhukh village (Zamyatnin, 1950). Survey for Paleolithic archaeological sites was conducted here in 1950s–1960s by V.G. Kotovich. During excavations in the piedmont zone of Dagestan, he managed to discover ten localities with surface visibility of archaeological materials. The most ancient artifacts were found at Chumus-Inits, in the middle reaches of the Darvagchay River, which were preliminary assigned to the Acheulean period (Kotovich, 1964). After the creation of the Gedzhukh water reservoir in the 1970s, steep slopes and erosional exposures of Early to Middle Neopleistocene deposits appeared in some areas. This development made the search for new archaeological sites much easier. A new investigation into the Paleolithic in these areas of Dagestan started in 2003 and involved joint expeditions of the IAET SB RAS and IA RAS under the supervision of A.P. Derevianko. Multi-

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year studies along the western coast of the Caspian Sea have resulted in the discovery of more than 20 Stone Age localities, including several multilayered stratified sites. These span the Lower Paleolithic to the beginning of the Upper Paleolithic, making it possible to evaluate the cultural sequence of most ancient cultures in the territory of coastal Dagestan (Derevianko et al., 2012). One of these key stratified sites is Darvagchay-Zaliv-4, which is characterized by the presence of large bifacially worked tools in the collection of lithic artifacts.

History of research

The locality of Darvagchay-Zaliv-4 was discovered by members of the Caucasian Paleolithic party of the IAET SB RAS (Fig. 1, 2) in 2010 during reconnaissance survey of the right bank of the Darvagchay River (Derbentsky District, the Republic of Dagestan) (Zenin et al., 2010). The site is located near a small bay of the Gedzhukh water reservoir, on the slope of a high (about 20 m) remnant of the third ancient Caspian terrace. This remnant was formed by a series of marine sediments, overlain by loose deposits in the form of sandy soils and loams. The site is located towards the northeast, at an elevation of approximately 125 m a.s.l.; its coordinates are 42º08′06″ N, 48º01′44″ E. The site location corresponds to the transition from the foothills (absolute altitude 120–270 m) to the lowland (< 90 m) of the western Caspian Sea region. The boundary of foothills is clearly distinguished in relief by erosional scarp, and highlighted by numerous shell rock and sandstone exposures (of the Baku age). Several points with Paleolithic artifacts have been discovered in this locality at the shores of the water reservoir. All of them are associated with steep slopes and exposures, wherein coastal-marine and terrestrial deposits can be traced from bottom to top.

Exploratory studies of the site*, conducted in 2011, revealed preliminary data about site stratigraphy and an impressive collection of Paleolithic items, including tools with traces of bifacial treatment (Derevianko et al., 2012). In 2014–2015 and 2017, archaeological excavations were continued at the site. A single excavation unearthed a cultural deposit of approximately 90 m^2 in scope, among which about 700 lithic artifacts have been identified.

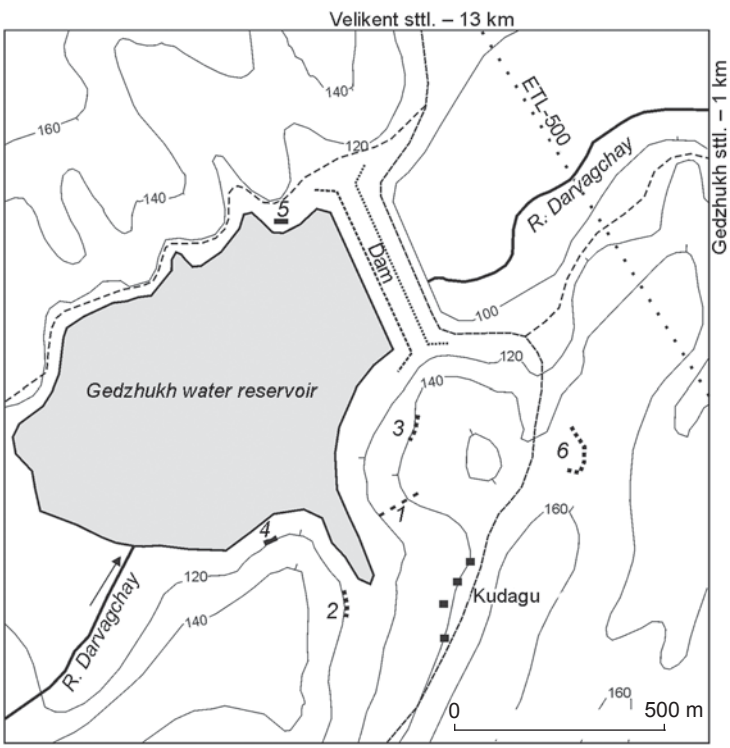


Fig. 1. Site locations near the Gedzhukh water reservoir.
1 – Darvagchay-Zaliv-1; *2* – Darvagchay-Zaliv-2; *3* – Darvagchay-Zaliv-3; *4* – Darvagchay-Zaliv-4; *5* – Darvagchay-1; *6* – Darvagchay-Karier.

Stratigraphic situation and the age of the site

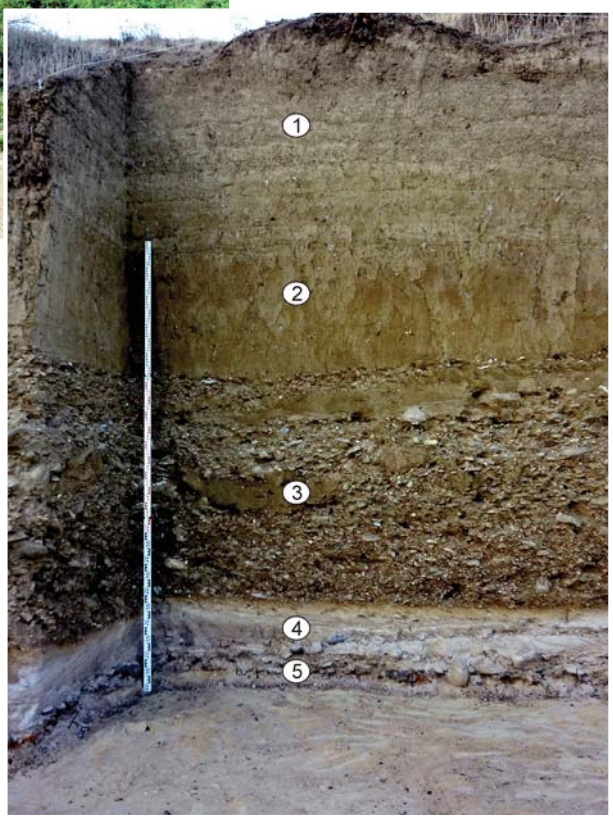
During the site excavations, we produced a series of geological profiles of the right bank of the Darvagchay River, which, along with exposures in the areas adjacent to the excavation area, have formed the basis for a detailed stratigraphic reconstruction (Fig. 3, 4). The following deposits are numbered from top to bottom, and are represented by those exposed along the bank (layers 1–5) and in the adjacent area of the terrace slope (layers 6–11):

Layer 1. Gray-brown sandy, friable, silt loam (in a dry state). The texture of the layer is heterogeneous. The genesis of deposits appears subaerial (eluvial-diluvial). Throughout the entire thickness, the layer contains numerous inclusions of carbonate

*Apart from researchers from the IAET SB RAS, geologists (doctoral students of the Tomsk State University) D.E. Luneva and A.V. Akhteryakova took part in these studies.

