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The collection contains the proceedings of the 5th annual meeting of the Asian Paleolithic Association (APA) and the 17th International Symposium "Suyanggae and her Neighbours" that were held in V.P. Astafiev State Pedagogical University in Krasnoyarsk. The papers were presented by the experts in archaeology, physical anthropology and paleoecology from Russia, China, Japan, Korea, USA, Belgium, France, Ukraine, Belarus and India. The papers highlighted the topical issues of archaeology, ethnology and paleoecology of Eurasia.

The book is directed toward students of archaeology, anthropology and related scientific disciplines.

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# THE MULTILAYER LATE PALAEOLITHIC SITE LISTVENKA (Middle Yenisey)

Listvenka site was discovered in 1982 and has been studied since 1983 by a group of archaeologists of the Krasnoyarsk Pedagogical University and the Institute of Archaeology and Ethnography of the Siberian Department of the Russian Academy of Sciences under the supervision of N.I. Drozdov (1983–1985) and E.V. Akimova (1986–1997). Geology and geomorphology were studied by S.A. Laykhin, V.P. Cheha, the conclusions on the palinology of the section were made by V.G. Kolzova, the faunal collection was defined by N.D. Ovodov, N.V. Martinovich, S.B. Vasiliev, A.A. Guliaev, A.N. Motuzko, A.F. Sanko, V.U. Ratnikov.

The site is situated in the southern Divnogorsk suburb, on the right bank of the Lisvenka-Zarechnaya river 600 metres below its mouth (this river flows into the Yenisey river). The river crosses the terrace complex formed by Yenisey on the convex right side of the valley and flows into Yenisey little below the Krasnoyarsk HES dam. In 50s, while the HES building the site was greatly destroyed, the local relief changed in a high degree, so the terrace correlation can be represented only approximaly only in the site region.

The site belongs to the fragment of the 40 metres terrace which is 23 metres above the Listvenka river level. The reason of it is a steep slope of the river bed in the crossing Yenisey terraces area. Its fragmentary situation by mouth Listvenka river part doesn't allow to attribute its belonging to Yenisey or to its tributary.

Quartery deposits of the site part are devided into two strata. The first is represented with detritus-pebble deposits two metres depth and evidently is the remains of the river Listvenka bed alluvy. At the point of contact debris and native rocks there is the 10–15 metres wide linear reduction. It is filled with sandy-allevrit sediments of the second stratum, which involves Late Palaeolithic cultural horizons. The strata is dated to Sartarian (Late Wurm).

The faunal assemblage is characterized by wooded-tundra and partially-wooded steepe forms mixing, while the last one dominates. There are mammoth bones at the base of the section only (19 c.l.), isolated tusk fragments and tusk hand-made articles are observed above it. The correlation of bison

and reindeer remains fixed in all cultural layers is signficant. So, reindeers bones dominate always in the deposits at the 1–8, 16–18 c.l. levels. Evidently, bison was a dominating object of hunting in 9–14 c.l. A single layer with horse bones dominance is the 15A c.l.

Listvenka site is one of a few Late Palaeolithic sites in Siberia, where great number of short-lived sites remains are fixed in the ranges of the local site part. About 25 cultural layers similar in genesis, features of occurence and character of filling are distingished at the monument at present (accepted level numbering basis consists of 1–19 c.l.).

One of distinclive Listvenka site features was the appearence of the recurrent sites at the same place, i.e. in a small ravine (perhaps, in the dried bed of the ancient channel). This fiture pvedetermined the hearth leaning towards one line, i.e. towards the bottom of the ravine. A compact refitting product fragments lay-out, abundance of bone remains in anatomical order, stable horizontal artefact occurence, availability of the household constructions show the predominance in situ materials. Local deformations took place because of criogenial distructions in the form of the ice veins, the cracks, made by thraw and rain waters, mole holes, the blowings and so on. More ancient artefacts gathering and secondary exploitation of them without repreparation promoted the vertical artefact dislocation.

The Listvenka site is distinguished by hearth character of the cultural deposits as a vast majority of Yenisey Late Palaeolithic monuments. A cultural layer can be traced as a dense seam of soot full of flakes, chips, bone fragments and on which surface larger artefacts and animal bones occur and complex houshold construction remains are fixed depending on the excavated part of the site. Another demonstrates faint marks of dotted horizon with a few artefacts without visible changes in soil colour. Such cultural layer “poorness” shows a peripheral position of the excavated site part more often than a short life of the site.

There are no reasons to speak about any narrow economical direction of the separate cultural according to the Listvenka site excavations. Each recurrent site existed as a complex polifunctional organizm and involved many types of economical activitiec evidently.

The analysis of the archaeological material makes to speak of five transformations of archaeological cultures at the site.

The highest group of the culture layers (1–4) has preserved only on a small area. Archaeological material is a few and does’t form stable series.

Large cores (biplatform cube-shaped bifront and monofront with adjacent platforms) are intendent for producing of blade spalls and flakes medium in size. Pseudowedge microcores are characterized by different modifications of a counter-front and smooth rightlateral retouched platform.

The vast majority of tools is produced on flakes (often on flat pebbles) with scaled or procumbent retouch of one or both of faces. Small scrapers (Fig. 1, *5, 8, 9*), side-scrapers and bifaces too (Fig. 1, *6*), chisel-shaped flake tools, piece escaille type (Fig. 1, *7*), chopper-pushplanes, knife-biface, a drill and borers on large pebble spalls (Fig. 1, *1*) consist the tool kit collection. Bone inven-

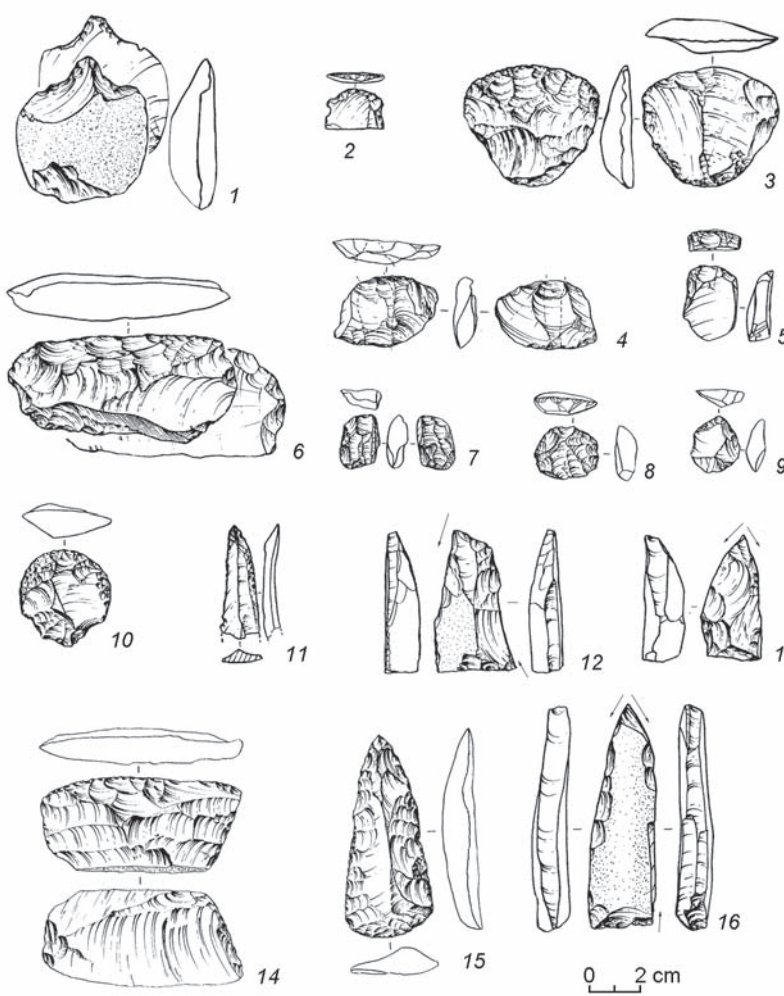


*Fig. 1*. Listvenka. Works 1984–1992.
C.l. 2: *1* – roller, *2* – scraper, *3* – knife-shaped tool – biface;
C.l. 4: *4*, *5*, *8*, *9* – scrapers, *6* – drill, *7* – chisel-like tool;
C.l. 9: *10* – scraper, 14 – recloir;
C.l. 10: *11*, *15* – points, *12*, *13*, *16* – burins.

tory is a perforator on a large bison bone spall, a needle fragment, an original cupshaped tusk product (2 c.l.).

Marked bladeness characterizes stone inventory of cultural layers 5–13 and 15A. Knapping techique determines producing of suitable blanks, so cores on boulders are only monoplatform monofronts with segment-shaped platforms and flat couter-fronts. Wedge-shaped microcores are mostly classical microforms with bifacial surface treatment, a marked keel and a crest. Specifical distinction is a left-lateral retouched platform.

Features of the basic blank, i.e. blade, determined the dominance of dorsal edge and unifacial retouch. Stone inventory consists of the following artefact categories: points with edge and unifacial treatment (Fig. 1, *11, 15*), central and side maltifacetted burins as usial and combined often (Fig. 1, *12, 13, 16*), push-planes and planing knives, end-scrapers and round scrapers (accounting scrapers on flakes) (Fig. 1, *10*), perforators and borers with point made on the natural blade projection, chisel-shaped tools are few, large in size and produced on spalls from cores and tool fragments. Different pebble tools are numerous: hammer-stones, choppers, with longitudinal and transverse working edge position.

The bone inuentory is marked: needles, notched tools made of horn and tusk accounting those ones which have stone insets, awls, points, a penetration made of bird bone, a pendant in a form of a sitting bird, serie of original products of undetermined function (for ex., it's a massive tusk product which belongs to a category of so-called a "chip baton" with 3 oval holes) (Fig. 2, *1*).

Three hearth types are observed in the 6, 8–10, 12V–12G,13 and the 15A c.l.: without lining (6, 9 c.l.), with compact concentric (6, 8, 10, 12G c.l.) and fragmental ones (1–3 stones) (12V, 13, 15A c. l.). Such differences in a construction accounting different preservation degree have functional character evedently.

The 9, 10, a group of the 12 c.l. (A–G) and 15 c.l. are the most interesting and informative for studing of Palaeolithic man economy and behavior, stone and bone industry.

The 9 c.l. is observed on the area of about 150 $m^2$. There is no charcoal, soot and any changes in soil colour in the excavating area central part. Some material concentration is observed along slope base in the ravine where bone remains form small horizontal assemblages without anatomical order. Bison (213 fragments of 3–4 specimens), reindeer, ram, hare, elk are faunal remains mostly. These are tubular bones and feet bones fragments as usual and ribs fragments rarely. A plot with an eroded hearth in a form of a solid charcoal-soot seam which is tull of numerous artefacts, bones fragments and detritus was found at the southern additional excavated area. Slight soot film with embedded charooal is observed out of area.

It's the 9 c.l. which shows a line of deformation along the bed of the criogenal vein most expressively. The deformation resulted in layer rupture, formation of a ledge (3 cm in height) and artefacts and natural infill dislocation (they were in a vein influential zone).

Natural c.l. uneventy, a northern-west direction slope (10 grades) ending in reduction made detritus concentration deposited on the layer surface after it formation possible. Perhaps, some large bison bones slipped down with detritus. An oval hearth (45 × 55 cm) has been found under detritus, its infill depth is no more than 5 cm. This object characteristic is its re-covering of the 10 c.l. hearth, and detritus re-covering "concealment" prevents a solvation of the problem on existance of a hearth lining. The combination of the natural ravine and younger criogenal vein crossing both of the hearths resulted in merging of 2 layers ash-soot seams into one. It's impossible to devoid archaeological material here.

Six conical dips (diametres are 3.5–5 cm, depths are up to 7 cm) with ash friable infill are observed near the hearth in north-cast direction. The distances

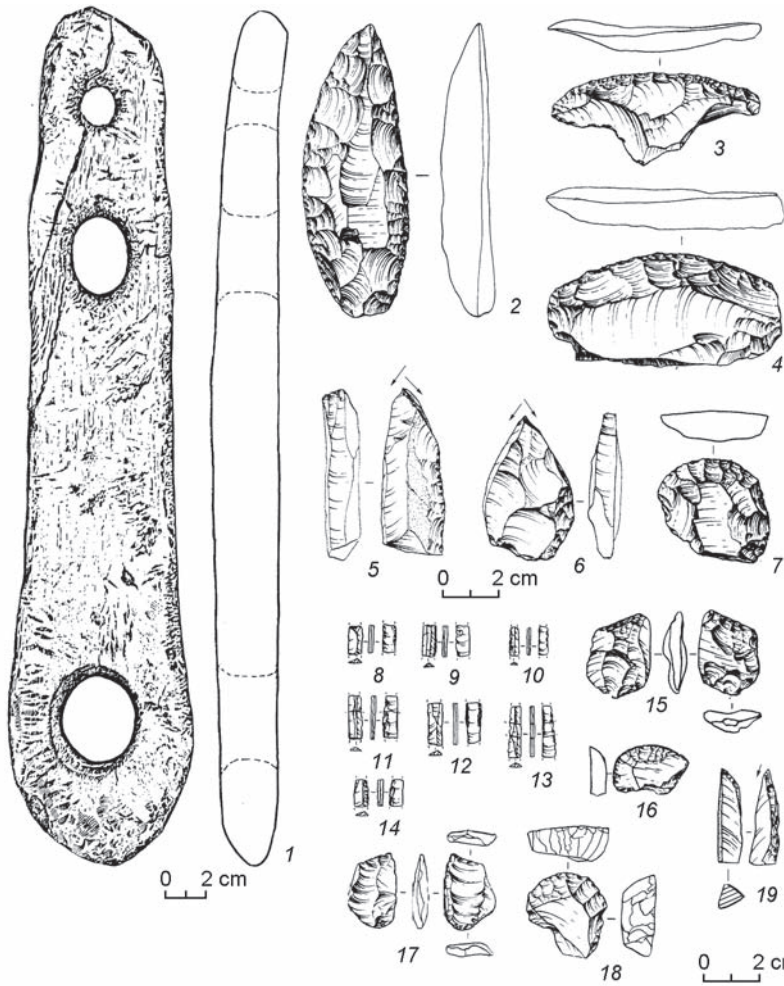


*Fig. 2.* Listvenka. Works 1990–1995.

C.l. 12B: *2* – point;
C.l. 12G: *1* – rectifier of the flagpole, *3*, *4* – recloirs, *5*, *6* – burins, *7* – scraper;
C.l. 14B: *8–14* – microbaldes-notched tools, *15*, *17* – chisel-like tools, *16*, *18* – scrapers, *19* – burin-like tool.

between the dips varies from 45 to 50 cm. Five dips form a conventional circumference segment with an evident 2.5 m diametre in the plan; the 6th dip is situated in the southern-western direction from the “centre”. It seems possible to interpretate such dips as light construction remains made of thin wooden poles with burnt ends.

Layer stone artefact set is characterized with knapping and secondary splitting products, there is a great number of cores with utilization degree, broken tools which show a production complex existance here, i.d. the stone treatment area.

The 10 c.l. is observed on the 150 $m^2$ area. The c.l. level is not marked practically, soot elements are rare; the layer is observed as faunal remains, mostly (more than 900 fragments of bison bones; there were 5 specimens at least) and detritus in the central part of the excavated area. Bone assemblage area is 40 $m^2$ and is situated in a dip and its sloping sides. Faunal remains have no an anatomical order usually, instead of some joints (a backbone, a cubital joint, feet fragments, a lower jaw with teeth...). Stone and bone inventory is few.

Faunal remains number decreases a little (assosiating with types increasing: bison, reindeer, horse, fox, partridge, hare), deposits soot colour intensifies (soot elements density of higher degree is observed), stone artefacts number increases in the southern part of the excavated area.

Archeological material concentrates around of a hearth which has a lining consisted of 13 plageogranite boulder fragments and cobble fragments. Stones are set on the pit bottom at the 30–60 grades angles or perpendicular to it. The lining of the southern part thickness was increased with the lower stone layer. The pit-fire filled with homogeneous small-grained charcoal has a rosette-shaped form (a diametre is 70 cm and depth is up to 15 cm).

The endproduct percentage is high on the area. One part of the endproducts is made of one brown jasper boulder or a cobble. Many tools have an effaced working edge, there is a lot of broken tools. The primary and secondary treatment products are a small material part, the stone splitting was subsidiary evidently. Tools intended for bone, hide treatment dominates (points, knife-shaped tools, scrapers, burins).

The 12 c.l. was observed on a larger excarated area as a single “dotted” horizon, marked with humus and charcoal organic fragments and having isolated artefacts. Its level changes in some places. Last years excavations were conduct at the area where 4 resembling ash-soot seams with abundant bison, hare, mountain goat bone fragments and numerous stone artefacts were observed at this level. An archaeological material analysis shows there is no one layer distribution but isolated cultural levels serie took place on this local area and these levels were partially defofrmed, i.d. some elements changed their place, but in situ state prevaied.

A hearth complex belongs to the lower cultural layers level (12V–G) (Fig. 2, *1–7*).

The hearth № 1 is oval and has 60 cm in a diametre and 12 cm in depth. Infill is dense ash. Two large plageogranite fragments hanging over the bottom and a transversally splitted cobble are set at the sides of rosettre-shaped hearth-pit. The hearth № 2 is situated in 80 cm to the south-east from the first one. Its shape is oval in plan, the outline is crooked, a diametre is 56–64 cm, the depth is 7 cm. The infill is friable and includes large charcoal pieces. There is no lining but large plageogranite fragment was found on the pit-fire bottom. The infill upper layer (of the both hearths) is full of flakes, blades and microblades fragments, indeterminate bone fragments. The hearth № 3 is at the bottom of the ledge, made by the criogenial crack. All the hearth construction is covered with the infill, i.d. highly vivid fulvousish charcoal, soot, archaeological and faunal material. The pit-fire is ovate and 87 cm in lenth

and 15 cm in depth. Large and medium size detritus and plageogranite fragments were used as lining. Stones are put perpendicularly or at 80–90 grades angles to the bottom at the northern and eastern pit-fire sides. The western side is observed unevenly on the destroyed lining remains. Boulder fragments are in disorder and don't show pit-fire out-line. The hearth infill is full of numerous blades, flakes, teeth and bison, reindeer and hare tubular bones.

Three hearth spots were found in the 12G cultural layer. They are situated one by one in the "north-south" direction. Distances between them are no more 7 cm. Metric characteristics are similar: diametres are 22–32 cm, depths are 3–6 cm. Their cross-sections have a rossette-shaped form. The infills are friable, siltish and have fulvousish calcining outlines.

A homo sapience jaw with teeth was found at the 12 c.l. level near which had no archaeological or faunal remains. Taking into account simultaneous formation of the crack and the layers 12 deposits we can't assume any finds transference. The preservation degree is as good as other bore remains preservation degree of the cultural layer; there are no nibbling traces. It's the jaw of a child who was 5–6 years old as D. Heisler (USA), A.R. Kim and V.A. Dreomov (Russia) determined. E.G. Shpakova considers that the child from Listvenka was 3 years old. It was europeoid but had the features of Neanderthal (Shpakova, 1997).

The cultural layer 12G is dated to 13 100 ± 410 (ГИН-6967), 13 470 ± 285 (СОАН-3733), 13 910 ± 400 (СОАН-3833), 13 260 ± 160 (СОАН-4868).

The 15 c.l. is observed on the 200 $m^2$ area as a thin fulvousish seam with isolated faunal remains. A consentrated archaeological complex presenting a north segment of the site household zone (dwelling?) was found on the southern additional excavated area (southern site part had been destroyed absolutly).

The hearth (the diametre is 90 cm; the depth is up to 20 cm) perhaps was a site centre.

Archaeological and faunal remains (bison, reindeer, horse, deer, ram, fox (Arctic fox?), hare) are observed in the friable ash ferri ferous seam and on its surface. They are compact and form flat multilevel assemblages on some areas. Large and small detritus is on the seam surfase which contains artefacts, and which is "ruined" with some stones. The assemblage concentrates on the 15 $m^2$ area out of which were found bison and horse bone fragments, a mammoth tusk fragment and a workshop area. Eight wedge-shaped microcores and cobble uniplatform monofrontal cores as well flakes and blades recieved from these cores (up to 2 000) concentrated on the 1.5 $m^2$ workshop area. A group of unharmed and splitted horse teeth is marked in the assemblage (perhaps, they were used as flaking tools).

The 14B c.l. is observed between the 13 c.l. and 15A c.l. This c.l. stone indastry is characterized with increasing of raw material which doesn't belong to Yenisey pebble bank – i.e. chalcedony, flint and quartz sandstone. This explains, perhaps, some artefacts categories microlithisation: chisel-shaped tools, burins and scrapers. Medium size flakes and spalls were used as blanks which needed edge retouch and bifacial and unifacial treatment. Blades and bladish spalls of medium sizes were recieved from biplatform monofrontal and bifrontal cores. Some wedge-shaped microcores have good scheme secondary treatment

of keels and crests and rightlateral retouched platform. Stone inventory consists of isolated chisel-shaped flake tools and piece eccaille type tools, scrapers (Fig. 2, *16, 18*) and burins on medium size blade fragments. Microblade-insets tools index is more than 50 % (Fig. 2, *8–14*). The bone articles collection consists of needles and notched tools, some of which have surface ornament elements and stone in-sets in the notch.

The 14B c.l. excavated area is about 150 $m^2$. The southern excavated area part where 2 spots (ochery and sooty ones) re-cover each other is the most interesting. Spot diametres are about 6–8 m. Zone central part is full of primary and secondary splitting products, varied stone and bone inventory, faunal remains (bison, reindeer, hare, mountain goat, wolf, partridge). The original hearth complex has been found here.

The hearth № 1 is in a rosette-shaped dip which sloping sides turn into a bottom smoothly. The pit-fire diametre is 65–70 cm and a depth is 12 cm. The infill is ash and charcoal, the last one is not much. The plageogranite boulder fragment ruins the pit-fire infill near the side. Hearth remains are observed out of the pit-fire in the form of the thick annealing seam and the small ash-soot infill. The burnt notched tool and a great number of small burnt bone fragments were found here.

Three dips (diametres are up to 20–40 cm and depths are up to 4–7 cm) and 2 cylindrical pits (diametres up to 15 cm and depths are 7–11 cm) with flat bottom and uneven vertical sides are around of the hearth. A large uniplatform core, microblads, flakes, bones fragments were found in the pit (which is in 30 cm to the south-west from the hearth). The pit is covered with boulder fragments. Ochre and charcoal fragments, detritus and undetermined bison bone are in another pit (it is in 20 cm to the north from the hearth).

The hearth № 2 is in 0.8 m from the hearth № 1 (to the south). It's ovate (72 × 50 cm) and its depth is up to 7 cm. Unburnt bison bones fragments are on the hearth bottom.

Stone and bone inventory concentrates as a large assemblage arround of the hearth № 1 in the ochre-soot seam. There is no set location of finds on the artificially limitted area according to excavation result-artefacts number decreases from the area centre to the outlines gradually.

Cultural origin of the 16–18 c.l. which locate lower is not clear, material is unnumerrous and uninformative.

Remains of an artificial construction which has a circular stone lining, an ash-pit, isolated stone artefacts (a biface pebble blank, flake knives, blade spall knives, microblades and flakes) and bone remains (reindeer, bison, hare) are studied in the 16 c.l.).

The most ancient 19 c.l. is observed on thick detritus layer surfasce in recovered whitish and ferruginous coarse-grained sands containing small gruss. Mammoth (specimen is 3–4 years old) skeleton fragments in particially anatomical order are observed on the main excavated area: a nape part of skull with 2 teeth, a pelvis connected with 4 vertebrae, isolated mammoth and bison tubular bones and ribs fragments. Stone inventory is nit numerous and marked: a splitted pebble and 4 flakes with surface corrosion traces.

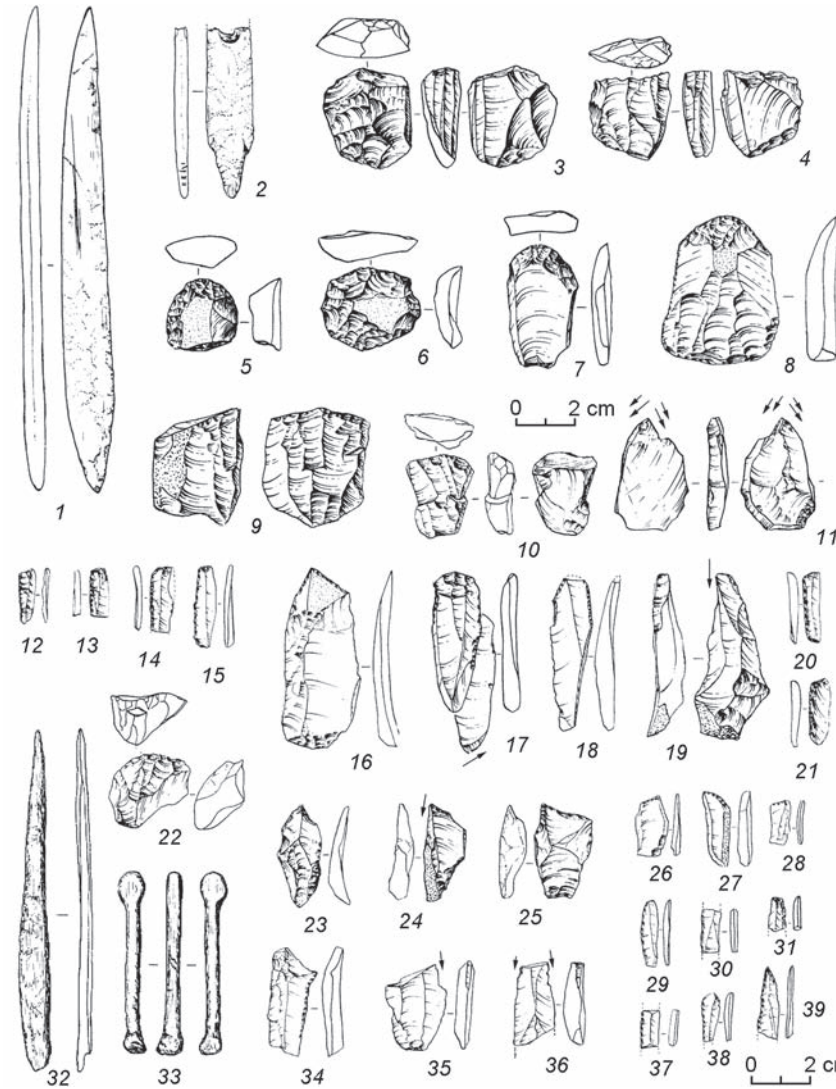


*Fig. 3.* Listvenka. Works 1992–1997.