Fig. 2. Darvagchay-Zaliv-4 site. View from N.

Fig. 3. Northeastern and southeastern walls of the 2015 excavation unit.



salts; gravel and pebbles are rarely encountered. The bottom of the layer is subhorizontal, the boundary with the underlying layer is distinct. Thickness is up to 1.4 m.

Layer 2. Dark brown carbonized heavy loam; denser toward the top of the layer, whitened, with rare inclusions of gravel and small pebbles. The texture of the layer is homogeneous. The lower part of the layer contains uneven-grained brown sand lenses, with a thickness ranging from 0.01 to 0.07 m. The genesis of the layer was subaerial (with a predominance of slope and eolian processes). The top contact of the layer is partially destroyed, while the bottom is sharp, distinct, subhorizontal. The layer contains isolated Paleolithic artifacts. Thickness for this layer is up to 1.5 m.

Layer 3. Gravel-pebble deposits with admixture of boulders, blocks, and shell rock debris (up to 0.7 m in diameter) with a various degree of roundness. The filler consists of debris, clay sand, and loams. In the center and towards the bottom of the layer, gray aleurite lenses with ferrugination spots up to 0.3 m thick are encountered. Pebbles and boulders lie at various angles and are oriented mainly along the long axis of the slope, in the northeastern direction. The debris is largely unsorted, with sorting observed only locally, in the lower part of the layer. Proluvial-diluvial and alluvial (mountainous alluvium) processes probably played a leading role in complex genesis of the deposits. The angle of dip of the layer's top (the azimuth is 150–170°) is 7–14°. The bottom is uneven, distinct. The layer contains Paleolithic artifacts. Thickness for this layer is up to 2 m.

Layer 4. Coastal-marine light gray sands (yellow in the top) are ochreous, cross-bedded, variously directed, with shell detritus and rare inclusions of coarse-grained materials (gravel, pebbles, rubble). Small lenses of greenish-gray aleurites up to 0.1 m thick are encountered towards the top of the layer. The layer's lower contact is uneven, distinct. Thickness for this layer is up to 0.45 m.

Layer 5. Gravel-pebble deposits. The fill consists of uneven-grained light brown sand, with inclusions of marine mollusk shells of various states of preservation. Debris is well rounded and lies subhorizontally. Clay

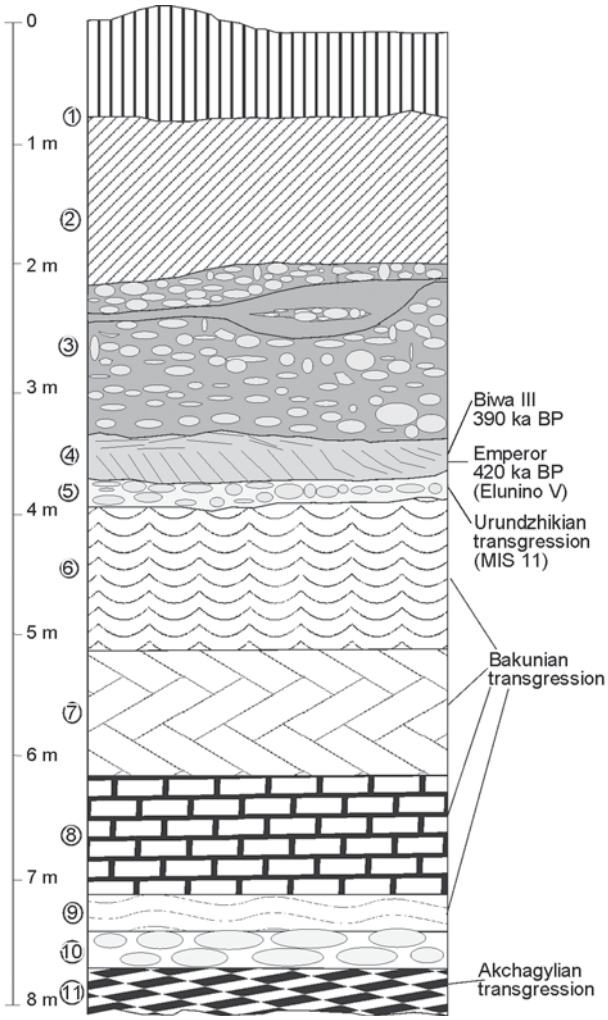


Fig. 4. General diagram of the stratigraphic section of the Darvagchay-Zaliv-4 site (the excavation unit and the underlying area of the terrace).

balls and oxidation lenses occur in this layer. The deposits were apparently formed during abrasion of mountainous alluvium and its subsequent redeposition in the sea beach coastal zone (the average depth is up to 2 m). Contact with the underlying deposits is distinct and clear. The layer contains Paleolithic artifacts. Thickness for this layer is up to 0.45 m.

Layer 6. Thin-layer gray sands with horizontal interdigitation of detrital sandstone. Marine mollusk scallop-shells with good preservation are encountered. Cemented sandstone interdigitated layers show oscillated ripples along the N-S axis; their thickness varies from 0.05 to 0.2 m. Genesis of these deposits is coastal-marine, with a thickness of up to 1.5 m.

Layer 7. The sandstones are detrital, monolithic. The apparent thickness is more than 1 m.

Layer 8. Bioclastic limestone (shell rock) with gravel and pebble inclusions, dense, monolithic, and massive. The rock color is dark gray with various tones. The deposits are only partially visible in the form of blocks protruding on the slope surface. The apparent thickness is more than 1 m.

Layer 9. Fine-grained, friable, yellow-gray sands. The apparent thickness is up to 0.3 m.

Layer 10. Pebble-boulder deposits. Fragments (sandstone) are well rounded and partially cemented (conglomerate). The apparent thickness is up to 0.3 m.

Layer 11. Dense, light gray clay aleurites, with thin gray sand interlayers. Presumably, Akchagyl deposits are included within this layer. The apparent thickness is 0.4 m.

Analysis of this section of the Darvagchay-Zaliv-4 locality provided for identification of three heterochronous bands of deposits having specific pedogenesis features, separated from each other by stratigraphic breaks with traces of erosion and tectonic deformations. Band 1 (layers 1–3) was formed predominantly under subaerial conditions, probably in the post-Bakunian time. Eluvial-diluvial and proluvial processes played the leading role in sedimentation. Band 2 (layers 4–10) was formed predominantly under subaqueous conditions along the sea coast, in the second half of the Early Neopleistocene (the Bakunian time). Band 3 (layer 11) was formed by deposits of coastal-marine genesis that correspond to the transition zone between the shelf and the coast (the Akchagylian time). The presumable chronology of lithological horizons relies on comparison of the described section with the stratigraphic data on the Darvagchay-1 site; where the relative age of culture-bearing deposits (the interval of Bakunian transgression of the Caspian Sea) was determined as a result of analysis of malacofauna (brackish water mollusk shells) and microfauna (ostracods, foraminifers) (Ibid.).

The chronological framework of the cultural horizons of Darvagchay-Zaliv-4 can be determined more accurately using analysis of malacofauna. During archaeological excavations, all intact mollusk shells (those suitable for determination) were selected from layer 5. These are dominated by Caspian Cardiidae (brackish water mollusk shells of the genus Didacna Eichw.), while representatives of the genus Dreissena van Beneden are rare. The genus Didacna, known for its high evolutionary rates at the species and subspecies levels, has a general importance for understanding the marine Neopleistocene chronology of the Caspian and for paleogeographic reconstruction of the Caspian basins.

Two groups are clearly distinguished among the Didacnas. The first one is represented by shells with obvious traces of redeposition (roundness, abrasion, "fuzziness"). It is dominated by *Didacna rudis* Nal., also, *D*. cf. *parvula* Nal., *D. lindleyi* (Dash.) Fed., *D. golubyatnikovi* Yan. are encountered. These are representatives of Bakunian (Late Bakunian) fauna of the Caspian region, among which *D. rudis* is a characteristic species.

The second group comprises shells in a state of good preservation, with distinct outlines, a hinge apparatus, and pronounced (non-abraded) shell ribs. The presence of such shells of not only adult individuals but also juveniles points to *in situ* occurrence of this malacofaunal community. It is dominated by *Didacna eulachia* (Bog.) Fed. and *D. kovalevskii* Bog.; *D. pravoslavlevi* Fed, specimens are few. Malacofauna (and deposits producing them) are of the Urundzhikian age, where *Didacna eulachia* and *D. kovalevskii* are characteristic species.

The stratigraphic position and relative age of the culture-bearing deposits is very important; therefore, proposed chronologies for the Urundzhikian stage should be considered. The Urundzhikian stage in development of the Caspian basin and its coasts was identified by P.V. Fedorov based on the results of analysis of malacofauna from the Quaternary deposits of southwestern Turkmenistan (1948) and of the Kura Depression in Azerbaijan (1957). This stage was initially assigned to the first period of the Khazarian epoch, and then to the final stage of the Bakunian transgressive epoch. It was also distinguished in Western Turkmenistan, though in a different scope, by L.A. Nevesskaya (1958). B.G. Vekilov has established the presence of this stage (but under the name of "Mingechaurian") for the Azerbaijan coast of the Caspian Sea at the end of the Bakunian epoch (1969). Later on, T.A. Yanina, having studied all the known malacofauna localities of the Caspian region, proved the existence of an independent Urundzhikian transgressive stage (2008). Though there is no consensus on the time represented by Urundzhikian transgression (the end of the Bakunian epoch, the beginning of the Khazarian epoch, or independent transgression in the early Middle Neopleistocene), accumulation of sediments containing mollusk shells apparently took place in the period after Late Bakunian transgression of the Caspian in the Urundzhikian basin, wherein the Bakunian mollusk shells were redeposited. By now, the majority of researchers recognize the Urundzhikian stage, and situate Urundzhikian horizon (layers) in the stratigraphic scheme of the Caspian Neopleistocene. At this time, the sea basin was isolated, warm-water, with an increased (as compared to the modern) salinity. The time of this event is suggested to be early Middle Neopleistocene, the Likhvin Interglacial (MIS 11).

In 2015–2016, paleomagnetic studies were conducted at Darvagchay-Zaliv-4*, which helped refine the age of culture-bearing horizons**. From the northeastern wall of the excavation, from –420 to –720 cm (layers 2–4) below the surface, cubic samples with side 2 cm long were taken at a spacing of 5–10 cm. The collection consists of 19 samples. In the section, two magnetic polarity zones are distinguished: normal polarity in the upper portion, and reversed polarity in the sea sands (layer 4). Taking into account the paleontological and general geological history of the Caspian basin during the Quaternary, the following interpretation of paleomagnetic data appears to be most probable: all magnetozones correspond to the Brunhes chron, while the polarity reversal corresponds to the Biwa III (390 ka BP) and Emperor (Elunino V) (420 ka BP) periods.

Thus, according to data obtained by scientific methods, archaeological materials recorded in layers 3 and 5 appear to have accumulated under subaerial and subaqueous seacoast conditions (beach and prefrontal zones) (Fig. 4). The time of formation of cultural horizons aligns with various phases of activity of the Caspian Sea (the Late Bakunian and post-Bakunian time) and, according to the traditional stratigraphic schemes, dates to approximately 0.4–0.3 Ma BP (MIS stages 11–9).

Characteristics of the stone industry

672 artifacts have been discovered at the site. Of these, 2 specimens were found in layer 2, 511—in layer 3, 140—in layer 5, and 19—in the talus slope at the exposure location.

Layer 2 is represented by a fragment and a flake with a faceted platform. These items cannot serve as cultural and chronological markers. Materials from the talus slope, which, apart from flakes and fragments, included an atypical end-scraper, a

*The studies were conducted in the Laboratory of Main Geomagnetic Field and Magnetic Petrology of the Schmidt Institute of Physics of the Earth RAS, and in the Paleomagnetic Center of the Trofimuk Institute of Petroleum Geology and Geophysics SB RAS, following the standard procedures.

**The works were carried out by A. Y. Kazansky.

notched tool, and a spur, did not differ meaningfully from those in the main body of finds. We base our analysis of the Darvagchay-Zaliv-4 industry only on materials from layers 3 and 5.

Layer 3 includes lithic artefacts differing in the degree of surface preservation. They are mainly medium-rounded, and edge damage and wear traces are observed on the spall faces. A yellow-whitish patina can be seen on some flint artifacts. The collection also contains poorly rounded items and those with relatively "fresh" faces. The state of these lithic artifacts point to partial redeposition of the assemblage. The pebble bed itself, as well as the artifacts found therein, are ungraded; both large and small objects occur at the same level.