C.l. 15A: *1* – point (antler), *2* – pendant (antler), *3*, *4* – microcores, *5*, *8* – scrapers;
C.l. 19: *9*, *10* – cores, *11*, *17*, *35*, *36* – burins, *12*, *15*, *20*, *21*, *26–31* – microblade notched tools, *16*, *18*, *19* – blade tools, *22* – scraper, *23–25*, *34*, *39* – borers, rollers, *32* – point (tusk), *33* – fastener (?) (tusk), *34–38* – burins, *39* – perforator.

However, the site central part proved to be related to a rich dwelling complex which was excavated on the 40 m$^2$ area. At present we can assume that 2 dwellings existed at the same time. The first dwelling lining is destroyed very much and boards are not clear. Large rock fragments and boulders were used in a complex double lining construction of the second dwelling. Archaeological

material (stone, tusk, bone articles, faunal remains) conentrates mainly inside of the construction. The layer thickness is up to 10 cm on some areas due to high degree finds concentration.

The 19 c.l. stone industry is characterized with marked bladeness. Small blades and blade spalls (sizes are no more than 5 cm) are recieved from cones with a segment-shaped or an oval platform, a flat or a very convex (up to concentric) front. Some samples have a front fransfered to a narrower butt. Mostly, tools are made on blades with small heavy retouch of edges, faces as well end which is truncated transversally or diagonally. There are series of microblades-insets (Fig. 3, *12–15, 26–31*), burins (Fig. 3, *11, 17, 19, 24, 35–38*), perforators (borers, drills) (Fig. 3, *23, 25, 39*), flake end-scrapers (Fig. 3, *22*), notched tools (push-planes). Small points (Fig. 3, *32*), a scapula-shaped tool with a shaft and a wide flat working edge, a large point with a wide shoot and other original articles wich need serious interpretation are made of mammoth tusk.

The cultural layer is dated to 16 640 ± 350 (COAH-3734), 17 200 ± 230 (COAH-5084).

The Listvenka-site studying has not been complete yet. We can confirm now that this multilayered settlement in the Middle Yenisei region is one of the most vivid and informative one in studing of Late Palaeolithic man archaeological cultures, householding and paleoecology in Siberia.

## REFERENCES

**Akimova E.V. 1981a**

Late Palaeolithic dwelling-workshop in the 19 cultural layer of Listvenka site (Middle Yenisei). In *Paleoecology of Pleistocene and culture of the stone age in the northern Asia and territories*. Novosibirsk: Izd. IAE SO RAN, vol. 1: 301–309.

**Akimova E.V. 1981b**

The history of the anthropological find from Listvenka site. In *Paleoecology of Pleistocene and culture of the stone age in the northern Asia and territories.* Novosibirsk: Izd. IAE SO RAN, vol. 1, pp. 298–301.

**Akimova E.V. 1992**

To the question of Afontova and Kokorevo cultures in the context of the multilayer site Listvenka. In *Paleoecology and occupation of ancient man in the northern Asia and America*. Krasnoyarsk: Zodiak, pp. 3–6.

**Akimova E.V. 2001**

Multilayer Palaeolithic site Listvenka in the context of the problem of preservation of cultural heritage. In *Problems of the struggle with operation of illegal excavation and illegal rev of the archaeological mineralogical and paleontological materials (material of the science-practical conference)*. Krasnoyarsk, pp. 3–12.

**Akimova E.V. 2002**

Processing of the tusk from the Palaeolithic site Listvenka. *Archaeology, Ethnography and Anthropology of Eurasia*, No. 3: 2–11.

**Palaeolithic of Yenisei. Listvenka. 2005**

Krasnoyarsk; Novosibirsk: Universe; Science.

**Shpakova E.G. 1997**

Odontological material of the Upper Palaeolithic site Listvenka (Krasnoyarsk territory). In *The problems of the archaeology, ethnography, anthropology of Siberia and territories*, vol. 3. Novosibirsk: Izd. IAE SB RAS, pp. 132–137.

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# NEW PALAEOLITHIC DATA FROM UST'-KOVA

During many decades the unique Late Palaeolithic site of the northern Angara was Ust'-Kova in Kezhma region. It was opened by A.P. Okladnikov in 1937 and investigated by N.I. Drozdov in 1970–1990 yrs. (Beregovaya, 1960; Drozdov 1981; Vasilevsky et al., 1988; Drozdov, Laukhin, 1979; Laukhin et al., 1980; Drozdov, Chekha, 1990, 2002, etc.). The site received world famous after discovery two zoomorphing images from mammoth's tusk (Vasilevsky, Drozdov, 1983; Akimova, Metlyaev, 2003; Shmidt, 2011).

In 1980 N.I. Drozdov allotted three complexes: late (15 000–11 000 yrs ago – in the brown loam), middle (about 24 000 yrs ago – in the carbonized loam), early (about 33 000–28 000 yrs ago – soliflual buried soil) (Drozdov, 1981; Vasilevsky et al., 1988). The early complex was fixed for certain in the excavations in 1976–1977. Then the material was not found in the buried soil except for sporadic bone debris. Two early horizons were not confirmed (Akimova, Bleynis, 1986). It can prove that the material received above the early sartarian solifluction is dated to the same Palaeolithic cultural layer.

In 2011 Palaeolithic layer was fixed in the south-eastern part of the location № 1, its area was about 200 m$^2$. Generalized stratigraphical section has the following structure:

1. Soil-vegetal horizon. The border is clean, clearcut. Average thickness is 0.3 m.

1A. Loamy sand is brownish dark grey, fulvous-brown, black, thin, porous, uncarbonized, spotted texture. Spotted colouring because of different humus contents. Lower and upper border is indistinct, unclean, with pockets, tongues and in the modern and ancient roots. The border is fixed by loosening of humus colouring. The humus degree decreases from up to down. The horizon becomes cleaner, more homogeneous and the humus is homogeneous. The average thickness is 0.4 m.

2. Loamy sand is grey, grey-brown, homogeneous, uncarbonated, easy. The horizon fills two frost wedges (pseudomorphs by caver-lode ice). The loamy sand changes to well washed grey sand in the base of the wedge. The horizon border is unclean, discontinuous and is fixed by changes

of the mechanical contents. The average thickness is 0.2 m, in the wedge filling – 1.5–2 m.

3. Brown loam, carbonized to the bottom, is situated on the fossil soil horizon. The horizon is presented by difficult overlaying of the sands, loams, clay. The horizon is warped, unlensed, in some places destroyed. The average thickness is 0.5m.

Archaeological material is scattered in the range of 30–50 cm, in the brown loam, which changed to the carbonized loam to the bottom, immediately upper solifluction buried soil. Debris of the same articles are situated in the different lithological conditions (Fig. 1, *9, 11*). The Late Pleistocene thickness is broken by cryogenic cracks with width up to 1–1.5 m and the depth up to 1.5–2 m in the orifice. The cracks make polygons. V.P. Chekha dates wedges by gydanian stage (Drozdov, Chekha, 2002). The excavation in 1980 demonstrated the situation of the removal of Palaeolithic material because of melting of the cracks, the material is set on the flange and bottom of the cracks. The period of the melting and filling of the cracks is not dated. The fact is fixation of the spots of the dense reddish brown loam with cryogenic material, overlaying orifice of the cracks in some places (notices 1980).

In 2011 maximum density of the archaeological material is situated down the terrace's border. The base of the archaeological material is congregation of the bones of young and adult mammoths in the partial anatomic form, with marks of partitions and gnawing. The congregation occupies the set about 15 $m^2$ and lays from the polygon's centre by the flange of the wedge to the northern direction. The upper part of the congregation is noticed on the contact with cultural layer 2 (Holocene), lower part – on the contact with solifluction buried soil. There are the whole and split thighbones and splint bones, three vertebra in the anatomic form, teeth with fragments of the jaws, numerous indefinable debris in the congregation. The individual bones of the deer and wolf are found among the mammoth's bones. The general quantity of the whole and fragmented bones exceeds 1 300 pieces.

The bones of small mammals were received from brown loam on the level of the middle/upper part of the congregation of the mammoth's bones and from lower part of the carbonized loam.

The fauna of the lower section contains 74 residue, 15 of which are definable up to the species: *Microtus (Stenocranius) gregalis Pall.* – 8 pieces, *Lemmus sibiricus Kerr* – 7 pieces. The morphology of the molars Microtus (Stenocranius) gregalis Pallas has a progressive look and corresponse to morphology of similar voles second half of the Late Pleistocene. The presence of fauna in the structure of Lemmus sibiricus Kerr suggests that the fauna existed during the Sartan glaciation. The set of marked points on the extensive development in the open treeless landscape Angara cold waterlogged tundra-steppe. These landscapes marked with this composition of the fauna are usually develops in the early stages of glaciation. All mentioned suggests that the fauna of the lower part of the overburden at the Ust-Kova site was formed in Early Sartan time, about 22 000–20 000 years ago.

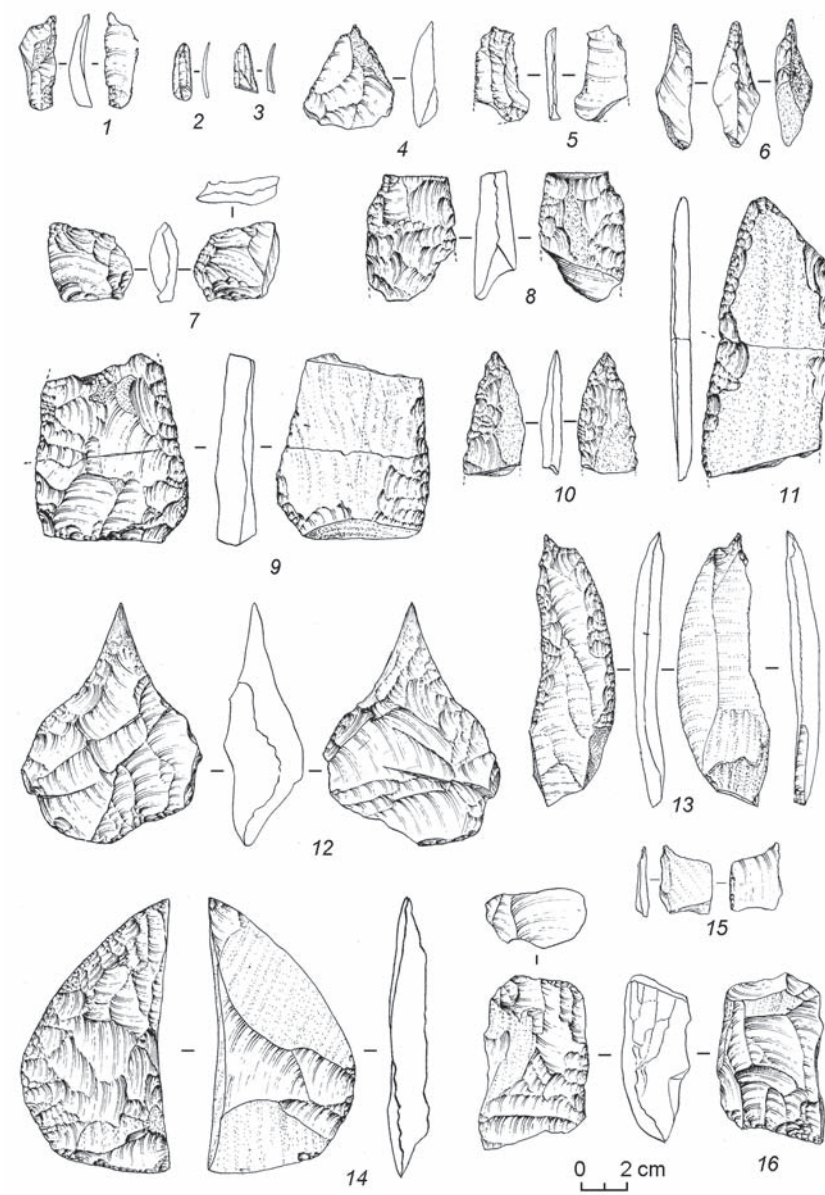


*Fig. 1.* Stone inventory of paleolithic site Ust'-Kova.

*1, 4–6, 12, 15* – points, borers; *2, 3* – retouched microblades; *7* – chisel-like tool; *8, 10* – fragments of bifaces tools; *9, 11* – blade-shaped tools; *13* – borer on the biface; *14* – knife-like tool; *16* – core.

The fauna from the upper part of the cover complex has 88 residues, 25 of which are definable up to the species. The structure of the fossil fauna is as follows: *Sorex caecutiens Laxm.* – 1, *Clethrionomys rutilus Pallas* – 3, *Clethrionomys rufocanus Sundervall* – 6, *Lemmus sp.* – 1, *Microtus (Stenocranius) gregalis Pallas* – 16. The fauna reflects the image of the forest-steppe landscapes with small patches of wetland tundra. Such conditions were typical of the Late glacial periods of warming or the beginning of the Holocene. The lifetime of the fauna is of about 10 000 – 11 000 years ago.

Thus, the question about age of the "basic" Paleolithic cultural layer of Ust-Kova is opened. The most preferable variant is a variant of the middle sartarian cooling: from the time of the formation of the cracks and polygon ground to the time of their melting.

The total quantity of the stone artifacts received of washing and cleaning layer is 915 sp.

As stone material the flints and flint rocks are used as a rule. These rocks were made as unwashed debris (fascia-picture flints, include flint wood etc.) or as pebbles (flint argillithes, jasper, chalcedony). The most famous "second sort" stone material was unwashed debris of clay argillithes and aleurolites, also ash tuff of the acid consist.

## THE STONE INVENTORY

**Cores.** In 1980 it was noticed that the cores are absent in the Palaeolithic Ust-Kova (Akimova, Bleynis, 1986). Chopper-drawknives are understood under them. The cores from flint wood are morphological substandard and individual. The flint wood was the main material for making forms of the inventory from Ust-Kova. The investigations in 2001 make individual two platform bifrontal cores with crossed or subtended position of the platforms (4 sp) (Fig. 1, *16*), spalls and debris core-like articles with traces of parallel flake. In all cases small long blade spalls are made from the cores. The cores for big spalls, which were used as the blanks of big recloir-like tools, are not found. At the same time series of the tools are made from the flat debris of the flint or flint wood.

**Pebble tools** are presented by small choppers, which made from as the pebbles and as part of the rocks. The use-wearing analysis of the series of big pieces from locations interprets them as draw-knives on the soft material (Bleynis, 1984). The analysis was made by V.E. Shchelinsky.

**Bifaces** of leaf-shaped, almond-shaped and oval forms are traditionally one of the main signs of the Paleolithic Ust-Kova (Drozdov, 1981; Vasilevsky et al., 1988; Chronostratigraphy…, 1990, etc.). In 2011 the bifaces were found only as debris of the blanks of the leaf-shaped pieces of small size (Fig. 1, *8, 10*). The segment-shaped tool (type of knife-ulu) can be belonged to the bifaces with some conventionality. The series of the compressed blade spalls are made on the second face. The big borer with polished stinger has bifacial processing.

**The recloir-like and knife-like tools** on the big blades or flat rock debris have not evident signs as a rule and are characterized with straight working

edge (two subtended working edges) on one or on the both edges of the blank. The tool on the big spall with wide working edge on the distal edge is belonged to the recloirs.

**The borers and the points** are made on the small blade spalls and the flakes as a rule (Fig. 1, *1, 3–6, 15*). The working part is made in two variants: strong retouched stinger, situated along the axis in the centre or edge of the blanks; projecting angle of the distal edge with small retouch on the edges. In the first variant the stinger was retouched on both edges as a rule on one side, rarely on the both sides. The big borer on the massive biface with conic polished stinger is noticed (Fig. 1, *12*). The function of the borer and burin are gone together on the flat flint debris, which were thoroughly retouched on both convex and concave edges. The huge quantity of the borers and points with absolutely domination small one- or two point forms were made in 1980 yrs (Vasilevsky, Burilov, Drozdov, 1988; Drozdov, 1981).

**Burins.** The burin working edge was noticed on the combined tool. The series of the characteristic blade spalls are made from splay narrow platform. Such sign (long burin spall from splay narrow platform) is noticed on the fragment of the big flake. In 1980 yrs the burins were not found in Paleolithic of Ust'-Kova, but similar specimen present in the earlier collections.

**Chisel-like tools** has bilateral processing. In one case the pair of the subtended edges is expressed neatly (Fig. 1, *7*), in other case – characteristic fillings are traced only on one edge. Both tools are corresponded typologically to numerous series of the chisel-like tool on the flakes. The series investigated in 1980 yrs (Vasilevsky et al., 1988).

The industry of Ust'-Kova has blade character, however, with domination of the blade with "wrong" forms: curved in the profile, without parallel cutting. The singular sign is long blanks. The peculiarity of the Palaeolithic Ust-Kova is usage of the flat fragments of the flint wood, sometimes with traces of the washing (or thermic) processing. Such fragments changed the spalls and probably satisfied the needs of people.

The articles from the tusk, found in Ust'-Kova in 1980 yrs, are published partly. The sculptural theriomorph images have the most famous. But the collection includes numerous flat beads, pendant – "eight", the fragment of the armletand the series of the indefinite articles such as round and oval "disks". There are numerous blades and flakes from the tusk both with negatives of previous flakes on the "back" and with grinded external surface of the tusk with the traces of different direction of the incisions (Vasylevsky et al., 1988; Chronostratigraphy…, 1990). In 2011 the polished artifact which had ellipse form from the tusk was found in the cultural layer. Its size is 23 × 8 mm (Fig. 2, *1*). The flushing of the most saturated parts of the layer elicited four beads from the mammoth's tusk (Fig. 2, *2–5*).

The horizon included Late Paleolithic debris, is traced from the orifice part of Kova along Angara in the different hypsometric levels, expensed about 800 m. The levels are corresponded to different geomorphological units: set II kovian (angarian?) terrace on the point Kova (9 m) and II angarian terrace upstream Angara (14–16 m). Theoretically, it has not obstacles for finding

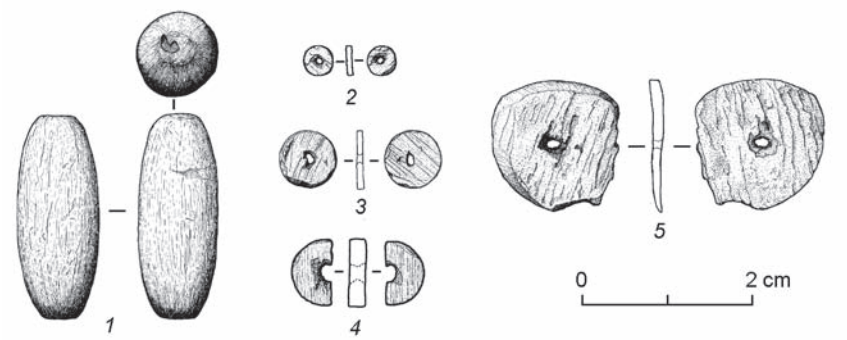


*Fig. 2.* Ivory industry of paleolithic site Ust'-Kova.
*1* – unidentified article; *2–5* – beads.

of Palaeolithic sites as in cover deposits as in the alluvium of the Kova terraces. It has aspects for studying of Palaeolithic along the Kova river, where the artifacts were found in the deposits of the I kovinian terrace. The artifacts are dated to early Holocene age (Ust-Kova I site, location II; Akimova et al., 2010).

The investigations of the last years show that the resources of Ust-Kova are not at the end as the unique Late Palaeolithic monument. The continuation of the works allows to hope not only refilling of the archaeological collection which have not analogs in Palaeolithic in Siberia and Angara, but to solve the questions connected with process of the occupation of the Northern Angara.

## REFERENCES

**Akimova E.V., Bleynis L.Yu. 1986**

Palaeolithic site Ust-Kova (according materials 1982). In *Archaeological and ethnographical investigations in the eastern Siberia: summary and aspects*. Irkutsk: ISU, pp. 63–65.

**Akimova E.V., Gorelchenkova O.A., Kuksa E.N., Stasyuk I.V., Tomilova E.A., Kharevich V.M. 2010**

The results of the investigations of Ust-Kova 1 site in 2010. In *The problem of the archeology, ethnography, anthropology of Siberia and territories*, vol. XVI. Novosibirsk: Izd. IAE SO RAN, pp. 474–478.

**Akimova E.V., Metlyaev S.V. 2003**

Interpretation of the sculptural image from the Palaeolithic site Ust-Kova. In *The ancients of the Priyeniseysk region*, iss. 2. Krasnoyarsk, pp. 18–19.

**Beregovaya N.P. 1960**

Palaeolithic sites in the USSR. Moscow; Leningrad: Nauka.

**Bleynis L.Yu. 1984**

Excretion of the draw-knives in the Palaeolithic site Ust-Kova in the northern Priangar'e. In *The problems of the investigations of the stone age in Eurasia*. Krasnoyarsk: KSPI, pp. 56–58.

**Chronostratigraphy of the Paleolithic site of Middle Siberia (the Yenisei basin). 1990**

The guide of the excursion of International Symposium. Novosibirsk: Publishing of the Institute of history, philology and philosophy of the Siberian Branch of Academy of Sciences of the USSR.

**Drozdov N.I. 1981**

The stone age of the northern Priangar'e. Novosibirsk.

**Drozdov N.I., Chekha V.P. 1990**

Paleofrost phenomena in the Palaeolithic site Ust-Kova and the problems of the preservation of the cultural layers. In *Chronostratigraphy of Paleolith of the northern, central and eastern Asia and America.* Novosibirsk, pp. 174–180.

**Drozdov N.I., Chekha V.P. 2002**

Paleocryogence, paleogeochemistry and the questions of the reconstruction of the climate in Quaternary period (basins of Angara and Yenisei). In *The main consistent patterns of the global and regional changes of the climate and landscapes in the Late Kaynozoy in Siberia*, iss. 1. Novosibirsk: Izd. IAE SO RAN, pp. 163–177.

**Drozdov N.I., Laukhin S.A. 1979**

Palaeolithic site in the orifice of the Angara river (middle stream of Angara). In *Ancient cultures of Siberia and the Pacific basin.* Novosibirsk: Nauka, pp. 38–41.

**Laukhin S.A., Drozdov N.I., Panychev V.A., Orlova L.A. 1980**

Ust-Kova on Angara is the most ancient site, dated by radiocarbon method between Lena and Ural. *The reports of Academy of sciences of the USSR*, vol. 254, No. 2: 182–185.

**Shmidt I.V. 2011**

To the problem of the reconsideration of the imagery of the figurine from Ust-Kova. In *Archaeology, ethnography, paleoecology of the northern Eurasia: problems, search, investigations*. Krasnoyarsk, pp. 9–11.

**Tarasov A.Yu. 1988**

The tusk treatment in Ust-Kova. In *The problem of the archaeology of the northern Asia*. Chita: ChSPI, pp. 69–70.

**Vasilevsky R.S., Burilov V.V., Drozdov N.I. 1988**

Archaeological sites of the northern Priangar'e. Novosibirsk: Nauka.

**Vasilevsky R.S., Drozdov N.I. 1983**

Palaeolithic sculptural images from the eastern Siberia. In *Calisthenics and pictures of the ancient cultures*. Novosibirsk: Nauka, pp. 59–65.

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# NEW DATA ON THE PALEOLITHIC OF TYVA

Since 1965 the present author had an opportunity to explore the Paleolithic of Republic Tyva on the permanent basis, annually working in the Sayan-Tuva expedition of the Institute for the History of Material Culture of Russian Academy of Sciences. This research continued to 1992. After that funding of the archaeological work became terminated, and then I continued my study through participation in different field projects run within the area in the 90s of the twenties centrury and as well in the within the first decade of XXI. These results had been reported at several conferences and then published as a monograph on the Paleolithic of Tyva (Astakhov, 2008).

In addition, in the early twenty first century archaeological investigation of Tyva Republic was carried out by the Krasnoyarsk team (Drozdov, Makulov, Cheha, 2006). A discovery of fundamental importance was made by Vl.A. Semenov, who excavated Paleolithic cave site (Semenov, 2004). A dozen years later, I was able to visit areas new to me, including part of the Kaa-Khem River valley. This project was supported by Professor KATO Hirofumi, Hokkaido University.

This work yielded several new Mousterian-like collections. In one of the sites pointed chopper (chopper with nose) was found (51°39’725’’ N, 94°52’214’’ E). It is heavily weathered, and it probably belongs to the Low Paleolithic. Special investigation of the question is required to obtain the firm evidence for the age indicated by the tool morphology. However, within the area the Low Paleolithic site Tell I is known in the Tes-Khem River valley under 50°30’509” N, 94°45’235” E (Derevianko et al., 1999). There is an easy way north from that place (if compared with the Tannu-Ola Ridge), so Middle Pleistocene human penetration up to the Kaa-Khem – Ulug-Khem valleys may have been possible.

Then, there are new opportunities for discovery of more ancient Paleolithic sites. For this area, Torgalyk A site (Astakhov, 2008) so far remains the most representative one. A tool set known from Torgalyk complex yielded series of hand-axes and different types of cores including the Levallois cores. By several grounds, the Torgalyk complex can be correlated with well-devel-

oped Acheulian. On the basis of the degree of weathering, it can be attributed to the Early Palaeolithic. Most likely the origin of these industry comes from the south-west, although reliable intermediate sites are still unknown. Finds in the Kaa-Khem valley most likely may help to define the limits of the distribution of Acheulian in Tyva.

Random finds from the last year of work come from the valley of Chadana River. Theu expand our understanding of the cultural development of the area (for example, site Bayan Tal 4 which is located under 51°22'238'' N, 90°29'180'' E). However, there is no major advancement in the study of this period.

In the study of materials from the valley Sagly, I have suggested that some Mousterian-like complexes, especially with late admixture may be comparable in time with the initial stages of the Upper Paleolithic. So, I wrote: «Typology and the degree of deflation of the surface of the predominant amount of Tyva's collections allow to assign them to the Levallois-Mousterian, presumably from the time R / W to R2. It is possible that these industries have existed, and later, while maintaining almost the same shape until the late Paleolithic period were replaced by the so-called "Siberian" type, but there is no evidence to support such hypothesis» (Astakhov, 2011).