Thirty-seven finds were assigned to the category of cores or core-like items: 3 pebbles with isolated spalls, 15 core-like fragments, and 19 cores. The finds are dominated by simple single- and double-platform monofrontal cores with traces of minimal preliminary preparation of the front and the striking platform, or without them (Fig. 5, *3*, *4*; 6, *7*). One item of oval shape corresponds to the category of radial single-faced cores. A core of 4.0 × 4.8 × 1.8 cm in size is most thoroughly worked. This specimen shows traits typical of the Levallois reduction strategy: faceted convex striking platform, lateral faces partially shaped by spalls and retouching, and a negative of laminar removal (Fig. 7, *4*). Debitage consists mainly of flakes (299 spec.), many of which preserve some natural cortex. The definable residual striking platforms are predominantly smooth and natural, faceted and dihedral instances are rare. Flakes are generally shortened, medium-sized, with pronounced bulbs of percussion and irregular outlines. Many of them reflect offset of the blank axis relative to the removal direction. Small areas of pebble-nodular cortex have been traced on the majority of fragments and splinters (161 spec.), volumetric angular rock pieces of various sizes and shapes. Some finds show traces of secondary working. Tablets and pebbles (14 spec.) of large and medium size show secondary working traces. One pebble has signs of use as a hammerstone.

The category of tools contains 158 items. The majority of tools are made on spalls, while some of them on flat fragments and pebbles. The toolkit is composed of 6 bifaces, 1 uniface, 4 picks, 3 core-like end-scrapers, 1 chopper, 2 "snouted" tools, 21 side-scrapers, 2 knives, 2 atypical end-scrapers, 4 points, 26 spurs, 32 notched and 5 combined tools, 30 flakes, and 17 fragments with retouch.

The most impressive types of large tools are bifaces (handaxes) and a uniface, which are different in their sizes and the way of shaping. The first biface, 17.5 × 8.2 × 4.0 cm, is made of dark gray sandstone. The item is strongly rounded, lanceolate, with a double-convex cross-section, and edges worked by flat spalls. The distal end is the flattest part of the item and resembles the ends of lancet handaxes (see Fig. 6, *4*). The second biface is thoroughly shaped, it is the largest (20.5 × 10.0 × 5.4 cm) and the most massive item of the collection, made on a gray-brown silicified pebble. The tool is medium-rounded, with a regular almond shape, a

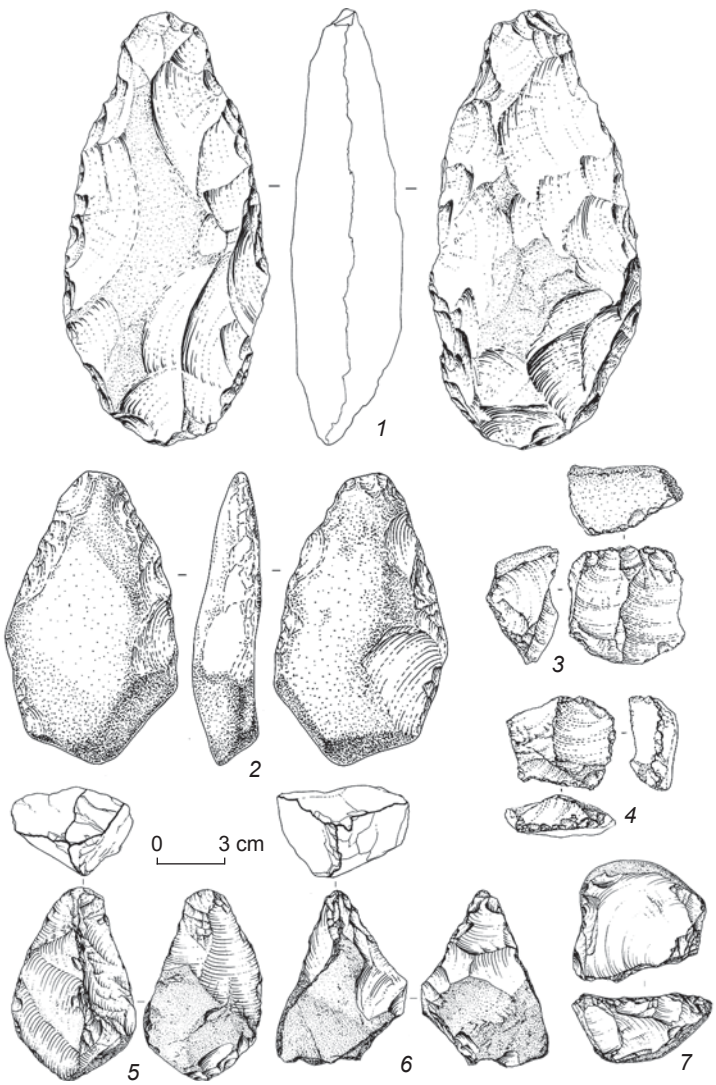


Fig. 5. Lithic artifacts from layer 3.
1, *2* – bifaces; *3*, *4* – cores; *5*, *6* – pick; *7* – core-like end-scraper.

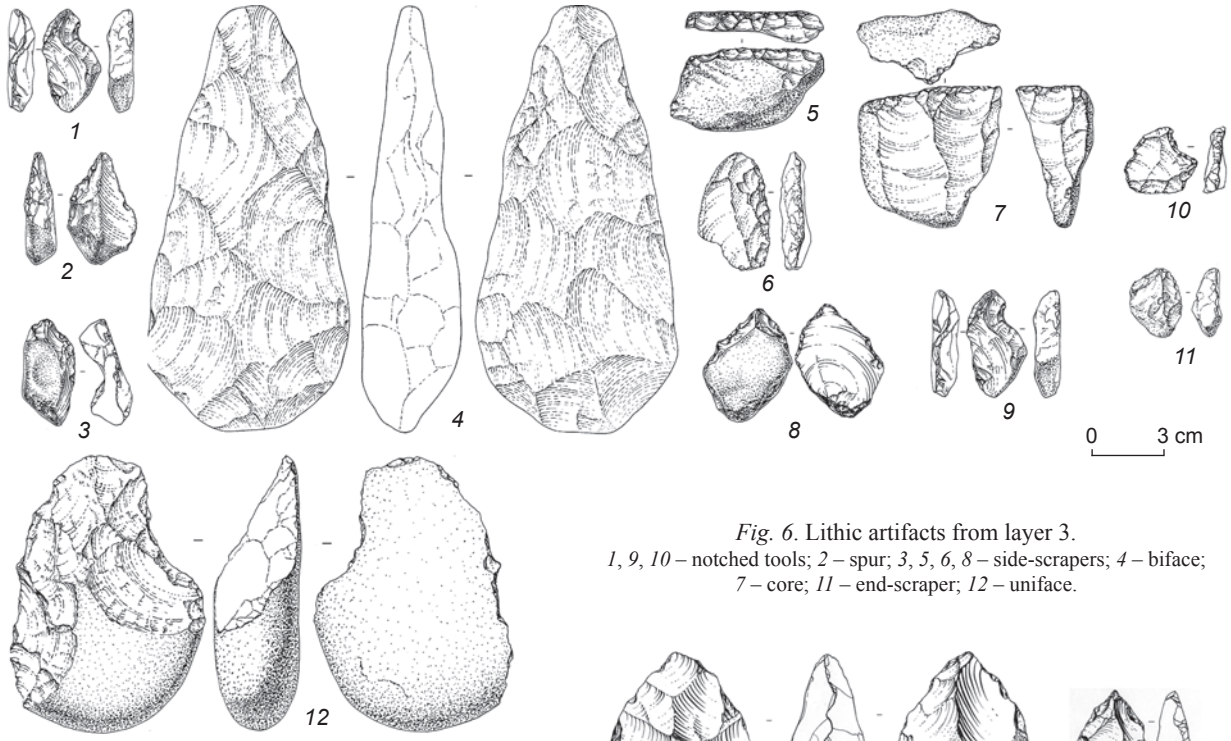


Fig. 6. Lithic artifacts from layer 3.
1, *9*, *10* – notched tools; *2* – spur; *3*, *5*, *6*, *8* – side-scrapers; *4* – biface; *7* – core; *11* – end-scraper; *12* – uniface.