In this relation it is interesting that the archaeological materials of 9 and 11 layers of Denisova cave, typology of which is close to that of Sagly site collection, are dated relatively late, within 51 000–29 000 BP (Zybankov, 2011). Perhaps it makes sense to re-analyze available Levallois-Mousterian materials, including the new ones. And then the lithic industry may show the continuity between the Middle and Late Paleolithic.

One of the most important discoveries in the Upper Paleolithic of Tyva was made recently by Vl.A. Semenov who investigated the first cave site ever found in Tyva. Chronology of Kuylug-Khem I Grotto is based on series of dates that span from 12 880 ± 90 for 3 horizon to 26 100 ± 800 for the fifth (lowest) level (as reported by Semenov at the conference "The ancient cultures of Central Asia: Aspects of the study and preservation", September 5, 2011, Kyzyl). Material yielded by the excavations is not very rich and still requires complete publication, but anyway it is a significant addition to the material of Low Idzhir site dated to 17 200 ± 70 BP (LE-1984) (Astakhov, 2008).

These are some of the latest conclusion in the study of Tyva Paleolithic. Certainly, more research, primarily focused on field survey and the formation of GIS database as a research tool is an urgent task of archaeologists studying the Stone Age of Tyva.

## REFERENCES

**Astakhov S.N. 2008**

Paleoliticheskie pamiatniki Tuvy. St. Petersburg: Nestor-Istoria.

**Astakhov S.N. 2011**

Paleolit Respuliki Tyva (istoria issledovania – voprosi hronologii – struktura). In *Materialy i issledvania po otechestvennoi i zarubeznoi istorii k 70-letiu doktora istoricheskih nauk, professora A.A. Kudriavzeva.* Stavropol: Izd. Stavropol. Gos. Univ., pp. 64–70.

**Derevianko A.P., Astakhov S.N., Petrin V.T., Zenin A.N., Gladisev S.A., Kazuia O., Kudriavzev V.I. 1999**

Issledovania paleoliticheskih pamiatnikov v Tive. In *Problemi arheologii, etnografii, antropologii Sibiri i sopredelnih territorii*, vol. V. Novosibirsk: Izd. IAE SO RAN, pp. 89–93.

**Drozdov N.I., Makulov V.I., Cheha V.P. 2006**

Geologia i arheologia Iuznoi Tyvi. *Vestnik Krasnoiarsk. Gos. Ped. Univ. im. V.P. Astafieva*, No. 3: 118–143.

**Semenov V.A. 2004**

K probleme neolitizazii Minusinskoi kotlovini i Tyvy. In *Problemi hronologii i etnokulturnih vzaimodeistvii v neolite Evrazii*. St.-Peterburg, pp. 70–87.

**Zybankov A.A. 2011**

Kamennaia industria verhnepaleoliticheskogo kompleksa vostochnoi galerei Denisovoi pescheri. In *Trudy III (XIX) Vserossiiskogo arheologicheskogo siezda*, vol. I. St. Peterburg; Moscow; Velikyi Novgorod, pp. 97.

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# THE UST'-MENZA ARCHAEOLOGICAL COMPLEX

The Ust'-Menza archaeological complex is located in Russia in the Krasnoyarsk District of the Trans-Baikal Region (Fig. 1) at the confluence of the Menza and Chikoi rivers (50°13'N, 108°37'E). Cultural material was first discovered there during archaeological reconnaissance of the Chita State Pedagogical Institute in 1980. The initial discoveries were the basis for joint archaeological and geological research between 1982 and 1995, including a number of academic field schools. Material about the site was initially presented at the all-union conference "Quaternary Geology and Prehistoric Archeology of South Siberia" (Semina, 1986; Semina, Pinksner, 1986) and later at the international symposium "Ancient Cultures of Asia and America" (Konstantinov M., 2003). In 2003, annual fieldwork resumed with the participation of archeologists from the United States.

The complex includes five main sites (Ust'-Menza 1–5), and 10 sites represented by isolated objects (Ust'-Menza 6–15), ranging in location from the low floodplain to the sixth terrace of the Menza and Chikoi rivers (Fig. 2, 3). Ust'-Menza is significant in terms of understanding regional prehistory for a number of reasons. For one, the first Mousterian artifacts in the Transbaikal were discovered here. It has also been the focus of research of numerous large Upper Paleolithic and Mesolithic dwellings in direct association with stone tools, flakes, and fragments of chipped bone. Likewise, Ust'-Menza produced the most ancient early Mesolithic arrowheads in the region. Moreover, it was here that the separation of the Transbaiakal Neolithic into three stages and Bronze Age into two stages was justified. Finally, the location has revealed a series of human burials, including one of the oldest (8 000 BP) in the Transbaikal.

*Ust'-Menza 1*. The main excavation block (500 m$^2$) at Ust'-Menza 1 was positioned on the first terrace and the high floodplain 5–6 m above the Menza River. Archaeologists discovered 25 cultural layers within a 4-m vertical package of alluvial sediments. Layers 2–5 are closer to the river within thin beds and divided into sublayers that are further designated with letters (e.g., 2f, 2, 2d, etc.). Cultural layers 11–25 are associated with Pleistocene alluvium, but 1–10 with polygenetic deposits (eolian and fluvial) of Holocene age. The lowest

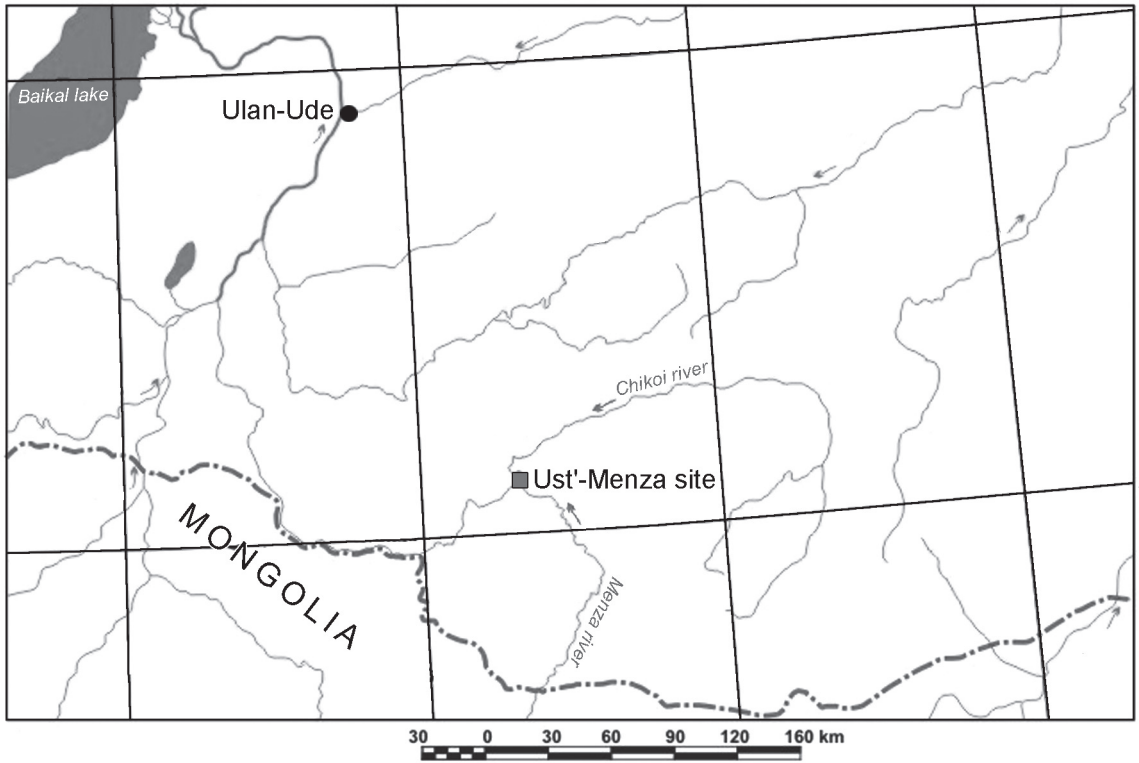


*Fig. 1.* Location of Ust'-Menza site in Transbaikalia.

*Fig. 2.* Ust’-Menza valley.

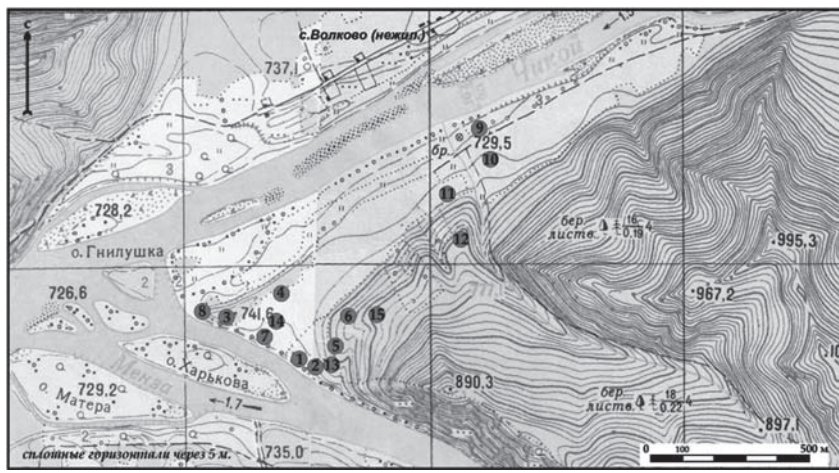


*Fig. 3.* Ust’-Menza. Location of archaeological sites (settlements).

*1* – Ust’-Menza 1; *2* – Ust’-Menza 2; *3* – Ust’-Menza 3; *4* – Ust’-Menza 4; *5* – Ust’-Menza 5; *6* – Ust’-Menza 6 (Gruzdevoi Sbor); *7* – Ust’-Menza 7 (Ovrazshnyi Krai); *8* – Ust’-Menza 8 (Peschanaya Tropa); *9* – Ust’-Menza 9 (Polevoi Bugor); *10* – Ust’-Menza 10 (Polevoi Bugor); *11* – Ust’-Menza 11 (Kabanii Kliuch); *12* – Ust’-Menza 12 (Zverinyi Knod); *13* – Ust’-Menza 13 (Uvalistaya); *14* – Ust’-Menza 14 (Lagernaya); *15* – Ust’-Menza 15 (Kedrovaya).

cultural layer (25) is situated directly on channel gravels at the base of the profile, while the highest (1) is within the modern soil near the top. In cultural layers 9, 11, 12, 20, archaeologists discovered cobble-outlined dwellings with single, central hearth features, and layer 25 includes a dwelling represented by a concentration of 289 river cobbles. Artifacts are as numerous in layers 2–8 as the others, but are scattered, or grouped in small clusters. In layers 1, 10, 13–19, 21–24 stone artifacts are relatively rare. Layers 11 and 12 produced bone tools and bone arrowheads. Pottery first appeared in layer 8, and traces of metal in the layer 2. Cultural layers 1–2 are ascribed to the Bronze Age, 3–5 to the late Neolithic, 6 to the Middle Neolithic, 7–8 to the early Neolithic, 9 to the Late Mesolithic, 10–12 to the Early Mesolithic, and 13–25 to the Late Palaeolithic (<13,000 years old). Charcoal from the site produced the following radiocarbon dates (*Table*): cultural layer 1 – 2 080 ± 140 $^{14}$C BP (GIN-4577), cultural layer 2 – 2 630 ± 50 $^{14}$C BP (GIN-4579), cultural layer 11 – 10 380 ± ± 250 $^{14}$C BP (GIN-5459), cultural layer 13 – 11 350 ± 250 $^{14}$C BP (GIN-5503), and cultural layer 14 – 11 820 ± 120 $^{14}$C BP (GIN-7161). Based on the dates, it would appear that cultural layers 1 and 2 were occupied during the late Holocene. Layers 11 through 14, on the other hand, date between >10 000 and around 11 800 $^{14}$C BP (Buvit, 2008; Konstantinov M., 1994; Konstantinov A., 2001).

Three depositional environments and four different landscape settings are associated with the occupations at Ust'-Menza 1. The earliest inhabitants made camp on exposed channel gravel (cultural layer 25). Prehistoric occupants of cultural layers 23 and 24, on the other hand, inhabited the dry, sandy surface of a point or channel bar. Following abandonment, overbank deposition ensued. Cultural layers 22 through 9 were occupied during floodplain aggradation. Camps were made fairly close to the channel and it was a popular location as people reoccupied the vertically accreting surface numerous times over the millennia.

By Neolithic times (cultural layers 8 through 4), the surface at Ust'-Menza 1 had stabilized, and at some point following the occupation of cultural layer 8, the Menza River downcut its floodplain and formed the first terrace. As folks became more sedentary, their camps gradually became more permanent. As a result, the Bronze Age component (cultural layers 2 and 1) is much thicker than earlier horizons.

*Ust'-Menza 2*. Ust'-Menza 2 was discovered in 1981 within sediments of the second (8 to 10-m) terrace of the Menza River nearly 30 m east of Ust'-Menza 1. Work at the site began in 1984 and since then over 500 m$^2$ have been excavated. The stratigraphic profile at Ust'-Menza 2 is over nine m deep and includes 31 cultural layers, of which the lowest 24 are assigned to the Upper Paleolithic. Fining-upward sequences of alternating sands and silt beds represent the bulk of the sediments where archaeologists unearthed the majority of cultural layers, however, layers 1–4 are associated with eolian and sheetwash deposits. Cultural layers are assigned to the following periods: 1–2 the Bronze Age, 3 the Neolithic, 4–27 the Late Paleolithic (<20 000 years old). Layers 4, and 20–22 produced dwellings. The most artifact-rich layers are 2, 4–6, and 8. The Paleolithic layers produced microblades and microblade cores, scrapers,

bifaces, burins, utilized flakes, gravers, notches, and flakes (Konstantinov M., 1994; Konstantinov A., 2001).

The site produced the following radiocarbon dates (all on charcoal) (*Table*): layer 2 – 4 700 ± 50 $^{14}$C BP (GIN-6116), layer 16 – 16 800 ± 100 $^{14}$C BP (AA-67836), layer 17 – 15 400 ± 400 $^{14}$C BP (GIN-5478) and 16 900 ± 500 $^{14}$C BP (GIN-6117), layer 20 – 16 980 ± 150 $^{14}$C BP (GIN-5465), 17 770 ± 130 $^{14}$C BP (AA-67834) and 17 900 ± 100 $^{14}$C BP (AA-67838), layer 21 – 17 190 ± ± 120 $^{14}$C BP (GIN-5464), 17 600 ± 250 $^{14}$C BP (GIN-5464), layer 21 – 17 080 ± ± 120 $^{14}$C BP (AA67837), and layer 23 – 12 120 ± 600 $^{14}$C BP (AA-67835), and layer 24 – 16 560 ± 300 $^{14}$C BP (GIN-5463). The ages do not paint a very clear picture. First, lab number GIN-5464, for example, is assigned to two samples. Moreover, the age from cultural layer 24 postdates all but two from overlying layers. Lastly, the two from cultural layer 17 differ from each other by around 1 500 years.

From the list of dates, it is clear that AA-67835 (12 120 ± 600 $^{14}$C BP) from layer 23 is an outlier. At one sigma many of the remaining Pleistocene-aged dates overlap between 20 000 and 21 000 cal BP. At two sigma, all but one (i.e., GIN-5478) overlap between 20 300 and 20 800 cal BP. Thus, it appears that cultural layer 16 was occupied 20 020 ± 300 cal BP, preceded by an occupation of cultural layer 17 at 20 260 ± 670 cal BP. Continuing downward through

**Radiocarbon Dates from Ust'-Menza 1 and 2**

| Locality | Lab Number | $^{14}$C Age BP | Cal Age BP | Cultural Layer |
|---|---|---|---|---|
| Ust'-Menza 1 | GIN-4577 | 2080±140 | 2080±180 | 1 |
| | GIN-4579 | 2630±50 | 2775±30 | 2 |
| | GIN-5459 | 10,380±250 | 12,120±420 | 11 |
| | GIN-5503 | 11,350±250 | 13,260±260 | 13 |
| | GIN-7161 | 11,820±120 | 13,740±180 | 14 |
| Ust'-Menza 2 | GIN-6116 | 4700±50 | 5450±100 | 2 |
| | AA-67836 | 16,800±100 | 20,020±300 | 16 |
| | GIN-5478 | 15,400±400 | 18,590±500 | 17 |
| | GIN-6117 | 16,900±500 | 20,260±670 | 17 |
| | GIN-5465 | 16,980±150 | 20,280±360 | 20 |
| | AA-67834 | 17,770±130 | 21,230±340 | 20 |
| | AA-67838 | 17,900±100 | 21,510±360 | 20 |
| | AA-67837 | 17,080±120 | 20,430±390 | 21 |
| | GIN-5464[a] | 17,190±120 | 20,640±320 | 21 |
| | GIN-5464[a] | 17,600±250 | 21,030±410 | 21 |
| | AA-67835 | 12,120±600 | 14,470±880 | 23 |
| | GIN-5463 | 16,560±300 | 19,830±410 | 24 |

the profile, the weighted average of the ages from cultural layers 20 and 21 (21 020 ± 200 cal BP and 20 690 ± 210 cal BP, respectively) are stratigraphically reversed but statistically identical. Although a precise chronological sequence is difficult to discern at this time, we conclude that the occupation of cultural layers 16 through 21 occurred between about 20 000 and 21 000 cal BP (~16 800 and 17 600 $^{14}$C BP).

*Ust'-Menza 3*. The site is related to the estuarine portion of the second (14 m) terrace of the Menza River. After its discovery, archaeologists opened an area of 496 m$^2$ discovering seven cultural layers (five of which are Paleolithic) between 6.5 and 10 m above the river channel. Layer 5 produced two flakes. Cultural layer 4 includes a large (3- by 14-m) dwelling with four internal hearth features associated with scrapers, retouched blades, microblades, and several hundred flakes and bone fragments. Of particular interest are the remains of a 0.8 m by 0.1 m wood object. Cultural layer 3 produced five hearth features and dozens of blades, microblades, scrapers, cores, and flakes. Cultural layer 2 (early Bronze Age) revealed two human burials, dwellings and 10 hearth features lined with stones associated with microblade cores, microblades, scrapers, angled burins, punches, scrapers, sinkers, choppers, and thick-and thin-walled ceramic sherds. Of interest were two burials associated with the cultural horizon 2. The first burial – within a circular, 5-m diameter depression – produced very poorly preserved human bones adjacent to a polished jade knife. In the second burial – a shallow 1.2 by 0.9 m pit covered in ochre – archaeologists discovered a skull, a tibia, and some other bones of the skeleton. Layer 2f also produced three large scrapers in a cache. Similar material was discovered in cultural layer 1 (in the modern soil), as well as an iron arrowhead, pieces of slag, and polishing instruments. Based on their geological position and artifact characteristics (i.e., similarities to dated assemblages), cultural layer 2 is estimated at 11 000 to 13 000 years old, layers 3 and 4 are 13 000 to 16 000 years old, and layer 5 is 16 000 to 18 000 years old (Konstantinov, 1994).

*Ust'-Menza 4*. Ust'-Menza 4 was discovered in 1982 within sediments associated with the second (8- to 10-m) terrace of the Chikoi River around 500 m north of Ust'-Menza 1. Sediments are primarily interbedded sands. Excavations in 1982 and again in 1984 opened 292 m$^2$ to a depth of 5.8 m, revealing a late Upper Paleolithic component (cultural layers 2 and 3) around 1 m below the surface and a Bronze Age component (cultural layer 1) within the modern soil. No chronometric dates exist, but the age of the Paleolithic occupation falls between around 15 000 and 12 700 years old based on geological context and archaeological correlations. Paleolithic material from cultural layer 2 includes a large, 5-m diameter cobble-outlined dwelling feature with a central hearth, microblades, microblade cores, 4 orthogonal cores, retouched blades, scrapers, flakes, and a few fragments of unidentifiable animal bone. The dwelling was comprised of 360 river cobbles, 60 of which were in place and the remainder disturbed by solifluction. Cultural layer 2 is associated with a paleosol dated to between 12 000 and 10 800 years old. In Cultural Layer 3, two charcoal stains identified as hearth features contained 41 micro-

blades, 171 flakes, 19 bone fragments, and bits of ochre. In addition, 22 smaller ash stains discovered at the site contained 9 wedge-shaped microblade cores, 37 microblades, 17 blades, hundreds of flakes, a tested cobble (i.e., a core with a single flake removed), and animal bone fragments. The Bronze Age component (layer 1) included animal bones, a few ceramic sherds, a chopper, microblades, and an end core (Konstantinov, 1994).

At Ust'-Menza 4 during the Paleolithic (cultural layers 2 and 3), prehistoric occupants camped on an aggrading floodplain near the confluence of the Menza and Chikoi rivers inhabiting an unstable sandy surface. It also seems that overbank flooding would have occurred often rendering long-term occupation difficult. By the Bronze Age (culture layer 1), the Chikoi River had entrenched its floodplain and the surface had stabilized.

*Ust'-Menza 5.* In 1984, archaeologists discovered and excavated Ust'-Menza 5 within sediments of the fourth (20- to 22-m) terrace of the Menza River 80 meters east of Ust'-Menza 2. The stratigraphic profile is characterized by 6 m of alluvial sands capped by a 1m-thick bed of sheetwash deposits. Archaeologists excavated 110 $m^2$ and discovered seven layers with material believed to be late Pleistocene in age based on its position in the profile. In the lowest layers (5, 6 and 7) excavators uncovered a few animal bones, including a fourth metatarsal of a rhino (*Coelodanta antiquitatis*) and the distal end of a horse's scapula (*Equus* sp.), along with angular stone fragments beleived to be Mousterian. These objects could be between 50 000 and 70 000 years old (Muruktinskoe Glaication). The 18 non-diagnostic artifacts uncovered in cultural layer 4 at the contact between alluvium and sheetwash deposits below the Karginsk Paleosol are in a redeposited context, but could be 43 000 to 45 000 years old. The layer 4 assemblage included 2 scrapers, 2 "crude" subprismatic cores, 2 worked nodules, a spall, and 11 flakes, a few of which may have been detached from Levallois cores. Given their secondary context, however, the artifacts could also date to the early Upper Paleolithic. Cultural layer 3 produced two blades dating either to the late Upper Paleolithic or Mesolithic, while Cultural layer 2 revealed a Neolithic human burial at a depth of 0.35–0.5 m below the surface. The burial was 2.45 by 1.7 m in dimensions and capped with cobbles. A human skeleton covered in red ochre was discovered at a depth of 1.05 m below the cobbles. The skeleton was positioned on its back with its head toward the east and its arms bent at the elbow. Its left hand covered the middle part of the pelvis and the legs were turned to the left, perpendicular to the backbone. The skull was crushed. Its age is estimated to be 8 000 years old. In cultural layer 1, archaeologists discovered isolated late Bronze Age ceramic sherds (Konstantinov M., 1990, 1994).

The oldest layers at Ust'-Menza 5 would have been occupied when the landform was an aggrading floodplain. Prehistoric occupants would have camped at a location relatively close to the Menza River channel, perhaps during warm periods of the Zyrian Glacial. Given the low density of cultural material, these early camps would have been brief and sporadic. Cultural layer 4, in contrast, would have formed following development of the fourth terrace. This would likely have occurred during the Karginsk Interstadial when climatic conditions

were relatively warm and moist compared to the Zyrian. These early inhabitants would have occupied a stable surface around 5 to 6 m above the active channel. During the occupation of cultural layer 3, the location would have served as a vantage overlooking the lower first and second terraces. The few blades comprising cultural layer 3 provide evidence for a short, perhaps single, occupation event during the late Pleistocene/early Holocene. During the Bronze Age (cultural layers 2 and 1), the landscape and vegetation would have been similar to today; a high, stabilized alluvial terrace buried under a thick bed of sheetwash.

*Ust'-Menza 6* (Gruzdevoi Sbor). Ust'-Menza 6 is associated with a alluvial formation 27 m above the Chikoi River. Within an 8-$m^2$ excavation block, archaeologists identified four cultural layers believed to date between the late Pleistocene and Holocene.

*Ust'-Menza 7* (Ovrazshnyi Krai). Ust'-Menza 7 is situated on the edge of the second (8 m) terrace of the Menza River. Three units were excavated to uncover an area of 16 $m^2$ and three cultural layers were identified. Layers 1 and 2 date to the Bronze Age. Material from layer 3 (large scrapers and flakes) is redeposited and associated with a 20 cm-thick layer of interbedded gravels at the base of the profile.

*Ust'-Menza 8* (Peschanaya Tropa). The site is associated with the first (4–5 m) terrace of the Menza River where 37 $m^2$ were excavated. The upper (Holocene) part of the profile is almost completely obscured. At the top of the Pleistocene alluvium (Noril'sk Period), archaeologists discovered a 3.4 by 3.5 m dwelling feature indicated by a 16-cobble outline with a central hearth feature. A second cultural layer, six cm below the first, produced a hearth feature and five artifacts.

*Ust'-Menza 9* (Polevoi Bugor). Ust'-Menza 9 is situated on the first terrace 6 m above the Chikoi River where stone tools and pottery within four Neolithic to Bronze Age cultural layers were discovered in a 10 $m^2$ excavation block.

*Ust'-Menza 10* (Polevoi Bugor). Ust'-Menza 10 is on the third terrace of the Chikoi River. Archaeologists excavated 4 $m^2$ and discovered five cultural layers with Upper Paleolithic burins, blades, and flakes in the late Karginsk Paleosol.

*Ust'-Menza 11* (Kabanii Kliuch). Ust'-Menza 11 is a surface collection at the back part of the second terrace of the Chikoi River. Artifacts resembling Paleolithic material were collected from a 10–12 $m^2$ area. Bison bones associated with the Karginsk Soil were discovered in a test pit at the site.

*Ust'-Menza 12* (Zverinyi Khod). The site is located on the sixth (40 m) terrace of the Chikoi. Test pits totaling 8 $m^2$ were excavated to a depth of 4 m. Of note, a series of Kazantsev Interglacial soils were identified. Pottery fragments and flakes were discovered in the Holocene sod layer.