lenticular cross-section, and edges worked by spalls and coarse retouch. Its maximum width and thickness fall at the middle of the tool. The edges are convex with a twisting rim, the distal end is narrowed by lateral spalls on two sides and does not form a clearly pronounced point. Judging by this feature, the item can be defined as a handaxe with "shoulders" (see Fig. 5, *1*; 8, *1*). The biface 13.6 × 8.3 × 3.2 cm is prepared on an elongated and flat sandstone pebble. The tool is strongly rounded, almond-shaped in terms of morphological characteristics, with traces of partial finishing, and plane-convex in cross-section. The distal portion of the item is flat, which is determined mainly by the use of flattening direct percussion, the base is angular-convex, the pebble cortex is preserved over much of the tool (see Fig. 5, *2*). A tool 11.0 × 7.5 × 3.0 cm in size is made on a limestone pebble; it is almond-shaped, double-convex, two-thirds of the blank are fashioned by spalls, the edges are weakly sinuous, the base of the tool is cortical, and fresh spalls can be seen on the point (see Fig. 7, *1*). A small handaxe, 5.0 × 4.0 × 3.0 cm, is made of flint, plane-convex, its base is pebble cortex, the point is rounded with traces of wear. An item 6.0 × 4.0 × 2.6 cm in size (a biface blank) is made on a pyramidal flint fragment, the point

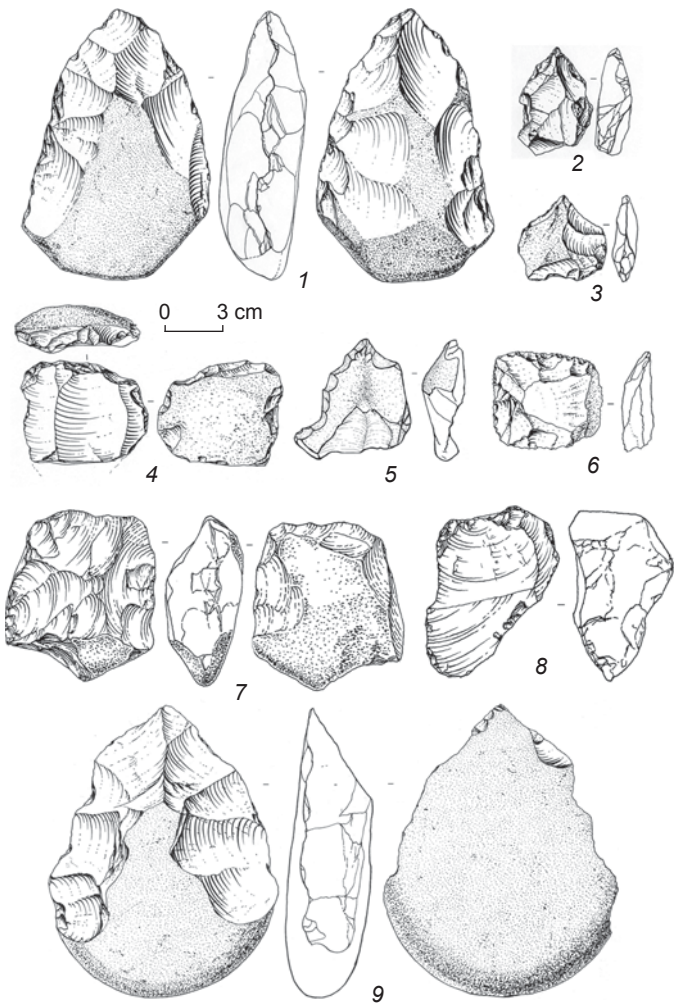


Fig. 7. Lithic artifacts from layer 3 (*1*, *2*, *4*) and 5 (*3*, *5–9*).
1 – biface; *2*, *3* – spurs; *4*, *7*, *8* – cores; *5* – combined tool; *6* – side-scraper; *9* – uniface.

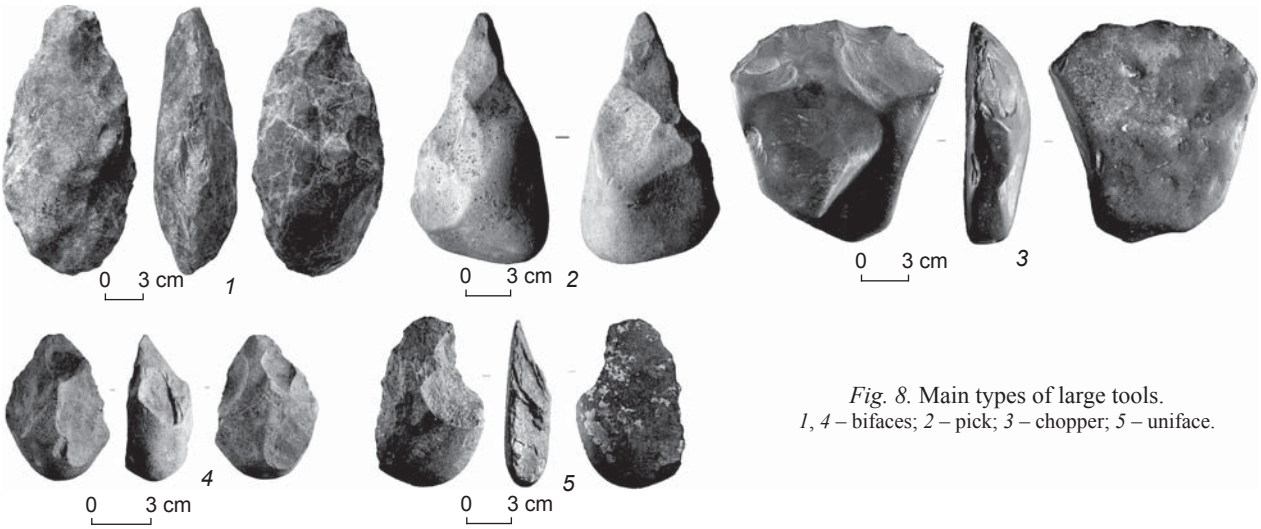


Fig. 8. Main types of large tools.
1, *4* – bifaces; *2* – pick; *3* – chopper; *5* – uniface.

is clearly pronounced; on one face, the object is fashioned by two-sided spalls. A large elongated uniface (11.2 × 7.6 × 3.2 cm) is worked by spalls on one side, and retains pebble cortex on the other side and along the base (see Fig. 6, *12*; 8, *5*).