*Ust'-Menza 13* (Uvalistaya). Ust'-Menza 13 is situated on the third terrace 14 m above the Chikoi River. Archaeologists excavated 14 $m^2$ and discovered four cultural layers each with an isolated artifact. The lowest two layers are associated with the late Karinsk Paleosol and the top two with Holocene deposits.

*Ust'-Menza 14* (Lagernaya). The site is on the second terrace 8 m above an abandoned channel of the Chikoi River. The excavation opened 64 $m^2$ revealing a single cultural layer at the base of a Sartan-age sandy loam. A collection of >1 000 artifacts included orthogonal cores, flakes, and scrapers estimated to be 24 000 years old.

*Ust'-Menza 15* (Kedrovaya). Archaeologists excavated 48 $m^2$ on the sixth (40 m) terrace of the Chikoi River and discovered a layer blades, flakes, scrapers, and cores within the Karginsk Soil. The material is believed to date from the late Mousterian to the beginning of the Upper Paleolithic.

To conclude, the above descriptions obviously represent only a sample of the archaeological record at Ust'-Menza. Our attempt was to simply introduce the sites and provide enough information to paint a brief picture of this truly remarkable complex. As much as we have learned about the late Pleistocene and Holocene inhabitants at Ust'-Menza, we have only scratched the surface as far as understanding its rich prehistory. In the years to come, there will be a need to straighten out some of the geochronological issues at undated localities, and clarify those that are not being resolved with radiocarbon methods such as at Ust'-Menza 2.

## REFERENCES

**Buvit I. 2008**

Geoarchaeological Investigations in the SW Transbaikal Region, Russia. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman, WA.

**Konstantinov A.V. 2001**

Ancient dwellings of Zabaikalye: Paleolith, Mezolite. Novosibirsk: Nauka.

**Konstantinov M.V. 1990**

Raskopki i Razvedki Drevnikh Pamyatnikov v Zabaikalye. Otchet o Polevikh Issledovaniyakh v 1989 g. Chast' 3: Arkheologicheskaya Razvedka po Chikoyu i Selenge v 1989 g. Chita: Chita State Pedagogical Institute.

**Konstantinov M.V. 1994**

Stone age of the East Transbaikal. Ulan-Ude; Chita.

**Konstantinov M.V. 2003**

Chelovek, Sreda, Vremya. Materials of scientific seminars on Studenoe field camp. Chita: ZabSPU.

**Semina L.V. 1986**

Neolith and paleometal epoch of South-Western Zabaikalye. Abstract of Ph.D. dissertation. Leningrad.

**Semina L.V., Pinksner M.P. 1986**

Ust-Menza 1: from final Paleolith to late Bronze. In *Chetvertichnaya geologiya i pervobitnaya archeologiya Yujnoi Sibiri: theses from all-USSR conference*, pt. 2. Ulan-Ude: BF SO AN USSR, pp. 62–65.

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# MANOMAY GHOSH ACHEULIAN CULTURE OF GABDHESWARI RIVER VALLEY: AN ECOLOGICAL PERSPECTIVE

## ABSTRACT

Palaeoecology also known as environmental archaeology or bio-archaeology is the study of biological remains from any archaeological site to understand the basic elements of living conditions in the past. The analysis of these biological remains is now considered as fundamental to the understanding of human behaviour and change of human activities through time and space.

Lower Palaeolithic or more precisely the Acheulian Culture is found to be concentrated along the Gandheswari River valley in Bankura district of West-Bengal. More than 55 Acheulian sites being dominated by Handaxe/Cleaver industry are found with major concentration along the Susunia foothills. There are also 15 fossil bearing sites and some of them are found directly associated with Acheulian tools. Among the fossil vertebrates identified from this region, the important ones are *Bos namadicus*, *Boselaphas namadicus*, *Equus anagur khur*, *Panthera* cf. *leo*, *Crocuta* sp. etc. The present paper attempts to reconstructs the palaeoecological background of the Acheulian people of Gandheswari river valley on the basis of animal fossil vertebrates found from the Pleistocene sediments of this region.

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# SIBIRYACHIKHINSKY VERSION OF THE MIDDLE PALEOLITHIC OF THE ALTAI: SITES AND MATERIALS

The Middle Paleolithic of Northern Asia is represented by sites with different states of preservation and concentrated mostly in the areas of Southern Siberia. The Altai region is recognized as one of such areas, where the density of site concentration is especially high and where cave and open sites have been found in the terrace deposits. The multi-layered cave sites of the northwestern Altai, Okladnikova and Chagyrskaya Caves, are standing out in the series of the Middle Paleolithic sites in Altai; the materials from these two caves are comparable with the Mousterian complexes from various regions of Eurasia and especially from the Southwestern Europe, Transcaucasia and the Middle East (Derevianko, Markin, 1992, 1995, 1998a, 2011; Derevianko et al., 2009; Derevianko, Markin, Zykin, 2009). Industries of these two caves are assumed to form a unique version of the regional Middle Paleolithic, for which the name "Sibiryachikhinskaya industrial development line" was put forward (Derevianko, 2009, 2010, 2011).

The two above-mentioned caves represent different karst formations. The south-facing Okladnikova Cave is situated in the belt of low-mountain Altai in the Anui River basin and consists of various interconnected and separate hollows – an overhang (situated 14 m above the level of the neighboring stream), a grotto, several galleries at different levels and also series of halls, located relatively far from the entrances. The north-facing Chagyrskaya Cave is located in the middle-altitude area of Altai and belongs to the section of the Charysh River valley, which drains the spurs of the northern slope of the Tigerekski ridge. The Chagyrskaya Cave has two neighboring halls, joined at an angle. The cave is located 25 m above the river level. The two caves are multi-layered (Okladnikova: layers 7, 6, 3, 2, 1; Chagyrskaya: layers 6a, 6b, 6c/1, 6c/2 (6а, 6б, 6в/1, 6в/2)), and can be characterized by the presence of homogenous industries with no signs of discontinuity.

In the Okladnikova Cave the majority of cave deposits (layers 2, 3, 6, 7) were formed under warm climatic conditions accompanied by development of forb-meadow-steppe vegetation. Certain variations can be observed only in the moisture of the climate conditions. The final stage of loose stratum

(layer 1) formation was formed under somewhat different conditions, i.e. in the conditions of open, not thickly forested, meadow-grassland spaces, with climate being damper and cooler, than it is nowadays. The paleontological materials, collected throughout the cross-section, serve as an indication of the "mixed" composition of the Late Pleistocene technocomplex, which highlights the uniqueness of the paleogeography of the mountain terrain. Aviafauna also does not form an exception, consisting as it is, of various biotopes, which is also characteristic of the mountainous regions (Derevianko, Markin, 1992, 1998b).

In the Chagyrskaya Cave (layers 6a – 6c/2 (6a – 6в/2)) the remains of large animal species, adapted to various landscape zones, i.e. steppe, forest-steppe and rocky environments were found (Vasil'ev, 2009). These include rhinoceros, small and big (*coballoid*) horse, bison – yak, caribou and red deer, Siberian ibex and wild ram. Isolated bones of mammoth, wolf and fox were also found. There are bones of cave hyena. Most of the remains (approximately 81 %) refer to ungulates and hemipterous, far less (approximately 19 %) refer to *Carnivora*. In respect to small mammals, V.S. Zazhigin points out to the remains of Siberian brown lemming (*Lemmus sibiricus*) found in the middle part of layer 6a and remains of yellow steppe lemming (*Eolagurus luteus*) found throughout the cross-section. Both species were widespread in Eurasia during certain intervals of Middle and Late Pleistocene and were typical elements of periglacial mammal fauna, corresponding to the periods of cooling and glacial maximums. A palinological analysis conducted at the Chagyrskaya Cave cross-section helps to reconstruct steppe conditions for the period of formation of layers 6a, 6b, 6c/1 (6a, 6б, 6в/1) and conditions of boreal evergreen and of deciduous coniferous forests during the accumulation of layer 6 c/2 (6в/1).

Structures of the sites have many common features, reflected primarily in the character of partitioning of flint remains. For the industries of the studied objects, no matter which layers the materials are obtained from, a scarce amount of evidences about the raw material flaking is observed. Small percentages of cores and edged and semi-edged bases in collections, even if not exclude completely, they significantly limit this cycle of stone treatment directly in the caves. At the same time, the amounts of tool forms seem to be quite significant, at times exceeding 20 %. Most likely, stone knapping was carried out somewhere away from the site, perhaps directly on the banks of rivers flowing nearby. The blanks were then delivered to the sites and turned into tools. As a result, one could find many debitage products, left after the retouching process and constituting 30–40 % of all the spalls. The data ratio between cores, potential blanks and tools indicates that every second – fourth blank went through secondary treatment. It is quite obvious that both sites can be characterized as hunting camps and this can possibly explain the homogenous typological selection of scrapers and scraper-knives. Economic activity of the primeval collectives of the Okladnikova Cave was associated with large game hunting, including hunting such animals as horse, argali, bison, rhinoceros and red deer. In the Chagyrskaya Cave the domination of bison remnants (over 54 %) can serve as a reflection of a hunter specialization of human collectives.

It was found out, that during the technocomplex formation of the Chagyrskaya Cave four types of local rocks were used: sedimentary (sandstone, siltstone-sandstone – 23 % of all artifacts), hornstones (16 %), effusive rocks (27 %) and jasperoids (around 33 %), among which the majority (29 %) are high-silicon jasperoids of Zasurinski suite (Kulik, Markin, 2009). It should be noted, that in the alluvium of the Charysh River, with the left side of which the cave is associated, all rock types used for the artifact production can be found, however, a different quantitative distribution of rock types can be observed. The effusive types constitute here over a half of all pebble material, while the presence of sedimentary rocks and particularly of hornstones is significantly lower, than their presence in the site's industry is. The amount of Zasurinski jasperoids is particularly low. Such evidences indicate the purposeful selection of raw materials. In the context of Okladnikova Cave the Zasurinski jasperoids (25,8 % of all the tools) are fairly important for the artifact production. On the other hand, a further petrographic comparison of the sites shows that overall they differ in terms of raw materials used. This way, in the Okladnikova Cave the use of hornstone makes up only 5 %, majority of the tools (65 %) was made on sedimentary rocks and primarily on fine-grained sandstone (Kulik, Markin, 2003). Therefore, as to the use of the same raw materials, the single-type industries, represented in the caves, are still characterized by significant petrographical differences, the raw material factor not being the main one in the formation of such culture type in the Middle Paleolithic of the region.

A single-type inventory, mainly based on the radial splitting of rocks, resulting in numerous spalls and a shift of the blank body from the axis of removal, is characteristic for the technocomplexes of these caves, no matter from which sediments they originated from. In the Okladnikova Cave apart from the radial cores, there are core samples represented, which reflect the technologies of the parallel and Levallios splitting. Scrapers and *déjeté*-type tools form a typological base of the tool selection. The majority of scrapers belong to single side- and transversal forms; there are fewer double parallel and convergent scrapers; there are single occurrences of scrapers with retouch along the perimeter, thinned backed scrapers, scrapers of the semi-*Quina* type, ventrally and alternatively retouched scrapers. It is important to note the presence of various scraper-knives with natural and retouched backs, which are either situated opposite the working retouched edges or adjoining the latter at an angle. Double and triple types of the *déjeté*-tools can be differentiated according to the number of working edges (diagonally truncated, diagonally-transversal et al.), their orientation, shape (double-concave, concave-convex, straight-concave et al.), secondary treatment techniques and angles between the working edges (acute-angled, right-angled et al.). The Levallois points and also isolated cases of tools of the Middle Paleolithic typology (scrapers, burins, chisel-like tools and borers) are found only in the technocomplexes of the Okladnikova Cave. The scarce groups of artifacts are represented by denticulate tools, tools with retouched encouches and points. Bifacies (backed forms with slanted thickened edges) (layer 7, 3, 2) were found in the Okladnikova Cave and oval flat-convex bifacies (base of layer 6b (6б)) with thickened base and flattened

active edge, formed by convergence of the longitudinal edges were excavated in the Chagyrskaya Cave. In layer 7 a biface was found, which is characterized by a flat-convex section, an elongated working part, side shoulders and blunted accommodation part. Tool treatment in the industries of the caves also seems identical, equally implemented in the organization of working edges of the tools and of various tool parts. Secondary treatment was implemented mainly through various retouch techniques. The following retouch types dominate here: facial, semi-abrupt, average, semi-deep, invasive, double-row and stepped. Among the secondary treatment techniques, the most widely used retouch technique is the one, the application of which leads to the formation of backed and working elements (retouch, various types of encouches). Various types of blank thinning, including the one used for bulge removal, basal thinning, thinning applied in fixing of the profile curvature, edge flattening and flattening of cross-sections of the angles between the working edges on the *déjeté*-type artifacts can be observed here (Derevianko, Markin, 1992, 2011; Derevianko et al., 2009; Derevianko, Markin, Zykin, 2009).

Overall, the structure of the technocomplexes in both caves is characteristic of the Middle Paleolithic, developing in the direction of Mousterian features, where the leading forms of artifacts are primarily represented by scrapers of various combinations.

In both caves anthropological materials were found, consisting of odontological remains and parts of postcranial skeleton. In the Okladnikova Cave (layers 7, 3, 2, 1) these are phalanxes, heel, femoral and shoulder bones, adult and child teeth and a patella, belonging to the anthropological type (Krause et al., 2007). In the Chagyrskaya Cave second upper premolar of an adult (layer 6c/1 (6в/1), horizon 2), first cervical vertebra of an adult (layer 6b (6б), horizon 4), lower incisor (right medial) of an adult (layer 6c/1 (6в/1), horizon 3), back surface of the distal condyle of the right tibia of an adult (layer 6c/1 (6в/1), horizon 3), deciduous tooth (left mandibular canine) of a child, aged 7–8 years were discovered and other human bones, as belonging Neanderthal anthropological type (Viola, Markin, Zenin et al., 2011; Viola, Markin, Buzhilova et al., 2012).

The temporal indicators were so far determined for the technocomplexes from the Okladnikova Cave, the absolute age of which ranges from 44 800 to 33 500 years ago, which corresponds to the Karginian time. Age material from the cave Chagyrskaya determined in the range 45 672 ± 481 years ago (MAMS 13 033), – 50 524 ± 833 years ago (MAMS 13 035). It is important to note that the initial stage of formation of the Middle Paleolithic industries in Altai, judging by the materials from the basal deposits of the Denisova Cave (layers 22, 21) and from the lower part of the section of the Ust-Karakol 1 site (layer 19) refers to the second half of middle Pleistocene in the interval between 282 and 133 ka BP. The materials from most of the cave and open sites (Denisova Cave, Ust-Karakol 1 site, Strashnaya Cave with layers, forming the middle part of the section, Okladnikova Cave, Ust-Kanskaya Cave, Tiumechin 1, 2 site, lower layers of the Kara Boms site) refer to the time between 100 and 44,8 ka BP (Derevianko, Shunkov, 2002, 2004; Zenin, Uly-

anov, 2007; Paleoliticheskiye kompleksy…, 1998; Postnov, 2006; Prirodnaya sreda i chelovek..., 2003; Shunkov, 1990). Finally, the latest complexes (upper layer of the Okladnikova Cave) of the Middle Paleolithic, in accordance with the radiocarbon data belong to 33,5 ka BP (Derevianko, Markin, 1992). It is obvious that the regional Middle Paleolithic variant, represented by the unusual materials from the Okladnikova and Chagyrskaya Caves, should be viewed in these temporal limits.

## REFERENCES


**Derevianko A.P. 2009**

Perekhod ot srednego k verkhnemy paleolitu i problema formirovaniya *Homo Sapiens* v Vostochnoi, Zentralnoi i Srednei Azii. Novosibirsk: Izd. IAE SO RAN.

**Derevianko A.P. 2010**

Three Scenarios of the Middle to Upper Paleolithic Transition. Scenario 1: The Middle to Upper Paleolithic Transition in Northern Asia. *Archaeology, Ethnology and Anthropology of Eurasia,* No. 3: 2–32.

**Derevianko A.P. 2011**

The Upper Paleolithic in Africa and Eurasia and the Origin of Anatomically Modern Humans. Novosibirsk: Izd. IAE SO RAN.

**Derevianko A.P., Markin S.V. 1992**

Mustie Gornogo Altaya (po materialam peschery im. Okladnikova). Novosibirsk: Nauka.

**Derevianko A.P., Markin S.V. 1995**

The Mousterian of the Altai in the Context of the Middle Paleolithic Culture of Eurasia. In *The definition and interpretation of Levallois Technology*. Madison: Prehistory Press, pp. 473–484. (Monographs in World Archaeology, No. 23).

**Derevianko A.P., Markin S.V. 1998a**

Mustie yuga Severnoi Azii v sravnenii so srednim paleolitom Vostochnogo Sredizemnomorya. In *Paleoekologia pleistotsena i kultury kamennogo veka Severnoi Azii i sopredelnykh territorii: Materialy mezhdunarodnogo simposiuma*, vol. 1. Novosibirsk: Izd. IAE SO RAN, pp. 100–106.

**Derevianko A.P., Markin S.V. 1998b**

Vozmozhnosti viyavleniya klimaticheskikh izmenenii v karginskikh i sartanskikh osadkakh ryada peschernykh arkheologicheskikh pamiatnikov Altaya. In *Problemy rekonstruktsii klimata i prirodnoi sredy golotsena i pleistotsena Sibiri.* Novosibirsk: Izd. IAE SO RAN, pp. 127–131.

**Derevianko A.P., Markin S.V. 2011**

Sibiryachikhinsky version sites of the Altai Middle Paleolithic industries. In *Characteristic Features of the Middle Paleolithic Transition in Eurasia.* Novosibirsk: Izd. IAE SO RAN, pp. 40–49.

**Derevianko A.P., Markin S.V., Zykin S.V. 2009**

Novyi ob'ekt srednego paleolita na Altaye. In *Drevneyshiye migrazii cheloveka v Evrazii: Materialy mezhdunarodnogo simpoziuma.* Novosibirsk: Izd. IAE SO RAN, pp. 101–106.

**Derevianko A.P., Markin S.V., Zykina V.S., Zykin V.S. 2009**

Chagyrskaya peschera: issledovaniya v 2009 godu. In *Problemy archeologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 15. Novosibirsk: Izd. IAE SO RAN, pp. 129–132.

**Derevianko A.P., Shunkov M.V. 2002**
Middle Paleolithic Industries with Foliate Bifacies in Gorny Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1: 16–41.

**Derevianko A.P., Shunkov M.V. 2004**
Formation of the Upper Paleolithic Traditions in the Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 12–40.

**Krause J., Orlando L., Serre D., Viola B., Prüfer K., Richards M.P., Hublin J.J., Hänni C., Derevianko A.P., Pääbos 2007**
Neanderthals in Central Asia and Siberia. *Nature*, vol. 449: 902–904.

**Kulik N.A., Markin S.V. 2003**
Petrografiya industrii peschery im. Okladnikova (Severo-Zapadnyi Gorny Altai). In *Problemy archeologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 9. Novosibirsk: Izd. IAE SO RAN, pp. 148–153.

**Kulik N.A., Markin S.V. 2009**
Petrograficheskaya kharakteristika srednepaleoliticheskikh industrii iz Chagyrskoi peschery. In *Problemy archeologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 15. Novosibirsk: Izd. IAE SO RAN, pp. 151–157.

**Paleoliticheskiye kompleksy stratifizirovannoi chasti stoyanki Kara-Bom. 1998**
Novosibirsk: Izd. IAE SO RAN.

**Postnov A.V. 2006**
K probleme tekhnologicheskoi "odnorodnosti" raznovozrastnykh paleoliticheskikh kompleksov Ust-Kanskoi peschery. In *Sovremennye problemy arkheologii Rossii*, vol. 1. Novosibirsk: Izd. IAE SO RAN, pp. 137–139.

**Prirodnaya sreda i chelovek v paleolite Gornogo Altaya. 2003**
Novosibirsk: Izd. IAE SO RAN.

**Shunkov M.V. 1990**
Mustierskiye pamyatniki mezhgornykh kotlovin Zentralnogo Altaya. Novosibirsk: Nauka.

**Vasil'ev S.K. 2009**
Ostatki teriofauny iz peschery Chagyrskaya (Severo-Zapadnyi Altai) po materialam raskopok v 2007 i 2008 godakh. In *Problemy archeologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 15. Novosibirsk: Izd. IAE SO RAN, pp. 50–54.

**Viola B.Th., Markin S.V., Buzhilova A.P., Mednikova M.B., Dobrovolskaya M.V., Le Cabec A., Shunkov M.V., Derevianko A.P., Hublen J.-J. 2012**
New Neanderthal remains from Chagyrskaya Cave (Altai Mountains, Russian Federation). *American Journal of Physical Anthropology*, vol. 147, suppl. 54: 293–294.

**Viola B., Markin S.V., Zenin A., Shunkov M.V., Derevianko A.P. 2011**
Late Pleistocene hominis from the Altai mountains, Russia. In *Characteristic Features of the Middle Paleolithic Transition in Eurasia.* Novosibirsk: Izd. IAE SO RAN, pp. 207–213.

**Zenin A.N., Ulyanov V.A. 2007**
Stratigraficheskiye issledovaniya v peschere Strashnaya. In *Problemy archeologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 13. Novosibirsk: Izd. IAE SO RAN, pp. 105–109.

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# PALEOGEOGRAPHIC AND PALEOECOLOGICAL COMMON FACTORS OF EVOLUTION OF HUMAN COMMUNITIES DURING THE PALAEOLITHIC (on the example of the Yenisei River basin)

The first traces of ancient man are recorded in the North-Minusinsk basin in the Altai-Sayan mountain region in the second half of the Middle Pleistocene, the epoch of maximum glaciation (Chekha, Koltsova, 1992). At this time the glaciers had a half-coated character and in the western part of the East Sayan they were located down the river valleys to the marks of 300–400 m. Ice formation in the mountains, humid and cold climate caused the migration of high-altitude vegetation belts – mountain taiga forests were located down to the foothills of the cavities. The North Minusinsk cavity in these conditions was probably the most favorable for human habitation. Severe «breathing» of the Siberian ice sheets could be felt to the North of the Eastern Sayan. Here, being protected by the Sayan mountain ranges the climate was more favorable. In the valley of the Yenisei larch-pine forests of cedar, spruce, fir, birch were developing. Steppe and forest-steppe groups preserved in watershed areas. Fauna was diverse and rich. Isolated settlements of ancient people of this stage were located within the Kurtak opening of the valley of the Yenisei, protected from the north and west by high Neogene terraces, ridges. The man dwelt in the coastal shallows of the Yenisei River, near the water (Kamenniy Log location, Berezhekovo).

The next emergence of a man in the territory mentioned above may be assumed in the late Middle Pleistocene stage (Razlog location). Due to the active melting of glaciers that was full-flowing time. Land settlements were also connected with the presence of ancient coarse clastic alluvium – as a source of raw materials.

Kazantsev time is one of the most significant stages in the history of the Quaternary period of warming. The climate in the south of Central Siberia was close to the modern one. The traces of a man in this period are not fixed here. He may have migrated to the mountains (Dvuglazka cave), to the south.

Early Muruktinsk stage takes the time from Kazantsev interglacial to Muruktinsk glaciation and, respectively, cooling in the areas outside the glacier. After a brief (extreme?) cooling at the beginning of early Wurm the mitigating of climate came. In the North-Minusinsk basin, where the traces

of a man in this stage were found, the temperature was a little harsher than now (Drozdov, Chekha, 2000). Climatic conditions were reflected in landscapes. Vegetation cover was mosaic – forest-steppe, forest, prairie landscapes were combined. In the conditions of increasing cold climate, humidity, there was a gradual expansion of the forest zone and the migration of taiga vegetation to the valley of the Yenisei. Steppe areas of the North-Minusinsk cavity were covered by grass-forb associations with pine and birch groves. Accordingly, the fauna of this time was diverse, some its members had a wide ecological amplitude – the North and the giant deer, horses, kulans, rhinos, mammoths, bears. In general, this stage is correlated with the beginning of new glaciation in the Sayan Mountains, the new creation of lakes, flooded environments with increasing humidity of climate to the south (including Mongolia). The emergence of a new man in the North-Minusinsk cavity is connected with exactly this stage. The coincidence of the habitat areas of Early Paleolithic man and Mousterian man in Kurtak opening of the valley of the Yenisei is significant.

Dependence of a way of life of a man on natural conditions at this time is clearly manifested in hunting. Impressive evidence of this were found on the Izhul location. Fossil remains of eleven individuals of thick enamel mammoth were identified here (Ovodov, 1995). Certainly, these are the traces of human activity and specialization in this stage on more massive and large animals can be expected. This pattern is manifested in many Eurasian Mousterian settlements, which implies a relative sedentism of a man.

The next break in the distribution of Paleolithic cultures is associated with the second half of Muruktinsk time. Increased cooling, aridization and intense foresterization apparently forced single, small groups of Mousterian hunters to leave the cavity.

Karginsk stage coincides with warming (Early Karginsk time) and the time moving to cooling (Late Karginsk). They are separated by the phase with extreme, crisis climate conditions in the range of about 33–30 thousand years (Middle Karginsk time). This stage in the stratigraphic scheme corresponds to Kurtak soil complex and archeological sites included in it (Drozdov, Chekha, 2003). It is believed that this time is the most complex in the chronostratigraphy related to archaeological problems. Consequently, almost everywhere the transition from the Mousterian to the Upper Paleolithic is badly traced. This situation is typical for our region. For Early Karginsk time, when after Zyryan cooling the landscapes close to modern ones rapidly recovered, human presence can be only expected. The situation is similar to Middle Karginsk time. Distinct traces of human presence begin to be recorded only in Late Karginsk time (28–22 kyr).

This time in the climatic cycle takes place, similar to Early Muruktinsk (Drozdov, Chekha, 2000). But more severe climatic conditions are also assumed. With an increase in cooling and moistening the next wave of migration of Sayan taiga vegetation in the intermontane basins occurred, although some steppe formation demonstrated for this period of time. A variety of wildlife in the region reflected the mosaic nature of the landscapes of transitional

stages – reindeer, bison, bear, horse, deer, argali, elk, mammoth, black grouse, capercaillie and ptarmigan.

The main morphological structure and the main area of habitation at this time was still the North Basin and Minusinsk Batenevsk-Derbinsk area in the valley of the Yenisei. The found settlements here are still rare, mostly within Kurtak area. But we can talk about some increase in the number of Paleolithic people.

A very important step in Karginsk stage was a sharp decline in the number and areas of mammoth. Populations of these animals survived «flourishing» in Early Muruktinsk time due to the changes in environmental conditions, reduction of the biological capacity of pastures and generally as the most vulnerable component of fauna, were gradually becoming rare and migrating to the north. In the second half of Kargin time reindeer became very widespread, being the main focus of hunting men.

In the early Sartan time (about 21–20 kyr) due to sharp cooling, small groups of Paleolithic people left the region once again. Their appearance here about 17 thousand years ago marked a very special stage regarding nature. It was the final stage in the history of the Paleolithic. Apparently, for a relatively short period of time man mastered the whole valley of the Yenisei River to the mouth of the Western Sayan Angara. It was the time of the formation of terrace I in the valley of the Yenisei River, subaerial sheets on the terraces and slopes. In the early middle Sartana (about 17 thousand years ago sparse pine and birch forests with dwarf formations remained, open spaces dominated, permafrost existed. Later (17–15 thousand years) with some increase in moisture migration in intermountain basins and foothills of dark coniferous taiga was observed, dwarf associations were present. In Late Sartan time (13–10 ka) with the existence of arid environments for the valley of the Yenisei, depending on the area, various landscapes (from coniferous and birch forests to forest-steppe), dwarf bushes, specific swamp-steppe reconstructed.

In the development of all the south of Central Siberia, exclusively through the valley of the Yenisei River and its tributaries, this process was still going on most actively in the North Minusinsk cavity. Then the foothills of the Eastern and Western Sayan followed. Thus, the mere existence of the Yenisei River valley did not play any role as a factor of habitation, unless being accompanied by a complex of landscape conditions – finding the area of the valley at the junction, in border parts of different nature zones. But there where the above conditions were complied, the density of the distribution of human communities was very different. This was logical due to the influence of geological and geomorphological and landscape factors. Simultaneous active habitation by man of the lower (lower terrace) and upper (high terraces, sloping hillsides of narrows, etc.) of the layers of the valley of the Yenisei is typical for Sartan stage. Sharp decrease in the density of human settlements in Paleolithic period was characterized by the edges of linear ranges – below the Krasnoyarsk and above Mainsk-Kantegirsk areas. Due to the thinning of populations of mammoths reindeer became very important in human nutrition. Migrations of reindeer to the valley of the Yenisei River, the foothills of the Sayan and Kuznetsk

Alatau were directly caused by the creation of the specific natural environment. In particular, the simultaneous settlement of all the tiers of the valley of the Yenisei, its dynamics and patterns are explained by the peculiarities of ecology and behavior of the reindeer, which was constantly followed by a Late Paleolithic hunter.

The foregoing allows us to formulate some conclusions.

First, the Paleolithic is the stage of the natural determination of man, direct dependence of many aspects of his life on natural conditions. The basic form of the impact was the changes in the environment. Obviously, they explained intermittent-continuous path of human evolution in Paleolithic. We can say that both the warmest periods (Kazantsev interglacial, Early Karginsk time) and extreme on their climatic conditions periods, led to certain changes, dispersals, displacement of human communities from the habitats. According to the climate model in a series of «warming-cooling» human habitation of the Paleolithic period was dated to either periods from warming to cooling (Early Muruktinsk, Late Carginsk stages) or the first half of cooling with the climate that was moderately cool and moist enough (Middle Pleistocene stage, the beginning of the Middle Sartan stage). In all cases these were not too cold, not too arid conditions with mosaic, diverse landscapes, where the factor of forestation was of considerable importance. Only at the end of the Sartan stage man adapted to arid environment. This meant reducing the role of environmental conditions. Thus, in the stability, in the maintenance of life support systems as a whole, in the evolutionary development of man, the most frequently recurring in the history of Middle-Late Pleistocene, relatively wet, colder than at present, but not crisis periods were of a primary importance. Their role in human history is assessed differently. Apparently, they were not the motivation, the impetus for progress, and almost always hampered the development. «As soon as nature swung to the opposite direction and progress was replaced by a much faster decline of cultural traditions, the memory of them disappeared over the centuries» (Krupnik, 1989). Obviously, crisis on their climatic conditions periods of Central Siberia played an extremely negative and depressing role. According to some paleocryogenic indicators they can be compared with modern environment of the north of Yakutia (Drozdov, Chekha, 2002). Intermittent, non-linear development of Paleolithic cultures in the region, therefore, was due to certain cyclicity of the natural environment. In general we can say, that the fate of Paleolithic man for many, many thousands of years was represented by a discontinuous series of emergences, disappearances, migrations with its extreme scarcity.

Secondly, the main form of the influence of man on nature, especially for the Upper Paleolithic, should include the factor of space, spatial diversity of the off-ice zone of Central Siberia (Chekha, 1997). Differentiation of the natural environment led to a wide variety of human relationships with spatial characteristics. A set of specific symptoms of «quality of environment», «attractiveness of landscapes» was a major one. In all cases, territories with a spatial and geographical variety of contrasts, boundaries, and contact lines were the regions, areas of higher concentrations of Paleolithic settlements.

From this perspective, different cultural communities manifested themselves in a unified manner. The manifestation of the factor of inheritance, conventionalism, continuity in the natural propensity of man of Paleolithic is very remarkable here. Regardless of his evolution, man came (updated, more advanced) to the same areas and even to the same districts after considerable breaks in time.

Thirdly, the influence of the environment on man was carried out through natural resources. The man satisfied his needs for 100 % by taking finished products of nature. Exactly this determined the specificity of his activity, controlled his life. The main ones among such products were: 1) the resources of fauna (game animals for food, raw materials for clothing and building material), 2) flora resources (fuel, building materials, food), 3) geological resources (raw materials for making tools, building materials), 4) water resources. The most important and defining many features of settlements and economic activity were the resources of fauna. In this case, like from other natural positions, various cultural communities of the Paleolithic people (for Sartan stage) also showed themselves in a united manner.

## REFERENCE

**Chekha V.P. 1997**

Natural laws of human development in the Paleolithic. In *Evolution of Life on Earth.* Tomsk: Tomsk Univ., pp. 166–168.

**Chekha V.P., Koltsova V.G. 1992**

Paleogeographic aspects of Paleolithic Minusinsk intermontane basins. In *Paleoecology and settlement of early man in North Asia and America*. Krasnoyarsk: RIO KSPU, pp. 255–258.

**Drozdov N.I., Chekha V.P. 2000**

Reconstruction of late Pleistocene climates in Central Siberia, according to the study of loess formation. In *Problems of reconstruction of climate and environment of Holocene and Pleistocene in Siberia*. Novosibirsk: Izd. IAE SO RAN, iss. 2: 175–188.

**Drozdov N., Chekha V.P. 2002**

Paleocryogenesis, paleogeochemistry and questions of reconstruction of climates of the Quaternary period (the basins of the Yenisei and Angara). In *The main regularities of global and regional changes in climate and environment in the Late Cenozoic of Siberia*, iss. 1. Novosibirsk: Izd. IAE SO RAN, pp. 163–177.

**Drozdov N., Chekha V.P. 2003**

Geological chronology and periodization of the Upper Paleolithic of the Yenisei – approaches and problems. *Archaeology, Ethnology and Anthropology of Eurasia*, No. 1 (13): 2–10.

**Krupnik I.I. 1989**

Arctic Ethnology. Moscow: Nauka.

**Ovodov N.A. 1995**

Ust-Izhulsk mammoth paradox (the Yenisei, 55°N). In *The first international meeting on mammoths: Proc. Reports*. St. Petersburg, p. 632.

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# MIDDLE PALAEOLITHIC ARCHEO-SEQUENCES FROM SOUTHWESTERN FRANCE: WHERE DO WE STAND A QUARTER CENTURY AFTER FRANÇOIS BORDES?

The scientific contribution of François Bordes is immense in many ways and, like several famous names who forged European Prehistory, particularly French prehistorians (Henri Breuil, Denis Peyrony, André Leroi-Gourhan…), it is rich, diversified and multifaceted. Here we are concerned with one of his major research interests: the significance of the variability observed in the Mousterian "facies" that he himself helped to define (Bordes and Bourgon, 1951; Bordes, 1953a, 1953b, 1963). However, in a more sensible and less ambitious way, we propose here the indispensable key to any attempt at unlocking their underlying mechanism: establishing their chronological succession, more precisely, their temporal succession seen through the lens of the major archeo-sequences from Southwestern France. We have limited this contribution to the western Aquitaine Basin.

By "archeo-sequence" we mean the succession of chrono-cultural entities recognised by prehistorians on techno-typological grounds, combined with the techniques and methods of stone tool production and any possible symbolic manifestation, in other words, the cultural image of a group via its main material productions. The recovery of archaeological material followed by the study of various categories of remains (essentially lithics for the Middle Palaeolithic) and ultimately their considered analysis will allow this goal to be achieved.

## FRANÇOIS BORDES AND MIDDLE PALAEOLITHIC ARCHEO-SEQUENCES

Even if their graphic representation still remains poor, if not disappointing, the chronological succession of Mousterian facies as defined by François Bordes is reflected in numerous fundamental contributions. This conception inspired a number of us and has clearly served as an example for various regional models (Combier, 1967; de Lumley-Woodyear, 1971; Le Tensorer, 1981) where we can see an evolution that was very early on described as "dendritic" (Bordes, 1950).

One of the clearest and most successful visual representations is the table presenting the Middle Palaeolithic sequence from the Perigord region pub-

lished in 1970 where we see the inescapable stratigraphy of Combe Grenal (always on the left and given pride of place), Pech de l'Azé II, Pech de l'Azé I, Le Moustier, La Micoque and, more interestingly, Combe-Capelle (Bordes and de Sonneville-Bordes, 1970). The reappearance of this table, although slightly modified and supplemented by Jean Guichard, seemed to affirm the somewhat rigid authority of the Master's original publication. The ensuing Anglo-American works, although interesting and occasionally brilliant, remained under-developed or too simplistic in terms of documentation (Mellars, 1969), as they failed to integrate updated data, or did so insufficiently (Mellars, 1996).

I am persuaded that although crucial progress made since the beginning of the second half of the 20th century has proven to be decisive and despite renewed information, we remain the direct and indebted inheritors of the concepts, definitions and analyses proposed by François Bordes and well-described in a final 1981 publication "The Mousterian revisted".

## ORIGIN OF A COLLECTIVE RESEARCH PROJECT

The origin of this work lies in a collective research project entitled "The Middle Palaeolithic in the Aquitaine: emergence, development and variability" which united three partner institutions (CNRS, INRAP and the Ministry of Culture) together with some forty researchers or doctoral students from the universities of Bordeaux, Aix-Marseille, Toulouse and Paris 1, led by J.-P. Texier and myself between 2003 and 2006. The first two years (2003–2004) were dedicated to six thematic workshops: *Geoarchaeology*, *Raw Materials*, *Technology of Technical Systems*, *Acquisition and Processing of Animals*, *Chronology and Dating* and finally *Palaeoenvironments*. The two following years (2005–2006) saw the development of five "trans-thematic" workshops: *The Degree of Site Integrity*, *Interactions between the Environment and Technical Systems*, *Relationships between Chronology and Technical Systems*, *Geography of Technical Systems* and finally *Site Function and Duration of Occupation*. The main results of the project, although presented in Wroclaw (Jaubert et al., 2006), Vancouver (Jaubert, 2008), Amiens (April 2008) and Barcelona (May 2008), were never published.

This present work draws upon workshops A3 and A5.

Workshop A3, *Technology of Technical Systems*, directed by L. Bourguignon, A. Delagnes and M. Lenoir included some twenty participants who contributed to various degrees: J.-G. Bordes, L. Bourguignon, M. Brenet, É. Claud, D. Colonge, A. Delagnes, P.-Y. Demars, L. Detrain, H. Djema, J.-Ph. Faivre, J.-M. Geneste, M. Folgado, J. Jaubert, M. Lenoir, V. Lhomme, A. Morala, V. Mourre, S.-J. Park, J.-Ph. Rigaud, M. Soressi, C. Thiébaut, A. Turq and B. Wisniewski. The major goal of the workshop consisted in establishing a template for each lithic assemblage summarising the statistics relative to each production system: raw material (dominant, secondary...), type of support (block, flake…), dominant or secondary debitage concepts, methods or modes (Levallois, Discoid, laminar...), shaping methods, retouched tools, etc.

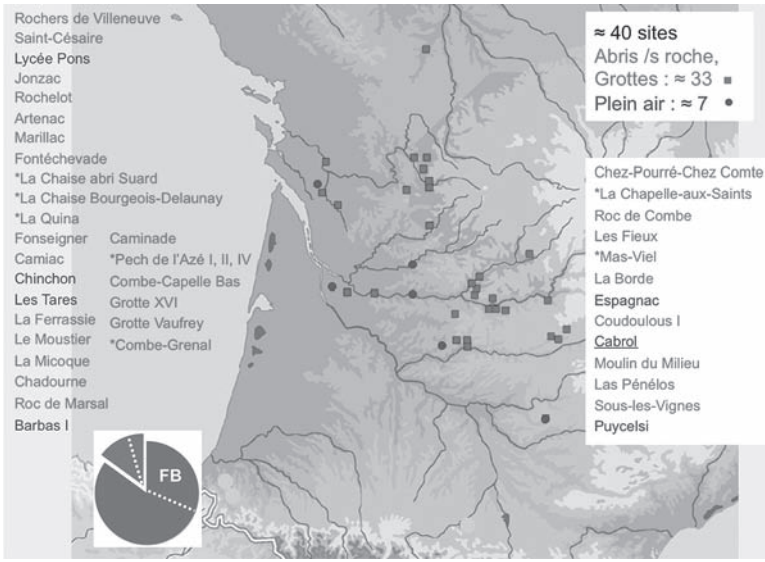
Workshop A5, *The Chronology of Technical Systems* (i.e. lithic industries) was directed by P. Guibert and for the most part carried out by F. Bechtel & coll. This recently published work (Guibert et al., 2008) was based on the creation of a database drawing together the entirety of available dates, regardless of the method, for the Middle Palaeolithic of the Aquitaine. The database included a reliability index for each of the 424 dates available in 2004 which were supplemented by new samples chosen in consultation with and essentially processed by the CRP2A (University of Bordeaux 3), as well as the LSCE in Gifs-sur-Yvette and the Max Planck Institute in Leipzig, leading to some forty new dates being produced between 2004 and 2006. In practical terms, the dates assigned a reliability index ranging from poor to weak (index 0 and 1) accounted for only 17 % (73 dates) of the dates versus 83 % (348 dates) falling within the acceptable to good categories (index 2–3) (Ibid.). Only the dates assigned indexes of 2–3 will be considered here.

## DOCUMENTATION

The sites included in the project (Fig. 1) can be divided into two groups: "classic" reference sites and those recently excavated in rescue contexts by the INRAP in Southwestern France. The two groups have nearly nothing in common in terms of the geomorphology of the sediments (cave entrances / rock shelters *versus* open-air sites), study conditions (research *versus* rescue contexts), taphonomy (preserved fauna from karstic contexts *versus* only lithic artefacts preserved in open-air sites), etc.

Amongst the first group, a "classic" sub-category can be distinguished within the "classic" group (Bourgon, 1957): Caminade (Sonneville-Bordes, 1969), Combe Grenal (Bordes, Laville, Paquereau, 1966), La Quina (Martin, 1923), La Ferrassie (Peyrony, 1934; Delporte dir., 1984), Le Moustier (Peyrony, 1930; Laville and Rigaud, 1976b), La Micoque (Peyrony, 1938; Bordes and Prat, 1965; Laville and Rigaud, 1976a), le Pech de l'Azé I (Bordes, 1954, 1955), II (Bordes, 1972) and IV (Bordes, 1975), Combe-Capelle, La Chaise… known and used by François Bordes himself (Bordes, 1973, 1981) and others as the basis for various interpretive syntheses (e.g. Binford and Binford, 1966; Mellars, 1969, 1996; Binford, 1973; Rolland, 1981; Dibble, 1983; Rolland and Dibble, 1990; Geneste, 1989). Numerous regional syntheses of other geographic entities or groups of sites have progressively been added to this classic core group of sites (Debénath, 1974; Le Tensorer, 1981; Jaubert, 1984; Geneste, 1985; Turq, 1988, 2000; Delagnes, 1990, 1992; Faivre, 2008). This group of site have been or still are the subject of revision:

- Geoarcheology: La Micoque (Texier, Bertran, 1993), Pech de l'Azé II (Texier, 2006), La Ferrassie (Texier, 2009).
- Radiometric chronology: Le Moustier (Valladas et al., 1987; Mellars and Grün, 1991), Pech de l'Azé II (Grün, Mellars, Laville, 1991), La Micoque (Falguères, Bahain, Saleki, 1997).
- Lithic industry: Le Moustier (Soressi, 1999), Combe Grenal, Les Fieux (Faivre, 2008), La Quina (Biewirth, 1996; Bourguignon, 1997; Park, 2007).



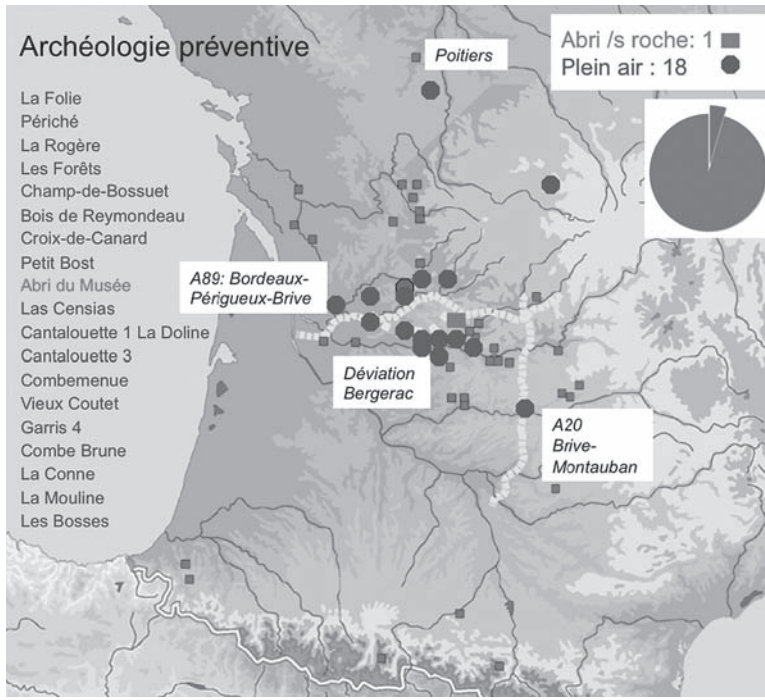




*Fig. 1.* Map of Middle Palaeolithic sites included in the "Middle Palaeolithic of the Aquitaine: emergence, development and variability" project.

• Animal palaeontology, biochronology (Delpech et al., 1983; Guadelli, 1987) and zooarchaeology (Chase, 1986).

• Multidisciplinary excavations incorporating the above research disciplines: La Ferrassie (Delporte dir., 1984; Tuffreau, 1984), Barbas I (Boëda et al., 1998; Boëda, Soriano, Noël-Soriano, 2004), La Quina (Chase et al., 1994; Debénath and Jelinek dir., 1999), Artenac (Delagnes et al., 1999), Marillac (Meignen and Vandermeersch, 1988; Maureille et al., 2007; Costamagno et al., 2006), Fontéchevade (Chase et al., 2009), Pech de l'Azé I (Soressi et al., 2002, 2007, 2008) and IV (McPherron and Dibble, 1999; Turq et al., 2008), Combe Capelle (Dibble and Lenoir eds., 1995; Dibble and Lenoir, 1998), Caminade, Roc de Marsal (Thiébaut, 2003; Turq et al., 2008), La Chapelle-aux-Saints (Beauval et al., 2007).

To which can be added several sites discovered, excavated and or published after the "Bordes years": Les Tares (Rigaud and Texier, 1981; Geneste and Plisson, 1998), Fonseigner (Geneste, 1985; Valladas et al., 1987), Grotte Vaufrey (Rigaud dir., 1988), Saint-Césaire (Lévêque, 1993; Lévêque, Backer, Guilbaud, 1993; Thiébaut, Meignen, Lévêque, 2009a), Coudoulous I (Jaubert et al., 2005), Les Fieux (Champagne and Jaubert, 1986; Faivre, 2004, 2006; Thiébaut, Mourre, Turq, 2009b), Grotte XVI (Rigaud, Simek, Gé, 1996; Guibert et al., 1999), Puycelsi (Briki-Heriech et al., 2005), Espagnac (Jaubert dir., 2001), Les Rochers de Villeneuve (Beauval et al., 2006) or Jonzac (Airvaux dir., 2004; Jaubert et al., 2008).

The second group is composed solely of open-air rescue excavations, with the exception of Abri du Musée (Detrain et al., 1991), found along the A89 highway connecting Bordeaux to Clermont-Ferrand via the Isle Valley, Périgeaux and Brive: Les Forêts (Brenet and Folgado, 2003) Petit-Bost (Bourguignon et al., 2008b; Djema, 2008), Champ de Bossuet (Lenoble, Ortega, Bourguignon, 2000) to name only those that have been at least partially published. More substantial rescue excavations have recently been carried out along the Bergerac bypass: Cantalouette 1, Combe-Brune 3 (Brenet et al., 2008; Brenet and Flogado, 2009), La Doline / Cantalouette II (Bourguignon et al., 2008a). Further to the north, at the border of the Aquitaine and Paris Basin lies the site of La Folie (Bourguignon et al., 2002), while work in the south of France on the A20 highway (Brive-Toulouse), where it crosses into the Lot, resulted in the excavation of Les Bosses (Jarry et al., 2004, 2007).

## A NATURAL DEVELOPMENT: THE ESTABLISHMENT OF ARCHEO-SEQUENCES

The table of "cultural" stratigraphies is now referred to as "archeo-sequences" and no longer as "chrono-stratigraphies" (Djindjian, 2003) as it is unrealistic to believe – unless through some sort of miracle of preservation – that these represent closed cases, as is often suggested when referring to textbook examples which are incompatible with the realities observed in the field. Specific studies which incorporate all methods available to archaeologists humble us

in the face of the challenge at hand which consists in drawing-up archeo-sequences without having previously subjected them to taphonomic tests: lithic and bone refits, geoarchaeology and increasing the number of dates available for a each assemblage. The first stages of this exercise therefore consisted in producing simple stratigraphic profiles of the succession of lithic techno-complexes and/or elements of the osseous industry (other remaining artefact types have little bearing in this exercise) and juxtaposing, from the oldest to the most recent, archeo-sequences from a given region and period. Our focus here is the Middle Palaeolithic of the northern and eastern Aquitaine Basin between 300 ky and 35 ky BP.

Some 240 different stratigraphic units were identified and taken into account, encompassing around 70 sites and no less than 35 ± 5 lithic techno-complexes. Concerning the latter, it is worth remembering that Fran3ois Bordes had defined 5 Mousterian facies, some of which were subdivided, and amount to about a dozen if we include such subsequent nuances as "atypical" or "rich in scrapers". The number of techno-complexes identified in the database resulting from the A3 Workshop therefore multiplied by three the number of "cases" (a neutral term that is preferred, for the time being, over *facies* which presupposes that its interpretation is settled).

A preliminary list can be proposed:

- MP[1*] / Mousterian, Levallois[2*] with large scrapers[3*]
- MP / Mousterian, Discoid / denticulates[4*]
- MP / Mousterian, Discoid, elongated flakes *cf.* MTA-B[5*]
- MP / Mousterian, Discoid, elongated flakes, bifaces[6*] *cf.* MTA-B
- MP / Mousterian, Discoid / Levallois / elongated flakes *cf.* MTA-B
- MP / Mousterian, recurrent Levallois, bifaces *cf.* MTA-A
- MP / Mousterian, unipolar crossed Levallois / Discoid, bifaces *cf.* MTA-A
- MP / Mousterian, Elongated flakes / Laminar / Discoid, bifaces *cf.* MTA
- MP / Mousterian, Levallois *cf.* Asinipodian
- MP / Mousterian, uni-bipolar / centripetal Levallois *cf.* Typical M. / MTA?
- MP / Mousterian, centripetal / uni-bipolar Levallois *cf.* Typical M.
- MP / Mousterian, centripetal / uni-bipolar Levallois with denticulates
- MP / Mousterian, centripetal Levallois, denticulates
- MP / Mousterian, Levallois / Kombewa *cf.* Typical M.
- MP / Mousterian, unipolar / centripetal Levallois, backed knives *cf.* MTA-B
- MP / Mousterian, dendritic Quina reduction system and Quina tools, *cf.* Evolved Quina
- MP / Mousterian, Quina debitage and Quina denticulates *cf.* Quina-Denticulate M.

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[1*] MP for *Middle Palaeolithic*; EMP for *Early Middle Palaeolithic*.
[2*] Levallois debitage is predominate, if not, exclusive.
[3*] Large scrapers are present.
[4*] Denticulates represent the dominant 'retouched' tool.
[5*] When the designation is preceded by 'cf.' it refers to a facies in Bordes' sense.
[6*] Presence of bifaces or bifacial pieces.

- MP / Mousterian, Quina debitage and tools
- MP / Mousterian Indeterminate, Probable Quina (small collections)
- MP / Mousterian, recurrent centripetal Levallois, *cf.* Ferrassie M.
- MP / Mousterian, uni-polar / centripetal Levallois *cf.* Ferrassie M.
- MP / Mousterian, Levallois dominated, Discoid present, *cf.* Typical / Ferrassie M.
- MP, uni-bipolar Levallois / bifacial, *cf.* Micoquian
- MP, Laminar Mousterian, bladelets, Discoid
- MP, Mousterian, Discoid dominated, occasional Levallois, denticulates
- MP, Mousterian, Discoid, occasional Levallois, denticulates
- EMP, preferential / unipolar crossed Levallois / Discoid / *cf.* Typical M.
- EMP, unipolar crossed Levallois / Discoid *cf.* Typical M. rich in scrapers
- EMP, uni-bipolar crossed Levallois / *cf.* Typical M. rich in scrapers
- EMP, uni-bipolar / centripetal Levallois *cf.* Typical M. rich in scrapers
- EMP, Almost exclusive bifacial shaping
- EMP, Discoid / Debitage on an anvil / Levallois
- EMP, uni-bipolar / preferential Levallois *cf.* Typical M.
- EMP, Trifacial, bifaces, *cf.* "Southern Acheulean"
- EMP, Les Tares debitage, dendritic reduction systems, *cf.* Rissian Charentian
- EMP, uni-bipolar / preferential Levallois / bifaces
- EMP, Discoid, centripetal Levallois / bifaces
- EMP, unipolar, parallel, convergent Levallois / Quina debitage / bifaces
- PM, Indeterminate Mousterian (small collections)

Although this list is imperfect and still provisional, it does nonetheless represents a first step towards building a new model. The post-doctoral project on the same subject entrusted to C. Thiébaut will also enrich the present analysis.