Two picks, 7.5 × 7.0 × 3.5 and 9.5 × 6.0 × 6.0 cm, are made on pyramidal flint fragments; the items have a quadrangular cross-section and show traces of use in the form of small spalls (see Fig. 5, *5*). Two other tools, 9.5 × 6.0 × 4.5 and 7.0 × 4.0 × 3.0 cm, are trihedral and made of flint fragments, their faces are fashioned by large spalls, and the points by small spalls (see Fig. 5, *6*).

The most impressive core-like end-scraper, 7.0 × 5.5 × 3.4 cm, is made of flint; it has a sub-rectangular shape, its working portion is fashioned by spalls and retouching along the base (see Fig. 5, *7*).

Tools on flakes and fragments are also very numerous and varied; besides, they have characteristics of standardization. The side-scrapers are dominated by single-edged backed forms (see Fig. 6, *3*, *5*, *6*); one of them can be assigned to the "convergent" type (see Fig. 6, *8*). Among notched tools, retouched forms and those with Clactonian encoches are encountered. The notches on all items are isolated, and have small length and depth (see Fig. 6, *1*, *9*, *10*). When manufacturing spurs, either natural outlines of blanks were taken into account, or one or two paired notches were made. Almost all items have small or slightly elongated spurs, modified by fine retouch on one or two sides (see Fig. 6, *2*; 7, *2*). All end-scrapers are atypical, made on small flakes and flat fragments; the working elements of tools are fashioned by fine marginal retouch (see Fig. 6, *11*). Flakes and fragments show traces of irregular working along one edge; retouch is fine and discontinuous.

The collection of artifacts from layer 5 is characterized by a medium or low degree of abrasion. Materials recovered from the lower layer of pebble bed generally form a more homogeneous assemblage as compared to the industry of layer 3; all items are similar in the degree of surface preservation. While some artifacts from layer 3 have smoothed faces, traces of impact, wear, and transportation; the items from layer 5 usually do not show such features.

Fifteen core-like shapes have been found: 5 core-like fragments and 10 cores, which pertain to the simplest forms of single-platform single-faced cores (see Fig. 7, *8*; 9, *5*). One item corresponds to the category of radial single-faced cores (see Fig. 7, *7*). Debitage consists mainly of spalls (69 spec.), which are predominantly shortened and large- or medium-sized. Dorsal patterns are represented by subparallel and orthogonal varieties in approximately equal proportions. The residual striking platforms are mainly smooth and natural, while faceted and dihedral ones are rare. Fragments (46 spec.), which make about 30 % of the assemblage, frequently do not exceed 5 cm in length, and are often plate-shaped. Pebbles (10 spec.) are large- and medium-sized; one of these has typical wear traces at the base—it was apparently used as a hammerstone.

The toolkit consists of 48 items. Flakes or, in some cases, flat pebbles and fragments were used as blanks. The following items were assigned to the tools: 4 bifaces, 1 uniface, 2 choppers, 3 picks, 1 knife, 5 side-scrapers (see Fig. 7, *6*), 4 atypical end-scrapers, 7 notched tools, 10 spurs (see Fig. 7, *3*), 2 combined tools (see Fig. 7, *5*), and 9 flakes and fragments with retouch.

The most impressive are bifaces, the uniface and picks. The biface 9.5 × 7.3 × 4.5 cm in size is made on a brown flint pebble. The item is rounded, with a plane-

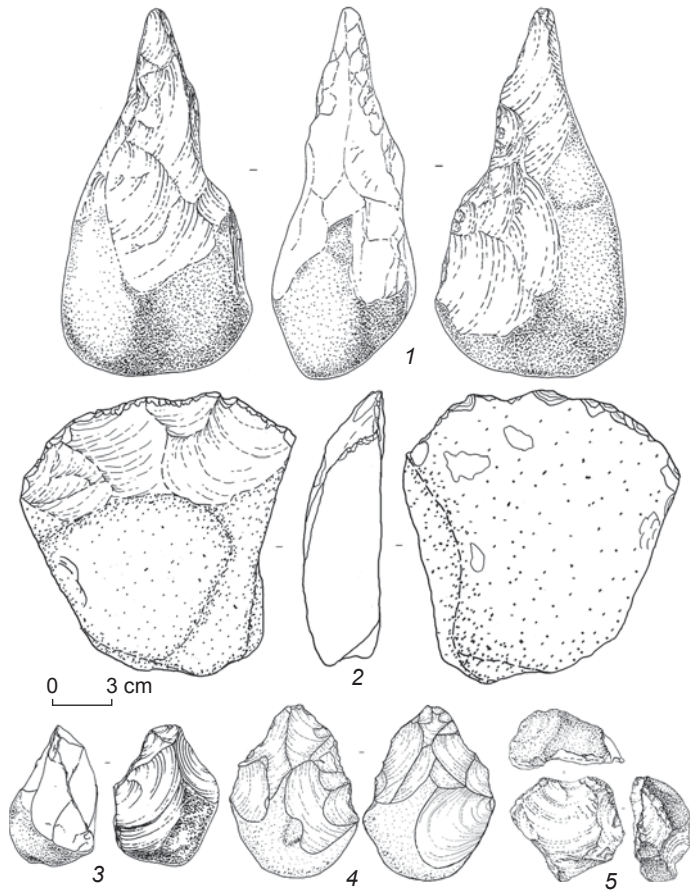


Fig. 9. Lithic artifacts from layer 5.
1 – pick; *2* – chopper; *3*, *4* – bifaces; *5* – core.

convex cross-section. The edges, narrowing to the distal edge, are roughly reduced by large spalls. The distal part in the form of a short transverse edge was fully bifacially worked. More than a half of the tool (including its massive base) was not treated. A handaxe 7.5 × 5.4 × 3.4 cm is made on a small yellowish-gray flint pebble. The sub-triangular tool is plane-convex, wide faces are worked by spalls, one side face and the point are additionally fashioned with medium retouch, a massive butt is pebbled (see Fig. 8, *4*; 9, *4*). The collection includes another two bifacially worked items: small natural-based flint pebbles, partially fashioned by spalls on two sides. Both tools have a sharpened edge in the distal part. Typologically, these items can be assigned to the category of protohandaxes (see Fig. 9, *3*). The uniface (12.5 × 9.5 × 2.8 cm) made on a flat sandstone pebble is almond-shaped, one surface is fashioned with large and medium spalls, the point is clearly pronounced (see Fig. 7, *9*). Among the pick tools, an item 18.6 × 9.9 × 6.8 cm in size, made of a grayish-yellow sandstone pebble stands out in particular. It boasts a well-pronounced point triangular in cross-section. The longitudinal edges are straight or weakly sinuous, coarsely worked by large spalls. The wide massive base is an unshaped edge of pebble (see Fig. 8, *2*; 9, *1*). Other picks (8.5 × 4.0 × 3.0 and 6.8 × 5.0 × 3.5 cm) are made of flint. They have a sub-triangular shape and show signs of use (wear traces and small spalls at the points).