The logical next step consists in classifying the different occurrences of various lithic techno-complexes (LTC) starting from the assumption that identical LTCs or those that are at least sufficiently similar to be grouped under the same heading are effectively contemporaneous. The table progressively takes shape with the subsequent help of radiometric dates. A more complete and collective version, as this work cannot be carried out by a single researcher, will be proposed in the future.

## PRELIMINARY RESULTS

Patterns emerge:

- The overwhelming majority of Levallois LTCs precede MIS 3–4 and are heavily concentrated in MIS 7, 6 and 5 where they are found in different forms (Delagnes and Meignen, 2006). The variability of these techno-complexes is linked to both the length of the period concerned and their incomplete documentation.
- Levallois LTCs only reappear very sporadically in distinct forms (Levallois Mousterian with denticulates at Roc de Marsal or Jonzac) and overlying the MTA at the end of certain sequences (Le Moustier?, Rochers de Villeneuve).

- Amongst the Levallois TLCs*, it is often delicate, if not impossible, to establish a hierarchy between the previously defined Ferrassie and Typical Mousterian facies.
- The LTCs containing Acheulean bifaces (Les Bosses, Petit-Bost, Barbas I...) are found during the early phases of the Middle Palaeolithic.
- The majority, if not all, of rescue excavations produced LTCs that are generally connected with the earlier phases of the Middle Palaeolithic (MIS 7–5) which does not help in sorting out the inextricable muddle or confusion of LTCs from MIS 3. On the other hand, they do supplement information available for earlier periods.
- Not surprisingly, the Quina *senso stricto* LTCs cluster after MIS 5, between MIS 4 and the onset of MIS 3. It is interesting to note that not only do they coincide with a Pleniglacial period, but they present troubling similarities with the Solutrean: technical innovations, new stone tool forms...
- While other occurrences of Quina debitage may exist (La Micoque, Petit-Bost), none associate all of the elements present in the Quina *sensu stricto* from MIS 4–3 which remains highly original. The recurrence of such phenomena (La Micoque = MIS 10 and Quina *sensu stricto* = MIS 4–3) is conceivable without any tie, other than technological convergence, linking them.
- The Discoid Denticulate Mousterian follows not only the Quina, but also the MTA type Pech I.
- It is now that clear that one of the LTCs which was previously assigned to the Mousterian of Acheulean Tradition (MTA) type A systematically precedes all MTA-B LTCs when stratified (Pech de l'Aze I, La Rochette, Le Moustier) regardless of the interpretation (Soressi, 2004).
- The recurrence of the "MTA" phenomenon is excessively applied to LTCs whenever bifaces are present. The designation "MTA" ought to be reserved, in our opinion, solely for the most typical, best dated and described LTCs, namely the MTA levels from Pech de l'Azé I (Bordes, 1954, 1955; Soressi, 2002). Besides "this" MTA, the LTCs containing several bifacial pieces known from the period between 300 and 40 ky BP should not be qualified as MTA as such, rather as MP with bifaces, for example Grotte XVI.
- The final LTC from the Mousterian sequence in Southwest France is not, and sometimes far from it, the MTA: it is succeeded by at least one, if not two LTCs: the Discoid Denticulate Mousterian and a still poorly documented and little described LTC with, strangely enough, Levallois debitage documented at Les Rochers de Villeneuve and perhaps Le Moustier.
- Etc.

In the meantime, it is clear that a certain number of anomalies have appeared, some of which were already documented some time ago (Bordes, 1981; Mellars, 1969, 1996): for example, the stratigraphic anomalies of an MTA level intercalated within a long series of Denticulate and Discoid Mousterian levels

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* Work is in progress under our direction and that of A. Turq for one of these, the "Typical Mousterian" of Pech de l'Azé II: J. Teyssandier, 2010.

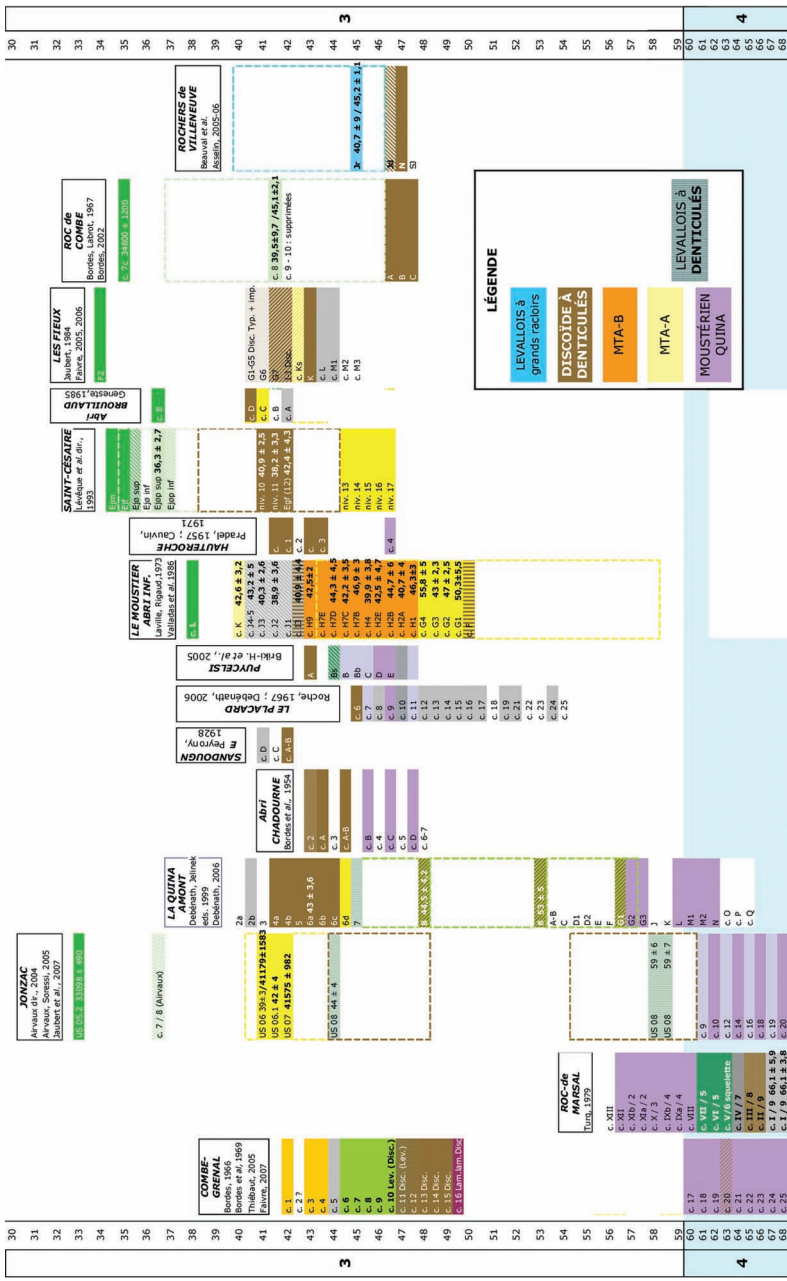


*Fig. 2.* Provisional model of the Middle Palaeolithic archeo-sequence for South-West France.

at La Quina (Park, 2007) or the famous level 20 at Combe Grenal assigned by Bordes to the Denticulate Mousterian that is, in fact, simply an artefact of an approach relying too heavily on typology. A recent techno-economic study has re-attributed this assemblage to the Quina LTC. Although rich in denticulates, the technological analysis clearly demonstrates the production methods to be associated with the Quina (Faivre, 2008). Other anomalies (upper portion of the Combe Grenal sequence) or a Denticulate Mousterian underlying the Quina levels at Puycelsi deserve to be revised or require further documentation.

## TOWARDS THE ESTABLISHMENT OF A NEW REGIONAL ARCHEO-SEQUENCE MODEL

It is tempting to elicit a single techno-cultural strato-type from the numerous archeo-sequences. In order to achieve this, we can reduce the matrix of archeo-sequences as much as possible to progressively obtain a sort of stratigraphic profile of LTCs encompassing a predefined geographic area (Fig. 2). The task is simpler when the patterns repeat themselves thereby validating THE succession which becomes the reference or type sequence and eventually the model. We are not hiding the fact that certain anomalies mentioned above are inevitable and that we had to cheat to complete the final stratigraphic profile. The reasons for this are multiple:

- Errors or imprecisions in the available dates.
- The variability observed in LTCs may be explained by another parameter: adaptations to raw materials, economic function, a specialised assemblage... confusing the matter.
- Or, on the other hand, their techno-typological uniformity resulting from a non-specialised site function mitigating the cultural traditions normally expressed in a particular LTC.

A variability explained by a LTC belonging to another geographic entity for which we have reached the spatial limits of the exercise: it is certain that while these patterns can be found over very broad territories, the archeo-sequences of the Crimea or of Southern Italy cannot be the same as those from the southwest of France. But what about the south of the Quercy or the limits of the Poitou? Or the Tarn and Basque Country? The information is sufficiently rich to limit ourselves to the northern Aquitaine Basin.

## CONCLUSION

A collective research project bringing together more or less all of the researchers* focusing on the Middle Palaeolithic of Southwest France has updated our understanding of the period. At the same time, the critical examination of the available information eliminated the unreliable or inse-

* All French speakers it is true.

curely dated sequences. Stratigraphic and techno-typological revisions and the integration of the initial publications of work carried out in rescue contexts has considerably enriched the Middle Palaeolithic archeo-sequences from Southwestern France which were more or less unchanged for decades (Guichard, 1976). We have been trying to build a new sequence for the region for several years now. I believe that the examination of relevant archeo-sequences proposed here is more interesting in its principle and progressive construction than the endless detailed analysis of each occurrence. We* believe that although we are still far from any sort of modelling, this step was necessary before reopening the debate initiated by Bordes at the beginning of the 1950s.

This leads us again (Jaubert, 1999) and as always (Delagnes, Jaubert, Meignen, 2007; Jaubert, 2010) to question the significance of such a variability, especially when we compare this provisional archeo-sequence to that of the Late Palaeolithic in terms of diachrony and complexity. If we were to challenge our colleagues working on the Upper Palaeolithic to the same sort of exercise, but deny them the osseous objects, mobiliary art (and for that matter: weaponry elements) which constitute documentation that doesn't – or hardly – exists for the Middle Palaeolithic, what sort of table would they be able to produce?... Probably a figure not far from our own. Ours is of course infinitely longer and incomplete, but just as varied and complex in its developments and mechanisms, and we are still far from proposing a definitive and agreed upon model.

## REFERENCES

**Airvaux J. (dir.). 2004**

Le site paléolithique de Chez-Pinaud à Jonzac, Charente-Maritime. Premiers résultats: études sur la coupe gauche. *Préhistoire du Sud-Ouest*, suppl. No. 8.

**Beauval C., Bismuth T., Bruxelles L., Mallye J.-B., Berthet A.-L. 2007**

La Chapelle-aux-Saints: 1905–2004. In *Un siècle de recherche. Congrès du Centenaire: Un siècle de construction du discours scientifique en Préhistoire*. Paris: Société préhistorique française, vol. 2: "Des idées d'hier...": 197–214.

**Beauval C., Lacrampe-Cuyaubère F., Maureille B., Trinkaus E. 2006**

Direct Radiocarbone Dating and Stable Isotopes of the neandertal Femur from Les Rochers de Villeneuve (Lussac-les-Châteaux, Vienne). *Bull. et Mémoires de la Soc. d'Anthropologie de Paris*, t. 18: 35–42.

**Biewirth S.L. 1996**

Lithic Analysis in Southwestern France. Middle Paleolithic assemblages from the site of La Quina. Oxford. (BAR Internat. Series, No. 633).

**Binford L.R. 1973**

Interassemblage variability – the Mousterian and the "functionnal" argument. In *C. Renfrew (dir.). The exploittion of culture change: models in Prehistory*. London: Duckworth, pp. 227–234.

**Binford L.R., Binford S. 1966**

A preliminary analysis of functional variability in the Mousterian of Levallois facies. *American Anthropologist*, vol. 68, No. 2: 238–295.

* The initial participants in the project and those still working on the issue.

**Boëda É., Kervazo B., Mercier N., Valladas H. 1998**

Barbas C'3 Base (Dordogne). Une industrie bifaciale contemporaine des industries du Moustérien ancien: une variabilité attendue. In *Reduction Processess ("Chaînes opératoires") for the European Mousterian*, A. Bietti, S. Grimaldi (eds.). Rome, pp. 465–504.

**Boëda É., Soriano S., Noël-Soriano S. 2004**

Fonction et fonctionnement d'un site à la fin du Pléistocène moyen. Le niveau acheuléen C'3 base de Barbas I (Creysse, Dordogne). In *P. Bodu, Cl. Constantin (dir.). Approches fonctionnelles en préhistoire. Actes du XXV^e^ Congr. Préhist. de France, Nanterre 24–26 nov. 2000, Mémoire de la Soc. préhist. Franç.*, pp. 293–305.

**Bordes F. 1950**

L'évolution buissonnante des industries en Europe occidentale. Considérations théoriques sur le paléolithique ancien et moyen. *L'Anthropologie*, t. 54, 5–6: 393–420.

**Bordes F. 1953a**

Essai de classification des industries "moustériennes". *Bulletin de la Société Préhistorique Française*, t. 50, No. 7–8: 457–466.

**Bordes F. 1953b**

Levalloisien et Moustérien. *Bulletin de la Société Préhistorique Française*, t. 50: 226–255.

**Bordes F. 1954**

Les gisements du Pech de l'Azé (Dordogne). I. Le Moustérien de Tradition Acheuléenne. *L'Anthropologie* (Paris), t. 58, No. 5–6: 401–432.

**Bordes F. 1955**

Les gisements du Pech de l'Azé (Dordogne). I. Le Moustérien de Tradition Acheuléenne (Suite). *L'Anthropologie* (Paris), t. 59, No.°1–2: 1–38.

**Bordes F. 1963**

Le Moustérien à denticulés. *Brodarjev Zbornik, Acta Archaeol. Acad. Sc. Art Sloven., Arkeolovski Vestnik*, t. XIII–XIV: 43–50.

**Bordes F. 1972**

A Tale of two Caves. New-York: Harper & Row.

**Bordes F. 1973**

On the chronology and contemporaneity of different Palaeolithic culture in France. In *The Explanation of Culture Change: models in Prehistory*, C. Renfrew (ed.). London: Duckworth, pp. 217–226.

**Bordes F. 1975**

Le gisement du Pech-de-l'Azé IV: Note préliminaire. *Bull. de la Soc. Préhist. Française*, t. 78: 293–308.

**Bordes F. 1981**

Vingt-cinq ans après: le complexe moustérien revisité. *Bull. de la Soc. Préhist. Française*, t. 78, No. 3: 77–87.

**Bordes F., Bourgon M. 1951**

Le complexe moustérien: Moustérien, Levalloisien et Tayacien. *L'Anthropologie*, t. 55: 1–23.

**Bordes F., Laville H., Paquereau M.-M. 1966**

Observations sur le Pléistocène supérieur du gisement de Combe-Grenal (Dordogne). *Actes de la Soc. Linéenne de Bordeaux*, t. 103, Sér. B, No. 10: 3–19.

**Bordes F., Prat F. 1965**

Observations sur les faunes du Riss et du Würm I en Dordogne. *L'Anthropologie*, t. 69, fasc. 1–2: 31–46.

**Bordes F., Sonneville-Bordes D. de. 1970**
The Signification of Variability in Palaeolithic assemblages. *World Archaeology*, vol. 2, No. 1: 61–73.

**Bourgon M. 1957**
Les industries moustériennes et pré-moustériennes du Périgord. Paris: Masson édit. (Archives de l'Institut de Paléontologie Humaine, No.°27).

**Bourguignon L. 1997**
Le Moustérien de type Quina: nouvelle définition d'une entité technique. Thèse N.D., Université de Paris X, 2 t.

**Bourguignon L., Blaser F., Rios J., Pradet L., Sellami F., Guibert P. 2008a**
L'occupation moustérienne de la Doline de Cantalouette II (Creysse, Dordogne): spécificités technologiques et économiques, premiers résultats d'une analyse intégrée. In *J. Jaubert, J.-G. Bordes, I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles methods. Mémoire de la Société préhistorique française*, vol. XLVII: 133–150.

**Bourguignon L., Djema H., Bertran P., Lahaye Ch., Guibert P. 2008b**
Le gisement Saalien de Petit-Bost (Neuvic, Dordogne) à l'origine du Moustérien d'Aquitaine? In *J. Jaubert, J.-G. Bordes, I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles méthodes. Mémoire de la Société préhistorique française*, vol. XLVII: 41–55.

**Bourguignon L., Sellami F., Deloze V., Sellier-Segard N., Beyries S., Émery-Barbier A. 2002**
L'habitat moustérien de "La Folie" (Poitiers, Vienne): synthèse des premiers résultats. *Paléo*, No.°14: 29–48.

**Brenet M., Folgado M. 2003**
Le débitage discoïde du gisement des Forêts à Saint-Martin-de-Gurçon (Dordogne). In *Discoid Lithic technology. Advances and implications*, M. Peresani (ed.). Pp. 153–177. (BAR Internat. Series, No. 1120).

**Brenet M., Folgado M. 2009**
Relations techno-économiques entre débitage et façonnage sur les gisements du Paléolithique moyen ancien de Cantalouette 1 et Combe Brune 3 (Creysse). *Rivista di Scienze Preistoriche*, t. LIX: 49–62.

**Brenet M., Folgado M., Lenoble A., Bertran P., Vieillevigne E., Guibert P. 2008**
Interprétation de la variabilité technologique de deux industries du Paléolithique moyen ancien du Bergeracois: Cantalouette 1 et Combe Brune 3 (Creysse, Dordogne). Contexte géoarchéologique et chronologique, analyse techno-économique. In J. *Jaubert, J.-G. Bordes, I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles methods. Mémoire de la Société préhistorique française*, vol. XLVII: 57–81.

**Briki-Heriech Dj., Duran J.-P., Saos Th., Grégoire S., Moigne A.-M. 2005**
Le gisement moustérien de la Rouquette à Puycelsi (Tarn, France): une occupation de plain air de chasseurs de grands herbivores. In *N. Molines, J.-L. Monnier, M.-H. Moncel (dir.). Données récentes sur les peuplements du Paléolithique inférieur et moyen en Europe, Actes du Colloque*. Rennes: Univ. de Rennes, pp. 577–586. (BAR International Series, No. 1364).

**Champagne F., Jaubert J. 1986**
Un exemple de remplissage archéologique en milieu karstique: la grotte des Fieux, à Miers (Lot). *Bull. de la Soc. Méridionale de Spéléol. et Préhist.*, t. XXVI: 21–33.

**Chase Ph. 1986**
The Hunters of Combe Grenal: Approaches to Middle Palaeolithic Subsistence in Europe. *BAR Internat. Series*, No. 286.

**Chase Ph., Armand D., Debénath A., Dibble H.L., Jélinek J. 1994**
Taphonomy and Zooarchaeology of a Mousterian faunal assemblage from la Quina, Charente, France. *Journal of Field Archaeology*, vol. 21: 289–305.

**Chase Ph.G., Debénath A., Dibble H.L., McPherron Sh.P. 2009**
The Cave of Fontéchevade. Cambridge: Cambridge Univ. Press.

**Combier J. 1967**
Le Paléolithique de l'Ardèche dans son cadre paléoclimatologique. *Publications de l'Institut de Préhistoire de l'Université de Bordeaux, Impr. Delmas*, mémoire No. 4.

**Costamagno S., Meignen L., Beauval C., Vandermeersch B., Maureille B. 2006**
Les Pradelles (Marillac-le-Franc, Charente, France): A Mousterian reindeer hunting camp? *Journal of Anthropological Archaeology*, vol. 25: 466–484.

**Debénath A. 1974**
Recherches sur terrains quaternaires et les industries qui leur sont associées. Thèse Doctorat ès Sciences, Université de Bordeaux.

**Debénath A., Jelinek A.J. (dir.). 1999**
Nouvelles fouilles à La Quina (Charente). Résultats préliminaires. *Gallia Préhistoire*, t. 40: 29–74.

**Delagnes A. 1990**
Analyse technologique de la méthode de débitage de l'Abri Suard (La Chaise-de-Vouthon, Charente). *Paléo*, No. 2: 81–88.

**Delagnes A. 1992**
L'organisation de la production lithique au Paléolithique moyen. Approche technologique à partir de l'étude des industries de La Chaise-de-Vouthon (Charente). Thèse de Doctorat, Univ. de Paris X-Nanterre.

**Delagnes A., Jaubert J., Meignen L. 2007**
Les techno-complexes du Paléolithique moyen en Europe occidentale dans leur cadre diachronique et géographique. In *B. Vandermeersch, B. Maureille (dir.), Les Néandertaliens. Biologie et culture*. Paris: Éd. du CTHS, pp. 213–229.

**Delagnes A., Meignen L. 2006**
Diversity of lithic production systems during the Middle Paleolithic in France. Are there any chronological trends? In *Transitions before the transition. Evolution and stability in the Middle Paleolithic and Middle Stone Age*, E. Hovers, S.L. Kuhn (eds.). Santa Barbara: Springer, pp. 85–107 (Interdisciplinary Contributions to Archaeology).

**Delagnes A., Tournepiche J.-F., Armand D., Desclaux E., Diot M.-F., Ferrier C., Le Fillâtre V., Vandermeersch B. 1999**
Le gisement Pléistocène moyen et supérieur d'Artenac (Saint-Mary, Charente): premier bilan interdisciplinaire. *Bull. de la Soc. Préhist. Franç.*, t. 96, n°4: 469–496.

**Delpech F., Donard E., Gilbert A., Guadelli J.-L., Le Gall O., Martini-Jacquin A., Paquereau M.-M., Prat F., Tournepiche J.-F. 1983**
Contribution à la lecture des paléoclimats quaternaires d'après les données de la paléontologie en milieu continental. Actes du colloque de l'A.G.S.O., Bordeaux. *Cahiers du Quaternaire*, Éd. du CNRS, num. special: 165–177.

**Delporte H. (dir.). 1984**
Le grand abri de La Ferrassie. Marseille: Éd. du Labo. de Paléont. Hum. et de Préhist., Université de Provence. (Études quaternaires, No. 7).

**Detrain L., Kervazo B., Aubry T., Bourguignon L., Guadelli J.-L., Marcon V., Teillet Ph. 1991**
Agrandissement du Musée National de Préhistoire des Eyzies: résultats préliminaires des fouilles de sauvetage. *Paléo*, No. 3: 75–91.

**Dibble H.L. 1983**

Variability and change in the Middle Paleolithic of Western Europe and the Near East. In *The Mousterian Legacy*, E. Trinkaus (ed.). Oxford, pp. 53–71. (BAR Internat. Series, No. S164).

**Dibble H.L., Lenoir M. (eds.). 1995**

The Middle Paleolithic site of Combe-Capelle Bas (France). Philadelphia: Univ. of Pennsylvania.

**Dibble H.L., Lenoir M. 1998**

Données nouvelles sur le gisement de Combe-Capelle à Saint-Avit-Sénieur (Dordogne). *Gallia Préhistoire*, vol. 39: 31–83.

**Djema H. 2008**

Le Paléolithique moyen ancien de la Corniche cantabrique et du Bassin aquitain ou le phénomène culturel des premiers néandertaliens. Thèse Univ. Paris 1 Panthéon-Sorbonne, 2 vol.

**Djindjian F. 2003**

La méthode chrono-stratigraphique. In *Chronologies géophysiques et archéologiques du Paléolithique supérieur*, F. Wiedeman, Y. Taborin (eds.). Paris; Ravello, pp. 29–32.

**Falguères Ch., Bahain J.-J., Saleki H. 1997**

U-series and ESR Dating of Teeth from Acheulian and Mousterian Levels at La Micoque (Dordogne, France). *Journal of Archaeological Science*, vol. 24: 537–545.

**Faivre J.-Ph. 2004**

L'industrie lithique moustérienne du niveau G7 des Fieux (Miers, Lot): mobilité humaine et diversité des compétences techniques. *Paléo*, No. 16: 71–90.

**Faivre J.-Ph. 2006**

L'industrie moustérienne du niveau Ks (locus 1) des Fieux (Miers, Lot): mobilité humaine et diversité des compétences techniques. *Bull. de la Soc. Préhist. franç.*, t. 103, No. 1: 17–32.

**Faivre J.-Ph. 2008**

Organisation techno-économique des systèmes de production dans le Paléolithique moyen récent du Nord-Est aquitain: Combe-Grenal et Les Fieux. Thèse Université Bordeaux 1.

**Geneste J.-M. 1985**

Analyse lithique d'industries moustériennes du Périgord: une approche technologique du comportement des groupes humains au paléolithique moyen. Thèse N.D., Université de Bordeaux I, 2 t.

**Geneste J.-M. 1989**

Économie des ressources lithiques dans le Moustérien du Sud-Ouest de la France. In *L'Homme de Néandertal*, M. Otte (ed.), vol. 6: La Subsistance. Liège, pp. 75–97.

**Geneste J.-M., Plisson H. 1998**

Production et utilisation de l'outillage lithique dans le Moustérien du Sud-Ouest de la France: Les Tare à Sourzac, vallée de l'Isle, Dordogne. In *Reduction Processes ("Chaînes opératoires") for the European Mousterian*, A. Bietti, S. Grimaldi (eds.). Rome, pp. 343–367.

**Grün R., Mellars P., Laville H. 1991**

ESR chronology of a 100,000-year archaeological sequence at Pech de l'Azé II, France. *Antiquity*, vol. 65: 544–551.

**Guadelli J.-L. 1987**

Contribution à l'étude des zoocénoses préhistoriques en Aquitaine (Würm ancien et interstade würmien). Thèse Université de Bordeaux I, 3 vol.

**Guibert P., Betchel F., Bourguignon L., Brenet M., Couchoud I., Delagnes A., Delpech F., Duttine M., Folgado M., Jaubert J., Lahaye Ch., Lenoir M., Maureille B., Texier J.-P., Vieillvigne E., Villeneuve G. 2008**

Une base de données pour la chronologie du Paléolithique moyen dans le Sud-Ouest de la France. In *J. Jaubert, J.-G. Bordes, I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles methods. Mémoire de la Société préhistorique française*, vol. XLVII: 19–40.

**Guibert P., Betchel F., Schvœrer M. Rigaud J.-Ph., Simek J. 1999**

Datation par thermoluminescence de sédiments chauffés provenant d'une aire de combustion moustérienne (Grotte XVI, Cénac et St-Julien, Dordogne, France). *Rev. d'Archéométrie*, vol. 23: 163–175.

**Guichard J. 1976**

Les civilisations du Paléolithique moyen en Périgord. In *H. de Lumley (dir.). La Préhistoire française. 1. Les civilisations paléolithiques et mésolithiques*. Paris: Éd. du CNRS, pp. 1053–1069.

**Jarry M., Bertran P., Colonge D., Lelouvier L.-A., Mourre V. 2004**

Le gisement Paléolithique moyen ancien des Bosses à Lamagdelaine (Lot, France). In *Sessions générales et posters. General Sessions and Posters. Actes du XIVe Congrès UISPP, Université de Liège, 2–8 sept. 2001*, Ph. Van Peer, P. Semal, D. Bonjean (eds.). Pp. 177–185. (BAR Internat. Series, No. 1239).

**Jarry M., Bertran P., Colonge D., Lelouvier L.-A., Mourre V. 2007**

Les Bosses (Lamagdelaine, Lot, France): un gisement paléolithique moyen antérieur à l'avant-dernier Interglaciaire sur la moyenne terrasse du Lot. Paris. (Travaux de la Soc. Préhist. Franç., 7).

**Jaubert J. 1984**

Contribution à l'étude du Paléolithique ancien et moyen des Causses. Doct. de 3 cycle, Univ. de Paris I Panthéon-Sorbonne, 2 vol.

**Jaubert J. 1999**

Chasseurs et artisans du Moustérien. Paris: La Maison des roches.

**Jaubert J. 2008**

The chronostratigraphy of the Middle Paleolithic industries in France: new data in the Southwest and specially the Quina Mousterian. Abstracts PaleoAnthropology meeting, Vancouver, April, 2008.

**Jaubert J. 2010**

Le Moustérien ou les sociétés néandertaliennes du Paléolithique moyen en France. In *J. Clottes (dir.). Histoire de la France Préhistorique*. Paris: Gallimard.

**Jaubert J., Hublin J.-J., McPherron Sh.P., Soressi M., Bordes J.-G., Claud É., Cochard D., Delagnes A., Mallye J.-B., MIichel A., Niclot M., Niven L., Park S.-J., Rendu W., Richards M., Richter D., Roussel M., Steele T.E., Texier J.-P., Thiébaut C. 2008**

Paléolithique moyen récent et Paléolithique supérieur ancien à Jonzac (Charente-Maritime): premiers résultats des campagnes 2004–2006. In *J. Jaubert, J.-G. Bordes, I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles methods. Mémoire de la Société préhistorique française, XLVII*, p. 203–243.

**Jaubert J., Kervazo B., Bahain J.-J., Brugal J.-Ph., Chalard P., Falguères Ch., Jarry M., Jeannet M., Lemori C., Louchart A., Maksud F., Mourre V., Quinif Y., Thiébaut C. 2005**

Coudoulous I (Tour-de-Faure, Lot), site du Pléistocène moyen en Quercy: Bilan pluridisciplinaire. In *N. Molines, J.-L. Monnier, M.-H. Moncel (dir.). Données récentes*

*sur les peuplements du Paléolithique inférieur et moyen en Europe. Actes du Colloque de Rennes, Univ. de Rennes, 22–25 sept. 2003*, p. 227–251. (BAR Internat. Series, No. 1364).

**Jaubert J., Texier J.-P., Bertran P., Bourguignon L., Brenet M., Costamagno S., Delagnes A., Delpech F., Detrain L., Guibert P., Lenoir M., Mourre V., Turq A. 2006**

The collective action of research (ACR) «Middle Palaeolithic of Northern Aquitaine: emergence, development and variability». In *J.M. Burdukiewicz (dir.). Middle Palaeolithic Human Activity and Paleoecology: New Discoveries and Ideas. Abstracts Wroclaw, juin 2006*.

**Laville H., Rigaud J.-Ph. 1976a**

Le gisement de La Micoque. In *J.-Ph. Rigaud, B. Vandermeersch (dir.). Livret-guide excursion A4, Sud-Ouest (Aquitaine et Charente), UISPP, Nice 13–18 sept. 1976*, p. 49–57.

**Laville H., Rigaud J.-Ph. 1976b**

Les gisements du Moustier. In *J.-Ph. Rigaud, B. Vandermeersch (dir.). Livret-guide excursion A4, Sud-Ouest (Aquitaine et Charente), UISPP, Nice 13–18 sept. 1976*, p. 79–85.

**Le Tensorer J.-M. 1981**

Le Paléolithique de l'Agenais. Paris: Éd. du CNRS. (Cahiers du Quaternaire, No. 3).

**Lenoble A., Ortega I., Bourguignon L. 2000**

Processus de formation du site moustérien de Champs-de-Bossuet (Gironde). *Paléo*, No. 12: 413–425.

**Lévêque F. 1993**

Les données du gisement de Saint-Césaire et la transition Paléolithique moyen/supérieur en Poitou-Charentes. In *El Origen del Hombre Moderno en el Suroeste de Europa*, V. Cabrera Valdés (ed.). Madrid: UNED, pp. 263–286.

**Lévêque F., Backer A.M., Guilbaud M. (eds.). 1993**

Context of a Late Neanderthal. Implications of Multidisisciplinary Research for the Transition to Upper Paleolithic Adaptations at Saint-Césaire, Charente-maritime, France. Madison: Prehistory Press. (Monographs in World Archaeology, No.°16).

**Lumley-Woodyear H. de. 1971**

Le Paléolithique inférieur et moyen du midi méditerranéen dans son cadre géologique. Paris: Éd. du CNRS. T. II: Bas-Languedoc-Roussillon-Catalogne. (Gallia Préhistoire, suppl. V, t. 1).

**Martin H. 1923**

Recherches sur l'évolution du Moustérien dans le gisement de La Quina. Angoulême: Éd. Ouvrière. Vol. 2: Industrie lithique. (Mémoire Soc. archéo. Hist. de la Charente, vol. XIV).

**Maureille B., Mann A., Beauval C., Bordes J.-G., Bourguignon L., Costamagno S., Couchoud I., Lacrampe-Cuyaubère F., Laroulandie V., Marquet J.-C., Meignen L., Texier J.-P., Vandermeersch B. 2007**

Le gisement moustérien des Pradelles (Marillac-le-Franc, Charente): passé, présent, futur. In *Congrès du Centenaire, Un siècle de construction du discours scientifique en Préhistoire, XXVIe Congr. Préhist. de France, Avignon 21–25 sept. 2004*, vol. III: 249–261.

**McPherron Sh.P., Dibble H.L. 1999**

The lithic assemblage of Pech-de-l'Azé IV (Dordogne, France). *Préhistoire Européenne*, vol. 15: 9–43.

**Meignen L., Vandermeersch B. 1988**

Le gisement moustérien de Marillac (Charente) couches 9 et 10. Caractéristiques des outillages, économie des matières premières. In *111e Congr. nat. des Soc. savantes, Poitiers 1986*. Paris: Éd. du CTHS, p. 135–144.

**Mellars P. 1969**

The Chronology of Mousterian Industries in the Perigord Region of South-West France. *Proceeding of Prehistoric Society*, vol. 35: 134–171.

**Mellars P. 1996**

The Neanderthal Legacy. An Archaeological Perspective from Western Europe. Princeton: Princeton Univ. Press.

**Mellars P., Grün R. 1991**

A Comparison of the Electron Spin Resonance and Thermoluminescence Dating Methods: the results of ESR Dating at le Moustier (France). *Cambridge Archaeological Journal*, vol. 1: 269–276.

**Park S.J. 2007**

Systèmes de production lithique et circulation des matières premières au Paléolithique moyen récent et final. Une approche techno-économique à partir de l'étude des industries lithiques de La Quina (Charente). Thèse Université de Paris X-Nanterre.

**Peyrony D. 1930**

Le Moustier, ses gisements, ses industries, ses couches géologiques. *Revue Anthropologique*, t. 40, 1–3: 48–76; 4–5: 155–176.

**Peyrony D. 1934**

La Ferrassie. Moustérien. Périgordien. Aurignacien. *Préhistoire*, No. III: 1–92.

**Peyrony D. 1938**

La Micoque, les fouilles récentes, leur signification. *Bul. Soc. Préhist. Franç.*, p. 257–288.

**Rigaud J.-Ph. (dir.). 1988**

La grotte Vaufrey. Paléoenvironnement. Chronologie. Activités humaines. Paris. (Mémoires de la Soc. Préhist. Franç., No. XIX).

**Rigaud J.Ph., Simek J.F., Gé T. 1996**

Structures de combustion du Moustérien de la grotte XVI à Cénac-et-Saint Julien (Dordogne-France). In *The Lower and Middle Palaeolithic, Colloquium X, XIII Internat. Congress of Prehistoric and Protohistoric Sciences, Forlì, 8–14 Sept. 1996*, O. Bar-Yosef et al. (eds.). ABACO éd., p. 77–80.

**Rigaud J.-Ph., Texier J.-P. 1981**

À propos des particularités techniques et typologiques du gisement des Tares, commune de Sourzac (Dordogne). *Bull. de la Soc. Préhist. Franç.*, t. 78: 109–117.

**Rolland N. 1981**

The Interpretation of Middle Palaeolithic variability. *Man* (N.S.), No. 16: 15–42.

**Rolland N., Dibble H. 1990**

A New Synthesis of Middle Paleolithic variability. *Amercian Antiquity*, vol. 55: 480–499.

**Sonneville-Bordes D. de. 1969**

Les industries moustériennes de l'abri Caminade-Est commune de La Canéda (Dordogne). *Bull. de la Soc. Préhist. Franç.*, t. 66: 293–310.

**Soressi M. 1999**

Variabilité technologique au Moustérien. Analyse comparée du débitage Levallois MTA A du Moustier (Dordogne, France). *Paléo*, No. 11: 111–134.

**Soressi M. 2002**

Le Moustérien de tradition acheuléenne du sud-ouest de la France. Discussion sur la signification du faciès à partir de l'étude comparée de quatre sites: Pech-de-l'Azé I, Le Moustier, La Rochette et la Grotte XVI. Thèse Université de Bordeaux I.

**Soressi M. 2004**

From the Mousterian of Acheulean Tradition Type A to Type B: A Change in Technical Tradition, Raw Material, Talsk, or Settlement Dynamics? In *N.J. Conard, Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*. Tübingen: Kerns Verlag, vol. II: 343–366.

**Soressi M., Armand D., D'Errico F., Jones H.L., Pubert É., Rink W.J., Texier J.-P., Vivent D. 2002**

Pech de l'Azé I (Carsac, Dordogne): nouveaux travaux de recherche sur le Moustérien de tradition acheuléenne. *Bull. de la Soc. Préhist. Franç.*, t. 99, No. 1: 5–11.

**Soressi M., Jones H.L., Rink W.J., Maureille B., Tillier A.-M. 2007**

The Pech-de-l'Azé I Neandertal child: ESR, uranium-series, and AMS $^{14}$C dating of its MTA type B context. *Journal of Human Evolution*, vol. 52: 1–12.

**Soressi M., Rendu W., Texier J.-P., Claud É., Daulny L., D'Errico F., Laroulandie V., Maureille B., Niclot M., Tillier A.-M. 2008**

Pech-de-l'Azé I (Dordogne, France): nouveau regard sur un gisement moustérien de tradition acheuléenne connu depuis le XIXe siècle. In *J. Jaubert, J.-G. Bordes, I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles méthodes. Mémoire de la Société préhistorique française, XLVII*, pp. 95–132.

**Texier J.-P. 2006**

Nouvelle lecture géologique du site paléolithique du Pech de l'Azé II (Dordogne, France). *Paléo*, No.°18: 217–236.

**Texier J.-P. 2009**

Histoire géologique de sites préhistoriques du Périgord: une vision actualisée. La Micoque, la grotte Vaufrey, le Pech de l'Azé I et II, La Ferrassie, L'abri Castanet, Le Flageolet, Laugerie-Haute. Paris: Éd. CTHS. (Documents préhist., 25).

**Texier J.-P., Bertran P. 1993**

Nouvelle interprétation paléoenvironementale et chronostratigraphique du site paléolithique de La Micoque (Dordogne). Implications archéologiques. *C.R. Acad. Sci. Paris*, sér. II, t. 316: 1611–1617.

**Thiébaut C. 2003**

L'industrie lithique de la couche III du Roc de Marsal (Dordogne): le problème de l'attribution d'une série lithique au Moustérien à denticulés. *Paléo*, No. 15: 141–168.

**Thiébaut C., Meignen L., Lévêque F. 2009**

Les dernières occupations de Saint-Césaire (Charente-Maritime, France): diversité des techniques utilisées et comportements économiques pratiqués. *Bull. de la Soc. Préhist. française*, t. 106, No. 4: 691–714.

**Thiébaut C., Mourre V., Turq A. 2009**

Diversité des matériaux et diversité des schémas de production au sein de l'industrie moustérienne de la couche K des Fieux (Miers, Lot). *Bull. de la Soc. Préhist. franç.*, t. 106, No. 2: 239–256.

**Tuffreau A. 1984**

Les industries moustériennes et castelperroniennes de La Ferrassie. In *H. Delporte (dir.). Le grand abri de La Ferrassie*. Marseille: Éd. du Labo. de Paléont. Hum. et de Préhist., Université de Provence, pp. 111–144. (Études quaternaires, 7).

**Turq A. 1988**

Le Moustérien de type Quina du Roc de Marsal à Campagne (Dordogne): contexte stratigraphique, analyse lithologique et technologique. *Documents d'Archéologie Périgourdine* (A.D.R.A.P.), t. 3: 5–30.

**Turq A. 2000**

Le Paléolithique inférieur et moyen entre les vallées de la Dordogne et du Lot. Les Eyzies-de-Tayac: SAMRA éd. (Suppl. à Paléo).

**Turq A., Dibble H., Faivre J.-Ph., Golberg P., McPherron Sh.J.P., Sangathe D. 2008**

Le Moustérien du Périgord Noir: quoi de neuf? In *J. Jaubert, J.-G. Bordes et I. Ortega (dir.). Les sociétés du Paléolithique dans un Grand Sud-Ouest: nouveaux gisements, nouveaux résultats, nouvelles méthodes. Mémoire de la Société préhistorique française, XLVII*, pp. 83–93.

**Valladas H., Chadelle J.-P., Geneste J.-M., Joron J.-L., Meignen L., Texier P.J. 1987**

Datation par la thermoluminescence de gisements moustériens du sud de la France. *L'Anthropologie*, t. 91, 1: 211–226.

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# HUMAN ECOLOGY AND LITHIC TECHNOLOGY IN THE PALAEOLITHIC

It has become common in archaeology to view much of behavior in the Palaeolithic as sensitive to ecological conditions. The choice of hunting prey, for example, clearly depends on the availability of different species. Hunting tactics similarly may be adjusted to factors such as the degree of aggregation and predictability of animal movements. Human mobility and patterns of settlement also may be geared to the distribution and behavior of various resources. Based on both observations of living hunter-gatherers and theoretical approaches such as optimal foraging theory, patterns and changes in Palaeolithic diet choices, hunting methods, and settlement patterns are increasingly comprehensible as flexible strategies of adapting to ecological circumstances.

Lithic technology, on the other hand, has been much less likely to be approached in the same way. More common has been the view that processes of lithic reduction and the characteristics of lithic typology are learned and culturally transmitted from one generation to the next. Variability in lithic assemblages, as a result, is more often viewed as reflecting cultural tradition rather than ecological context. This contrast between tradition and context underlies much of the debates about the causes of change through time in lithic industries and the meaning of the co-existence of different industries in the same area (Jochim, 2011). Isaac (1972, p. 177) points this out in distinguishing between traditional models that "assume tremendous inertia in craft transmission systems so that successive generations of craftsmen are tightly bound to particular systems" and activity-variant models, which assume that "functional requirements exert an influence on assemblage character, which creates variety and which commonly transcends differences in the degree of culture-historic interconnectedness".

In the last few years, however, more attention has been devoted to exploring the view that many aspects of lithic technology may be more flexible and more sensitive to ecological circumstances than previously thought. This is particularly true in Western Europe and North America. As a result, there is an increasing tendency for the manufacture and use of stone tools to be seen

as one more flexible strategy of adaptation and therefore varying in a predictable way with ecological conditions, as a set of solutions to problems of adjusting to ecological context. Such problems may be posed by various factors, including vegetational conditions affecting visibility and movement, the mobility and predictability of animal prey, and the accessibility of stone raw materials of different size and quality. Because lithic assemblages are the primary evidence we have for the Palaeolithic, most of our interpretations of Palaeolithic behavior and change derive from our interpretations of lithic patterns and variability. If lithic technology is indeed influenced by ecological conditions, then questions about technological change or contemporaneous assemblage variability may be fruitfully approached through analysis of their ecological context. Two examples from the European archaeological record will be discussed to illustrate the changing approaches to studying lithic technology.

## LOWER PALAEOLITHIC

Historically, discussions of the Lower Palaeolithic record of England cited the existence of two different, partially contemporaneous industries, the Clactonian and the Acheulean. The Clactonian is characterized by crude, thick flakes with large striking platforms and bulbs of percussion created by hammer-and-anvil and hard-hammer percussion, some of which were retouched into scrapers. Accompanying these artifacts are pebble chopping tools that also served as cores. The Acheulean consists of finer flakes and flake tools as well as bifacial handaxes, some of which may have been shaped by soft-hammer percussion. The prevailing interpretation of the co-existence of these two industries was that "the Clactonian may represent a cultural tradition quite separate from the Acheulean" (Mellars, 1973, p. 51). This interpretation has gradually been largely abandoned in favor of an emphasis on situational factors. Both technologies have been found together, for example, in nearby sections of the site of East Farm Barnham (Ashton et al., 1994) and at the site of High Lodge (Ashton and McNab, 1992), leading to the conclusion that "it is more practical to view the British Lower Palaeolithic as a complex of similar technologies that vary according to site use, raw material quality and supply and only occasionally cultural tradition" (Ashton et al., 1992, p. 174). Similarly, Gamble (1999, p. 128) stresses the situational character of early Palaeolithic technology. He points out that some areas of the Boxgrove site look Clactonian and others Acheulean, concluding that "the Clactonian can no longer be regarded as a typological, technological, and hence cultural entity distinct from the wider Acheulean… Rather than being bound by cultural preference, the decision to follow an Acheulean or a Clactonian reduction sequence was bound up in the immediate context of deploying stone to assist behaviour." In this view, the Clactonian is a technique of rapidly producing expedient butchering tools in a context of abundant stone raw material. The production of Acheulean bifaces, on the other hand, required more time and effort but provided for a longer use-life for the more curated handaxes. In this view, the situational character of lithic technology is emphasized.

Supporting this view are patterns of variation within the Acheulean itself. On the European continent, handaxes show a clinal decrease in abundance from west to east, with Moravia containing only isolated bifaces. The meaning of this pattern is unclear, but is difficult to explain in terms of cultural tradition. In Italy the Acheulean contains assemblages both with and without bifaces, sometimes interstratified, a pattern that has been attributed to sampling bias, activity differences, or raw material availability (Mussi, 2001, p. 76). The presence of flake cleavers in Italian sites, on the other hand, has been suggested either to represent interaction with, or migration from, north Africa or to reflect the situational availability of quartzite and other coarse-grained raw materials in large blocks.

This is but one example that there is increasingly a shift away from invoking cultural traditions toward an emphasis on situational factors in shaping European lithic variability, although in a study of regional variation in handaxes in Europe, Africa, the Near East, and India, cultural factors were not dismissed altogether (Wynn and Tierson, 1990). The specific situational factors discussed vary. They include raw material abundance, quality, and size, site type (open-air or cave), habitat (open country or forest), specific site activities, and mobility (Gamble, 1999; Mussi, 2001; Pitts and Roberts, 1997; Svoboda et al., 1996). However, because the functions and uses of handaxes are still poorly understood, linking their presence to particular contexts is difficult. They have been suggested to have served as cores, useful in mobile situations, but this has been disputed (Wynn, 1995). Microwear studies indicate their use in meat- and bone-butchering, but also in dry hide-working and plant or woodworking (Pitts and Roberts, 1997). Variations in their form can, in some cases, be correlated with differences in raw material (Ibid.), but in other cases not. Formal variation, including aspects of thickness, symmetry and pointedness, although interpreted in functional or cultural terms, may simply indicate that the "handaxe" is not a unitary or discrete tool type, with the implication that the edges may be more significant than the overall form itself.

## MIDDLE PALAEOLITHIC

Lithic variability in the Middle Palaeolithic has long been a major focus of research. In France, Bordes (1961) developed a typology for Mousterian artifacts, with 63 different types of flake tools recognized, based largely on their shape and location of retouch, with some attention to the appearance or kind of the retouch scars as well. Entire assemblages were then classified into four types on the basis of their relative proportions of the different tool types. These four kinds of assemblage he called *Denticulate Mousterian* (dominated by denticulates and notches), *Charentian Mousterian* (dominated by side scrapers), *Mousterian of Acheulean Tradition* (with many handaxes or backed knives), and *Typical Mousterian* (with more or less equal proportions of all tool types). He further subdivided the Charentian Mousterian into two groups using a different set of criteria: the technique of core preparation. The *Ferrassie Mousterian* is characterized by much use of the Levallois

technique, whereas the *Quina Mousterian* is not. On the basis of presumed contemporaneity of these five different kinds of assemblage in southwestern France over thousands of years (inferred largely from correlations of the stratigraphy at different sites), Bordes argued that they represented five different social groups (or tribes) of Neanderthals (Bordes, 1961; Bordes and de Sonneville-Bordes, 1970). In other words, he gave social and stylistic meaning to the differences in the assemblages: different groups had different ways of making tools, cultural traditions that were conservatively passed on through the generations.

Others offered an alternative, situational interpretation of the different assemblage groups (Binford L. and Binford S., 1966). In their view, the differences were more likely to have a functional meaning, rather than a social one. They suggested that the Neanderthals had different functional tool kits for different activities, and that functionally different site types would contain different mixes of these activities and their tool kits in recurring patterns.

Subsequent research into Mousterian variability has been prompted largely by this debate. A major focus of this research has been the function of the different stone tools, with microscopic analysis of use-wear playing an important role. These analyses have reached a number of conclusions that are relevant to the disputed interpretations and shed light on Neanderthal behavior. First, many of the unretouched flakes were used as tools, particularly as knives for cutting meat or hide. Consequently, any attempt to infer the activities that occurred at a site solely from the retouched tools will miss a major class of evidence. Second, different retouched tool types were used in the same activities, and many types were used for several activities: there is no one-to-one correlation between recognized tool type and specific activity (Anderson-Gerfaud, 1990). As a result, the varying proportions of different types cannot be easily translated into varying proportions of different activities. Third, although archaeologists have usually assumed that retouching was done in order to shape the edge of a tool, in some cases this may not be the case. A study of Quina scrapers with rather unique, overlapping scalar retouch suggests that it was the retouched surface, rather than the edge of the tool, that was used, in this case on mineral pigments like red ochre (Beyries and Walter, 1996). Fourth, a good number of tools that have been examined show evidence that they were hafted or attached to wooden handles with tree resins. It may well be, then, that some of the shaping done to tools was aimed, not at creating functional edges, but at facilitating their attachment.

Other work has examined the suitability of the classification system developed for the flake tools as the basis for inferring anything about function or social identity. It has been long recognized that there is some ambiguity in the definition of types, so that it may be difficult, for example, to differentiate a retouched point from a convergent scraper. More recently archaeologists have suggested that the purpose of retouch in many cases may have been to resharpen an edge, rather than to shape it initially (Dibble, 1987; Barton, 1990). If this is the case, then many of the supposedly different types may represent nothing more than different stages in the lifetime of a category of tool that undergoes

progressive resharpening to prolong its use. Scrapers are the category most implicated in this interpretation, as resharpening of a cutting or scraping edge would create tools of this category. In this view, the frequency of resharpening is a major determinant of both the proportion of scrapers and the proportion of all retouched tools in an assemblage (Rolland, 1990; Rolland and Dibble, 1990). The frequency of resharpening, in turn, may be related to the kind and abundance of stone raw material. If high quality stone is locally scarce, then tool users may more often resort to resharpening old tools rather than making new ones, whereas if good stone is easily available, old tools may be discarded and new ones quickly made. Determinants of stone availability include both natural factors such as the distribution and accessibility of stones of differing quality and behavioral factors including the degree and extent of mobility. People who normally range over large areas may more easily find and make use of good stone sources, while more spatially restricted or seasonally sedentary people may have to make do with whatever stone is locally available and may resort more often to resharpening.

In seeking to explain the patterns of variation of stone tools and assemblages, therefore, archaeologists have increasingly turned attention to the organization of technology on the landscape and the patterns of human movement. In interpreting changes in Middle Palaeolithic technology through time in the Dordogne region of France, for example, Delagnes and Meignen (2006, p. 100) see a correlation with changes in residential mobility: "high residential mobility would have led to the production of a portable, multifunctional toolkit, intended for general use and requiring a low degree of predetermination but likely subject to much retouch and re-sharpening". An innovative approach to Middle Palaeolithic technology explores the relationship between lithic reduction sequences, transportability, and potential mobility (Delagnes and Rendu, 2011). This study compares four different reduction systems seen in the French Mousterian in terms the duration of the production sequence, the versatility of the blanks produced, and their potential for maintenance and recycling. The reduction systems examined include Levallois and laminar systems, bifacial systems, Quina flaking systems, and discoidal-denticulate flaking systems. Each of these has different implications for transportability and mobility through their effects on tool versatility and use-life. Each, in turn, may be related to different characteristics of major prey and different patterns of settlement. In this study, then, clear relationships between lithic technology and ecology are suggested. Importantly, several of these reduction systems are represented prominently at individual sites, with assemblages therefore containing different mixtures of the different systems. It is an easy extension of logic to reason that the different Mousterian "cultures" of Bordes reflect, in part, different combinations of lithic production approaches that, in turn, are sensitive to ecological factors. In fact, whenever we have situations in which large points and microlithic armatures occurring at the same sites, or both flake and blade technologies simultaneously present in sites or regions, we might suggest that they are different technological and organizational responses to elements of the local and regional ecology.