The chopper is made on a flat large pebble (14.5 × 13.4 × 4.3 cm). The transverse edge is transformed with several wide large spalls into a working edge showing wear traces (see Fig. 8, *3*; 9, *2*).

In general, the main techniques of producing blanks, secondary reduction strategy, shapes and types of tools on flakes and fragments from layer 5 do not differ from those found in layer 3.

Results

The stone industry of the Darvagchay-Zaliv-4 was produced using multiple kinds of locally-available raw materials. These materials included layered and nodular flintstone, strongly silicified limestone on the outside of siliceous nodules, and weakly silicified sandy limestone in the form of pebbles and nodules*. These materials are encountered in the Upper Cretaceous (the Danian stage) limestones (Cr_{2d}) in the form of lenses of various thicknesses and lengths, as well as nodules (no more than 0.3 m in diameter on the average). These varieties of stone are components of the culture-bearing horizons of the site, and are clearly discernible in several exposures nearby. Such rocks are also extremely varied in their ornamental properties, which constrained the kinds of tools produced.

Analysis of the archaeological collection has demonstrated that the most popular raw material at the site was flint (the proportion of flint artifacts amounts to at least 80 % of their total number). In the pebble gravel horizons, flint is represented by small pebbles or debris, whose diameter rarely exceeds 10 cm. Flint boulders (up to 30 cm in diameter) are extremely rare. Flint from the pebble-gravel horizons has a lot of internal defects—primarily fracturing, but also foreign inclusions and caverns. Observations and experiments

*Petrographic studies were conducted by N.A. Kulik.

have shown that the process of flint knapping is difficult to control: the spalls are often interrupted by fractures, they are massive, short, and irregular, and the striking platforms are destroyed upon percussion by a hard hammer. Probably, owing to these features of raw material, unspalled bases were often used to manufacture tools. These characteristics of local flint resulted in an abundance of artifact-like debris in the culture-bearing layers, and made secondary working of material more difficult.

Artifacts from Darvagchay-Zaliv-4 differ in their surface preservation, from items with the unsmoothed "fresh" ridges to strongly rounded objects. Meanwhile, we observed no relationship between the degree of surface weathering and the planigraphic and stratigraphic position of artifacts. Traces of impact in water flow on the surface of nodules are relatively rare. The absence of such traces on the artifacts and the presence of a great amount of quartz particles suggest that such abrasion took place in water-sand slurry in the intertidal beach zone. Transportation and mixing of artifacts in the littoral zone is evidenced by their "suspended" position and differences in surface preservation. It should be also taken into account that about 25 % of items have no traces of any smoothing action on their surfaces at all.

The set of tool types and the character of secondary working remains consistent across the cultural-lithological units, but the diversity of tool forms, as well as their quantity, increases in later levels, and reaches its maximum in layer 3. However, in spite of a small chronological gap between the development of cultural horizons, the assemblages are similar in their basic techno-typological characteristics. Common features are primary knapping and secondary working strategies, the types and shapes of tools and cores, and the presence of bifacial tools.

Analysis of planigraphy and stratigraphy demonstrates that the artifacts experienced post-depositional movement. The high concentration of artifacts (for the Early Paleolithic), presence of all primary knapping products (including small flakes), and impressive diversity of tools represent a full-fledged Early Paleolithic industry. Collections of artifacts from Darvagchay-Zaliv-4 demonstrate consistent similarity in their main typological and technological criteria. These materials may represent the accumulation of several sites or activity loci across a broad period of time. At the same time, the results of analysis of lithic artifacts testify that in the period of formation of layers 3 and 5, this area was inhabited by people using a common lithic tradition based on local varieties of raw material. This evidence is of great significance for both understanding the morphology of the discovered archaeological materials, as well as for further correlation with other Early Paleolithic sites to determine its regional context and significance.

General analysis of archaeological materials allows the following conclusions to be made about the type of the Darvagchay-Zaliv-4 industry. Primary knapping and secondary working strategies consisted of relatively simple techniques. Preliminary preparation of cores for regular knapping was minimal, and as a rule convenient natural surfaces were used. There is evidence of crushing and the "citron" technique (traces of the use of flint fragments for secondary working, and isolated "citron" spalls). Flakes are dominated by massive sub-rectangular and wide blanks. More than 40 % of flakes preserve, fully or partially, the pebble cortex. Commonly, faceting of dorsal surfaces was smooth, natural, or unsystematic. Secondary working in the form of retouch encountered in the assemblage is most frequently marginal; only very rarely was it used to change the blank morphology. Direct percussion and the techniques of producing Clactonian encoches were widely used. Side-scrapers, spurs, and notched tools prevail among the distinguished categories of tools. The most distinguishing traits of the toolkit are large pebble and bifacially worked items. These are not numerous but morphologically impressive specimens consistent with archaeological classifications for the Early Paleolithic (see Fig. 8). The studied materials reflect all cycles of stone working (from acquisition of raw materials to manufacture of tools), which allows consideration of the site as a base workshop, which was visited many times and where mass production of series of artifacts took place, including complex tools.

Conclusions

New light on the lithic industries of the late Early Paleolithic in the territory of coastal Dagestan is shed by the finds from layers 3 and 5 of the site Darvagchay-Zaliv-4, by materials from the stratified sites Darvagchay-1 (layer 8) and Darvagchay-Zaliv-1 (Early Paleolithic assemblage), as well as by stone items collected from surface at other sites of Dyubekchay, Darvagchay-Zaliv-2, Darvagchay-Karier, and Chumus-Inits (Derevianko et al., 2012). The materials from these sites are generally characterized by parallel and radial cores, notched tools and spurs, single-edged side-scrapers and atypical end-scrapers, and occasional pebble tools (choppers) and bifacial (handaxes, picks)

tools. Regularity in the key categories of typologically distinct artifacts, as well as the geologic age of culture-bearing deposits, allow us to assign these materials to the Middle and Late Acheulean assemblages of Caucasus.

The emergence and subsequent spread of Acheulean industries, characterized by the presence of handaxes (bifaces), in the territories of Africa and Eurasia is one of the most discussed topics in the archaeological community. To assess the presence of Acheulean features in the Darvagchay-Zaliv-4 industry, it is necessary to compare it with the most significant, well-studied and synchronous Caucasian archaeological sites.

In the Caucasus, most known Acheulean artifacts have been recovered from outside of stratigraphic context. There are several zones of distribution of such assemblages, which differ both in their composition and in the type of the utilized raw materials: southern Armenian and southern Georgian (obsidian, andesite: Satani-Dar, Arzni, Djraber, Tchikiani, etc.), southern Ossetian (flint, basalt, andesite: Lashe-Balta, Kaleti, etc.), Pontic and Trans-Kuban (flint, sandstone: Yashtukh, Ignatenkov Kutok, Abadzekhskoye, etc.) (Lyubin, 1998; Lyubin, Belyaeva, 2006). In the last decade, a great amount of surface finds pertaining to this period were also discovered on the Lori Plateau (northwestern Armenia) and near the Mingechaur water reservoir (western Azerbaijan) (Belyaeva, Lyubin, 2013; Kulakov, Zeynalov, 2014). A typical feature of these industries is the presence of various bifacial tools (bifaces, cleavers, picks, etc.), which often serve as the main dating characteristic. These assemblages (characterized by their occurrence outside of stratigraphic context, with mixed and incomplete collections) nonetheless demonstrate the spatial distribution and diversity of Acheulean industries throughout the Caucasus.

One of the main reference sites in Caucasus where Acheulean materials have been recovered in reliable, stratified conditions is multilayered cave site of Kudaro I (South Ossetia), whose age is determined within 0.4–0.3 Ma BP (Lyubin, Belyaeva, 2004; Lyubin, Belyaeva, 2006: 47–49). The collection of lithic artifacts contains about 5500 items, where approximately 20 % are tools. The assemblage consists of multiple raw materials, with a predominance of silicified sandstones and shales, and with infrequent use of flint, obsidian, and andesite. Primary reduction was usually performed by the parallel technique; preparation of cores was generally limited to straight- or oblique-platform fashioning with one or several spalls. Flakes, on which the majority of tools were made, served as the main blanks. Secondary working was performed by direct percussion and retouch, mainly marginal and irregular. The toolkit is represented by side-scrapers of various modifications (~ 40 %), denticulate-notched (~ 17 %) and beaked (~ 10 %) items, and large tools (~ 9 %). Large tools are rather diversified and include choppers, handaxes and core-like end-scrapers.

Materials similar to the Kudaro assemblages have been found in Tsona Cave, located in the same area. Tool forms are the largest and most diverse category of artifacts, about half of which are represented by bifacially worked tools (handaxes and cleavers), with the remaining items being side-scraper and beaked forms. The industry is based on multiple raw materials; argillite, andesite, flint, sandstone and other rock types were used. Owing to a small number of finds and limited publications, comparison of this industry with other Acheulean assemblages of Caucasus is difficult. Notably, V.P. Lyubin highlights the cultural and chronological similarity between the assemblages from the sites of Tsona and Kudaro I (Lyubin, Belyaeva, 2004: 260–265).

One of the most well-known archaeological sites of Caucasus is Azykh Cave (Nagorno-Karabakh). Two layers containing Acheulean-like materials (layers VI and V) were identified at this site, the age of which was estimated to ca ~0.5–0.3 Ma BP according to paleontological and palynological criteria. The archaeological materials demonstrate the full cycle of lithic reduction oriented toward the use of pebble materials, mainly sandstone and siliceous schist. Primary reduction is represented by a small number of discoid (radial) and parallel cores, mainly exhausted. The majority of tools were made on flakes and their fragments. Secondary working was performed by fine flaking and retouching, where retouch generally was usually regular fine marginal, on some items stepped, and sometimes bifacial. The blank fragmenting technique was widely used. The leading categories of the toolkit consist of various side-scrapers: double-edged side-scrapers, including convergent and angular. Denticulate-notched tools and atypical end-scrapers are representative. Large tools (choppers, handaxes, and cleavers) amount to about 10 % (Guseinov, 2010).

The Darvagchay-Zaliv-4 industry is closest to the Kudaro variant of the Upper Acheulean of Caucasus. Both of these industries were formed on the basis of local multiple raw materials including limestones, sandstones, and low-quality flintstones. They show a low percentage of large tools (of similar types) that consist of pebble and bifacially worked

items. Certain types of handaxes (lancet, those with "shoulders" and a transverse edge) have direct analogies in the Acheulean assemblages of Kudaro I and Tsona (Lyubin, Belyaeva, 2004: 105, fig. 47, *1*; Lyubin, 1998: 105, fig. 55, *2*). Noteworthy is a high percentage and a variety of tools made on flakes, among which large series of side-scraper forms, spurs, notched, denticulate, and combination tools were identified. At the same time, there are fundamental differences between the materials of the Darvagchay-Zaliv-4 site and those of Caucasian cave sites. Lithic collections of these cave assemblages appear more developed than the materials of Darvagchay-Zaliv-4. They contain distinct blade blanks and some traits of secondary working complication, more frequent use of regular stepped retouch, as well as technique of blank base thinning. Among recognizable tools, tsaldi-type items, limaces, complex shapes of side-scrapers (convergent and angular), and points (some specimens of which correspond to the Tayac and Quinson points) are noted.

In discussing the Acheulean industries of Caucasus, all researchers agree on the wide diversity of local variants. However, they disagree about the principles of distinguishing these variants, or their chronology and distribution boundaries (Lyubin, 1998; Lyubin, Belyaeva, 2006; Doronichev et al., 2007; Amirkhanov, 2016). According to Derevianko, the Acheulean industries in the conventional sense of this term appear in Caucasus with migration of human populations (*Homo erectus*) to this area from the Near East not earlier than 600–500 ka BP, and spread widely at a later time. The Acheulean complexes in Caucasus are characterized by the presence of handaxes and by an extremely small quantity of cleavers. Among the Acheulean localities, conspicuous are local groupings, which are substantially different both from each other and from analogous industries of other Eurasian regions in general. The bifacial technique could come to Caucasus by "passing the baton" (culturally diffusion) or could have evolved on the basis of local traditions of bifacial working of stone tools that emerged here more than 1 Ma BP. In any case there are no grounds for grouping the bifacial industry of Caucasus with analogous industries of other regions into some common so-called Acheulean culture (Derevianko, 2014). The differences in the ornamental properties of the used raw materials, and a variety of their shapes and sizes resulted in wide variability of bifacially worked tools. At the same time, the best technologies and manufacturing practices were elaborated for specific raw materials.

In this context, the late Early Paleolithic complexes of southeastern Dagestan should obviously be considered as a local variant of a trans-Caucasian lithic production and development zone of Acheulean-like industries. Assemblage features such as a relative paucity of handaxes, common for the entire Greater Caucasus, also characterize southeastern Dagestan. A great variety is observed in the types, shapes, and techniques of fashioning of bifacial tools, which do not form distinct typological groups. Moreover, thoroughly worked, regularly-shaped classical items characteristic of other Acheulean industries are not numerous here. The prevailing tools are so-called partial bifaces, sometimes in the form of roughly chipped out pebbles, asymmetric along the outline, with uneven edges. Technological features of available raw materials, as well as a diverse shape range of initial blanks, produced a great variety of morphological forms and low standardization of Early Paleolithic tools in southeastern Dagestan.

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