There is growing evidence that aspects of lithic technology do, in fact, show patterning in relation to ecological conditions. This is not to deny the role that cultural factors and learning play in shaping stone tools as well. Certainly, there exist cultural traditions in many characteristics of material culture, and different options that may be chosen and taught for making tools to meet certain ends. Such choices could shape different, alternative trajectories of technological development in specific ecological circumstances. Nevertheless, the role of context in technological choices deserves further investigation and appears likely to be more easily testable as a major determinant of archaeological patterning.

## REFERENCES


**Anderson-Gerfaud P. 1990**

Aspects of behaviour in the Middle Palaeolithic: functional analysis of stone tools from southwest France. In *The emergence of modern humans,* P. Mellars (ed.). Edinburgh: Edinburgh Univ. Press, pp. 389–418.

**Ashton N., McNabb J. 1992**

High Lodge: excavations by G. de G. Sieveking 1962–1968 and J. Cook 1988. London: British Museum Press.

**Ashton N. et al. 1994**

Excavation at the Lower Palaeolithic site at East Farm Barnham, Suffolk: 1989–1992. *Journal of the Geological Society*, vol. 151: 599–605.

**Barton C. 1990**

Beyond style and function: a view from the Middle Paleolithic. *American Anthropologist*, vol. 92: 57–72.

**Beyries S., Walter P. 1996**

Racloirs et colorants a Combe-Grenal: le problème de la retouche Quina. *Quaternaria Nova*, vol. VI: 167–185.

**Binford L., Binford S. 1966**

A preliminary analysis of functional variability in the Mousterian of Levallois Facies. *American Anthropologist*, vol. 68: 238–295.

**Bordes F. 1961**

Mousterian cultures in France. *Science*, vol. 134: 803–810.

**Bordes F., De Sonneville-Bordes D. 1970**

The significance of variability in Palaeolithic assemblages. *World Archaeology*, vol. 2: 61–73.

**Delagnes A., Meignen L. 2006.** Diversity of lithic production systems during the Middle Palaeolithic in France: are there any chronological trends? In *Transitions before the transition: evolution and stability in the Middle Paleolithic and Middle Stone Age*, E. Hovers, S. Kuhn (eds.). New York: Springer, pp. 85–108.

**Delagnes A., Rendu W. 2011**

Shifts in Neandertal mobility, technology and subsistence strategies in western France. *Journal of Archaeological Science*, vol. 38: 1771–1783.

**Dibble H. 1987**

The Interpretation of Middle Palaeolithic scraper morphology. *American Antiquity*, vol. 52: 109–117.

**Gamble C. 1999**

The Palaeolithic societies of Europe. Cambridge: Cambridge Univ. Press.

**Isaac G. 1972**
Early phases of human behaviour: models in Lower Palaeolithic archaeology, In *Models in Archaeology*, D. Clarke (ed.). London: Methuen & Co., pp.167–200.
**Jochim M. 1972**
Tradition and context: challenges in the interpretation of the Early Palaeolithic. In *Handaxes in the Imjin Basin*, S. Yi (ed.). Seoul: SNU Press, pp. 25–36.
**Mellars P. 1974**
The Paleolithic and Mesolithic. In *British prehistory: a new outline*, C. Renfrew (ed.). Park Ridge: Noyes Press, pp. 41–99.
**Mussi M. 2001**
Earliest Italy. New York: Plenum.
**Pitts M., Roberts M. 1997**
Fairweather Eden: life in Britain half a million years ago as revealed by the excavations at Boxgrove. London: Century.
**Rolland N.** Middle Palaeolithic socio-economic formations in Western Eurasia: an exploratory survey. In *The emergence of modern humans*, P. Mellars (ed.). Ithac: Cornell Univ. Press, pp. 347–388.
**Roland N., Dibble H. 1990**
A new synthesis of Middle Palaeolithic variability. *American Antiquity*, vol. 55: 480–499.
**Svoboda J. et al. 1996**
Hunters between east and west: The Palaeolithic of Moravia. New York: Kluwer.
**Wynn T. 1995**
Handaxe Enigmas. *World Archaeology*, vol. 27: 10–24.
**Wynn T., Tierson F. 1990**
Regional comparison of the shapes of later Acheulean handaxes. *American Anthropologist*, vol. 92: 73–84.

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# THE DIFFUSION OF NORTHERN MICROBLADE INDUSTRIES IN EAST ASIA

What called "the Northern Microblade Industry (NMI)" in this paper indicates microblade industries which are characterized by the wedge-shaped microcore and the transversal graver (Araya type graver). NMI had diffused throughout North and East Asia. It was pointed out that NMI have their origin in the vast area covered from Altai to East Siberia (Kuzmin, 2007). This Paper tries to compare the development of NMI in Japan with that in North China, and to show the view about the diffusion of NMI in East Asia.

## THE DIFFUSION OF NMI IN JAPAN

### Industries with the Lankoshi type microcore

The oldest NMI in Japan is industries with the Lankoshi type microcore which are observed only in Hokkaido. The representative sites are Kashiwadai-1, Pirika-1, Obarubetsu-2, Kyu-Shirataki-15 and Yunosato-4. AMS dates of Kasiwadai-1 are 19 660 ± 130 – 20 790 ± 160 $^{14}$C BP (23 340–24 966 calBP) (The Kashiwadai l site..., 1999). Those AMS dates are consisted with the geological context of Kasiwadai1 where micorobalde industries are unearthed under En-a volcanic ash (about 18 ka $^{14}$C BP).

The Lankoshi type microcore characterized those industries products blades with direct percussion before the microblade-production by pressure flaking (Takakura, 2012). Those blades become the raw materials of stone tools such as end scrapers and gravers. Beads made of olivine and jasper are also characteristic materials of those industries.

The technological factors which connect with microblade technology can't be observed in flake tool industries which spread in Hokkaido before industries with Lankoshi type microcores. And main producing areas of olivine which is used for beads are Siberia and North China, not Hokkaido, Honshu. So, it is assumed that Industries with the Lankoshi type microcore were formed under the close and direct relationship with industries of mainland.

### Industries with Yubetsu technique

NMI diffused into Honsyu area after the stage of Lankoshi industries. Representative sites of Honsyu are Kakuniyama, Araya, Ushirono A, Onbara. AMS dates of the Araya site are concentrated to 14 050 ± 110 – 14 250 ± ± 110 $^{14}$C BP (16 890–17 550 calBP) (The Araya Site..., 2003). Those NMI distributed at Hokkaido and the area from Sea of Japan side to the central mountain range of North Honsyu, and a few sites of them are discovered at the Pacific side of Honsyu.

Those industries put the Yubetsu technique at the center of lithic production. Not only microblade, but stone tools such as Araya type gravers, end scrapers are also produced with Yubetsu technique. Those stone tools are made of flakes which are detached under the process of biface reduction.

Because of their widespread around Hokkaido, it is confident that industries with Yubetsu technique were spread form Hokkaido to Honsyu.

The Sakkotssu type microcore is the main wedge-shaped microcore used in Yubetsu technique. The several types of wedge-shaped microcores which are derived from Sakotssu type microcore appeared in Hokkaido, and industries with boat- shaped microcore (Horoka type or Hunano type) such as Masugata, Ebiyama are discovered in Honsyu. Those boat-shaped microcores are also recognized to be derived from wedge-shaped micorcores.

### Industries with Saikai technique

At the end of microblade stage, Industries with Saikai technique appeared at North Kyusyu (the most west part of Honsyu). Those industries had the potteries. Representative sites are Fukui cave layer 2-3 and Senpukuji cave. $^{14}$C dates of Fukui L2-3 are 12 400 ± 350 $^{14}$C BP (L2: 13 950–15 090 calBP), 12 700 ± ± 500 $^{14}$C BP (L3: 14 130–16 030 calBP), AMS date of Senpukuji is 12 220 ± ± 80 $^{14}$C BP (13 920–14 210 calBP) (Kudo, 2012).

About the origin of those industries, there are two theories. One of them alleges that they have the connection with NMI which had distributed from North Honsyu to Chugoku mountain area in West Honsyu. Another one defines that they spread from Korea Peninsula to Northern Kyusyu across the Tsushima-Korea Straits. This dispute has not been solved up to the present (Okamoto, 2002).

## THE DIFFUSION OF NMI IN NORTH CHINA

### Initial Microblade Industries in North China

The industry of Longwangchan in Shaanxi is pointed out as one of the oldest microblade industries in North China. The main microblade technique of Longwangchan is depended on non-wedge-shaped microcores such as semi conical ones. But, a few wedge-shaped microcores are reported to be in them (Paleolithic Site..., 2007). AMS dates of Longwangchan are 20 920 ± ± 70 – 24 145 ± 55 $^{14}$C BP (24 585–29 303 calBP) (Zhang J. et al., 2011).

The oldest microblade industry of Nihewan basin is Erdaoliang in Hebei, Its $^{14}C$ date is 17 580 ± 230 $^{14}C$ BP (20 821–21 256 calBP) (Xie, Li, Liu, 2006). Many transversal gravers (Araya type graver) and their spalls are recognized in it. It's same as Longwangchan, the microblade technique of Erdaoliang is also based on non-wedge-shaped microcores. But, its main microcores are small boat-shaped microcores.

Because fragmentary factors of NMI such as the wedge-shaped microcore and the transversal graver can be observed in those two initial microblade industries of North China, it is assumed that the initial microblade industries in North China were formed under the close connection with NMI.

At present, NMI which existed at the same time as the initial microblade industry of North China has not been discovered in North and Northeast China, so details of those NMI have not been clear, yet. But, Factors of NMI observed in initial microblade industries of North China are very fragmentary, and aren't well organaized. From those points, those NMI are assumed that their microblade technologies were separated from the stone tool manufactures. This lithic technological structure differs from that of the industry with Yubetsu technique in which microblade technology tightly connects with stone tool manufacture, and looks like that of Youfang industry (Xie, Cheng, 1989) in Hebei. The Youfang site is located in Nihewan basin, and its cultural layer is geologically accumulated under that of the Hutouliang sites which are described later. The age of cultural layer which was estimated from the optical dates is about 15ka (Nagatomo et al., 2009). There are microblade technology based on wedge-shaped microcores and blade technology in the lithic technology. Those two technologies are separated from each other. Stone tools are made of blades produced from the latter. Araya type gravers are also observed in them.

Except for Youfang industry, the industry of Dadong in Jilin may correspond to early NMI. On the Li Youqian's article, a Lankoshi type microcore is unearthed form the layer which is accumulated under the cultural layers of other microblade industries (Li, 2009).

At present, many microblade industries with wedge-shaped microcores have been discovered at Changbaishan mountain range. Since their microblade technology also separate from the stone tool manufacture, NMI connected with initial microblade industries in North China might have gone south through the east edge of Northeast China.

## Industries with Hutouliang microblade techno complex

The Hutouliang industries in Hebei represent late NMI. They produced microblades with Hutouliang microblade techno complex. The character of this microblade techno complex is microblade production with various types of wedge-shaped maicrocores. And, It is same as Yubetsu technique, flakes detached under the process of biface reduction are used for raw materials of stone tools such as end scrapers, gravers. Moreover, bifacial points, stone axes in which included triangle ones are often observed.

The oldest industries with this techno complex are the Xueguan industry in Shanxi (13 170 ± 150 $^{14}$C BP, 15 601–16 474 calBP) (Wang, Ding, Tao, 1983) and the Maanshan industry in Hebei (12 650 ± 120 $^{14}$C BP, 14 615–15 169 calBP) (Xie, Li, Liu, 2006). Except for them, the industries of Hutouliang and Jiqitan in Hebei, Weijiaxiaobao and Shizitan S1 in Shanxi, Shayuan in Shaanxi are also mentioned as those industries.

At the Yujiagou site, one of the Hutouliang sites located in Nihewan basin, such industry got its peak at 11.87–11.51 TL ka (Xia et al., 2001). That is a period of time immediately after the dry and cool condition corresponding to the Younger Dryas Event (YD). According to TL dates of Yujiagou, $^{14}$C date of Hutouliang (10 690 ± 210 $^{14}$C BP, 12 379–12 871 calBP) (Gai, 1993) and AMS date of Shizitan S1 (10 190 ± 520 $^{14}$C BP, 11 197–12 587 calBP) (Yuan et al., 1998), those industries peaked at 11–13 cal ka.

Because industries which are similar to those microblade industries in North China are observed from Hulunbeier Plain to Nenjiang-River area in Northeast China, those industries of North China may have relationship with industries in the west area of Northeast China. And, any NMI themselves appeared in the vast area of North China at this stage. So, it is assumed that human groups with those industries had flowed into North China form the Northern, and diffused vastly in that area.

## THE MOVEMENT OF NMI IN EAST ASIA

### The first movement of NMI

Fig. 1 shows the record of Oxygen isotope at Hulu Cave in Jiangsu (Wang et al., 2001), and radiocarbon or optical ages of the abovementioned microblade industries. It can be perceived on Fig. 1 that two large scale waves of NMI had occurred in East Asia.

Both Hokkaido and North China accepted the first influence of NMI at the same time of early LGM. At that time, the Mammoth fauna of East Siberia commenced to diffuse around Siberia with the progress of grovel cooling. The diffusion of the Mammoth fauna reached Hokkaido which connected with Sakhalin and formed Palaeo-Hokkaido Peninsula at that time, Mammoth also appeared at Hokkaido (Takahashi et al., 2006). The state in China is not same as Hokkaido, the mammoth fauna was obvious only in Northeast China, was indistinct in most of North China.

It is assumed that the diffusion of the Mammoth fauna caused the migration of human groups with NMI which resulted in the emergence of NMI in East Asia. In Hokkaido, industries with the Lankoshi type microcore, the first NMI of Japan, maintained not only lithic technology of NMI, but also spiritual and social system of NMI such as displaying personal ornaments. This state is assumed to be the result of the direct arrival into Hokkaido of human groups with NMI followed the Mammoth fauna.

On the other hand, only fragmentary factors of NMI are observed in North China. Because the direct diffusion of the mammoth fauna was almost limited

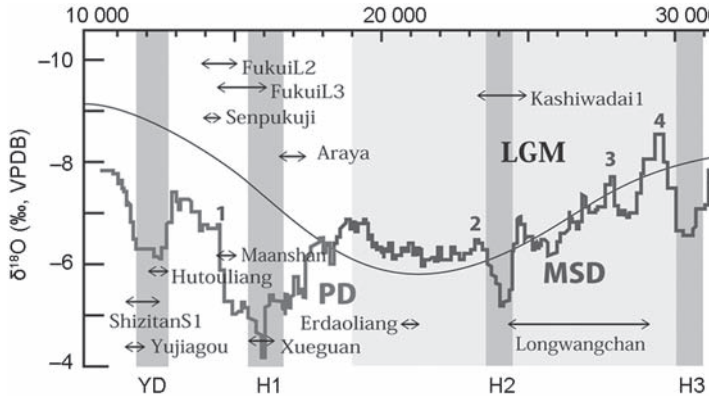


*Fig. 1.*

to the Northeast China, and human groups with small flake tool industries had lived in North China, it is supposed that the area where human groups with NMI arrived was limited to Northeast China, as a result, the diffusion of NMI into North China was progressed under the contacts of human groups of small flake tool industries in North China with those of NMI in Northeast China. Human groups of North China are assumed to select the technological factors which they needed from those of Northeast China, take them in their lithic technology, and spread that lithic technology around North China through the existing social network.

## Second movement of NMI

The second large scale movements of NMI in East Asia are observed at 11 000–17 000 calBP. In Japan, NMI with Yubetsu technique arrived in Honsyu form Hokkaido, but in North China, late NMI were industries based on Hutouliang microblade techno complex. The difference between them is observed on not only lithic technology, but also the time of peak of NMI. And, industries connected with late NMI had excited in neighboring area of both such as Hokkaido in japan and Northerneast China in China. It is supposed from those points that the second NMI movements in both areas had no direct relationship with each other and occurred at the same time.

Fig. 1 shows this period corresponded to the environmental change before and after Heinrich Event1 (H1) at Late Glacial. It is supposed that this environmental change triggered the movements of NMI at each area.

As mentioned above, the second movements of NMI in Japan and North China had no direct relationship with each other, but in both areas, the distribution of industries with late NMI is wider than those with early NMI. It shows that late NMI had the “permeability” which was stronger than that of early NMI. The “permeability” of late NMI are depended on various lithic assemblages, the collecting strategy of subsistence system and bifacial reduction systems

such as Yubetsu technique and Hutouliang microblade techno complex which are necessarily to adapt to various environments and resources.

In the Araya site which was regarded as the residential base of late NMI in North Honsyu where the subarctic coniferous forest or the cool-temperate mixed forest dominated, many burned seeds of Japanese walnuts were unearthed, and it became clear that nuts had been important food resources. Moreover, the use-wear analysis for gravers and end scrapers shows that the processing activities of animal leather, bones and antlers were actively performed in the site, and it is supposed that the deer hunting was very important activities to get such raw materials (The Araya Site..., 2003). In addition to those, because the Araya site was formed at the river-bed of Uono-gawa River where many salmons swim up in autumn at present, it is assumed that salmon-fishing had been performed around the site.

On the other hand, since steppe or forest steppe environment dominated, and bones of gazelle or deer are unearthed frequently from the microblade sites in North China, it is supposed that the hunting targeted those animals was the main subsistence at that area. A series of analyses of Hutouliang sites and their industries shows that the collecting strategy of subsistence system was selected by human groups in Nihewan basin (Zhang X. et al., 2010, 2011). And, in the Yujiagou site, one of the Hutouliang sites, potteries appeared at the peak of NMI (Xie, Li, Liu, 2006). So, it is assumed that subsistence activities and available environments had diversified at that time.

### Industries with Saikai technique in the west end of Japan

When NMI with Hutouliang microblade techno complex appeared and spread in North China, industries with Saikai technique also appeared in Northern Kyusyu, the west end of Japan. The analysis of wedge-shaped microcores unearthed from the Fukui Cave site shows that various platform formation and rejuvenation techniques for wedge-shaped microcores characterize Saikai technique (Hashimoto, 1983). This is common character between Saikai technique and Hutouliang microblade techno complex. The emergence of Industries with Saikai technique is assumed to have the relationship with the movement of NMI with Hutouliang microblade techno complex in North China and Korean Peninsula.

## FUTURE DIRECTIONS

The diffusion of NMI in East Asia was progressed in the context of the global environmental changes and the adaptation to local environments of each human group. Furthermore, it is necessary to collect and analyze data in detail and to restore more concrete processes of movements of NMI. Moreover, non-Northern Microblade Industries coexisted with NMI in East Asia. So, the analysis of those is necessary to restore microblade industries of East Asia at the final stage of Upper Palaeolithic age.

I would like to advance research in cooperation with researchers of every place.

## REFERENCES

**Gai P. 1993**

Microblade cores of Late Paleolithic period in China. In *The origin and dispersal of microblade industry in northern Eurasia.* Sapporo: Organizing Committee of Sapporo Univ., pp. 76–90.

**Hashimoto K. 1983**

On the Microblade technology of the Fukui cave site, Nagasaki Prefecture. Focus on L2-3. *The Collection of Archaeological articles*, vol. 1: 105–136.

**Kudo Y. 2012**

Environment and Cultural History of the Upper Palaeolithic and the Jomon Period. In *High-precision Radiocarbon Dating and Archaeology*. Tokyo: Shinsen-sya, p. 373.

**Kuzmin Y.V. 2007**

Geoarchaeological Aspects of the Origin and Spread of Microblade Technology in Northern and Central Asia. In *Origin and Spread of Microblade Technology in Northern Asia and North America.* Burnaby: Archaeology Press, Simon Fraser Univ., pp. 115–124.

**Li Y. 2009**

The Chronology, Type and Related Issues of the Paleolithic Remains in Northeast China since the Last Glacial Period. *Zhongyuan Wenwu (Cultural relics of Central China)*, No. 9: 25–35.

**Nagatomo T., Shitaoka Y., Namioka H., Sagawa M., Wei Q. 2009**

OSL dating of the strata at Paleolithic sites in the Nihewan Basin, China. *Acta Anthropologica Sinica*, vol. 28, No. 3: 276–284.

**Okamoto T. 2002**

Microlithic culture and Mikoshiba culture in Kyusyu island. *The Senpukuji Cave Site.* Isahaya: Showa-do, pp. 155–170.

**Paleolithic Site at Longwangchan in Yichuan County, Shaanxi. 2007**

In *Kaogu (Archaeology)*, No. 7: 3–8.

**Takahashi K., Soeda Y., Izuho M., Yamada G., Akamatsu M., Chang C. 2006**

The chronological record of the woolly mammoths (*Mammuthus primigenius*) in Japan, and its temporary replacement by *Palaeoloxodon naumanni* during MIS 3 in Hokkaido (northern Japan). *Palaeogeography, Palaeoclimatology, Palaeoecology,* vol. 233: 1–10.

**Takakura J. 2012**

Identification of flaking techniques through the analysis of fracture wings. In *Shirataki Sites.* Ebetsu: Hokkaido Archaeological Operations Center, vol. XII: 547–566.

**The Araya Site. Report of The second and third term excavations, 1988–1989. 2003**

Sendai: Society of Archaeological Studies, Faculty of Arts and Letters, Tohoku University, p. 135.

**The Kashiwadai 1 site, Chitose City. 1999**

Ebetsu: Hokkaido Archaeological Operations Center.

**Wang J., Cheng H., Edwards R.L., An Z., Wu J., Shen C., Dorale J.A. 2001**

A high-resolution absolute-dated Late Pleistocene monsoon record from Hulu Cave, China. *Science*, vol. 294: 2345–2348.

**Wang X., Ding J., Tao F. 1983**

Microliths from Xueguan, Puxian county, Shanxi. *Acta Anthropologica Sinica,* vol. 2, No. 2: 162–171.

**Xia Z., Chen F., Chen G., Zheng G., Xie F., Mei H. 2001**

Environmental background of evolution from the paleolithic to neolithic culture in Nihewan Basin, North China. *Science in China Series D: Earth Sciences,* vol. 44, No. 9: 779–788.

**Xie F., Cheng S. 1989**

Report on the excavation of microliths site at Youfang, Yangyuan Country, Hebei Province. *Acta Anthropologica Sinica*, vol. 8, No. 1: 59–68.

**Xie F., Li J., Liu L. 2006**

The Palaeolithic Culture of Nihewan. Shijiazhuang: Huashan Literary Publisher.

**Yuan S., Zhao C., Zhu X., Yan J., Yan Y. 1998**

A study of the date and cultural remains of the Shizitan site in Jixian Country. *Kaogu (Archaeology),* No. 6: 57–62.

**Zhang J., Wang X., Qiu W., Shelach G., Hu G., Zhuang M., Zhou L. 2011**

The Paleolithic site of Longwangchan in the middle Yellow River, China: chronology, paleoenvironment and implications. *Journal of Archaeological Science*, vol. 38, No. 7: 1537–1550.

**Zhang X., Gao X., Chen S. 2011**

A functional study of lithic artifacts from an upper Paleolithic site in Northern China. Dual symposia: Symposium on the emergence and diversity of modern human behavior in Palaeolithic Asia and The 4th Annual meeting of the Asian Palaeolithic Association. Tokyo: National museum of nature and science, Tokyo and Japanese Palaeolithic research association.

**Zhang X., Gao X., Chen S., Chen F., Wang C. 2010**

A functional study of the points from the Hutouliang site, North China. *Acta Anthropologica Sinica*, vol. 29, No. 4: 337–354.

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# LATE PLEISTOCENE ARCHEOLOGY AND PALEONTOLOGY OF THE TUNKA RIFT VALLEY, CIS-BAIKAL: NEW DATA*

The Tunka rift valley extends sub-latitudinally for 200 km from the south-western tip of the Lake Baikal to Lake Khubsugul. This part of Cis-Baikal region has been always considered highly promising area in terms of archeological sites, Paleolithic in particular. However, until recently, in spite of active archaeological digs, one stratified Paleolithic location – "Big Zangisan" – and some points for the detection of Pleistocene artifacts (Shabartai, Zaktui) (Lbova et al., 2005) have only been known in the Tunka valley (Fig. 1).

The faunal remains, together with Paleolithic-like artifacts, have been found during the study of the Late Cenozoic lithologic-stratigraphic cross-sections of the Tunka rift valley. The bone remains discovered in the Quaternary sediments (including cultivated deposits) have provided a basis for the first radiocarbon dating that made it possible to enlarge and detail the ideas of chronostratigraphic position of the archaeological materials in the investigated area.

## STRATIGRAPHIC, PALEONTOLOGICAL AND ARCHAEOLOGICAL SITE SLAVIN YAR

The "Slavin Yar" (Fig. 2) is located in the Tora basin of the Tunka rift at the left bank of the Zun-Murin River, in 11 km from the river mouth. The apparent thickness of composing alluvial sediments reaches 30 m at a more than 1 km long outcrop. The crystalline bedrock is overlain by the Pliocene ochreous boulder-pebble conglomerates, which in turn are overlain by a 20-m thick stratum of the Late Pleistocene sediments, primarily alluvium sands saturated with various fossil fauna and associated with several intensely cryoturbated buried soil horizons. The bone fragments of the Late Pleistocene fauna (*Mammuthus primigenius Blum.*, *Ursus sp.*, *Coelodonta antiguitatis Blum.*, *Equus sp.*, *Cervus elaphus L.*, *Capreolus sp.*, *Procapra gutturosa*) have been found at different depth levels of the cross-section. Charcoal found in the upper part of the buried pedocomplex at a depth of 8 m has provided a radiocarbon AMS

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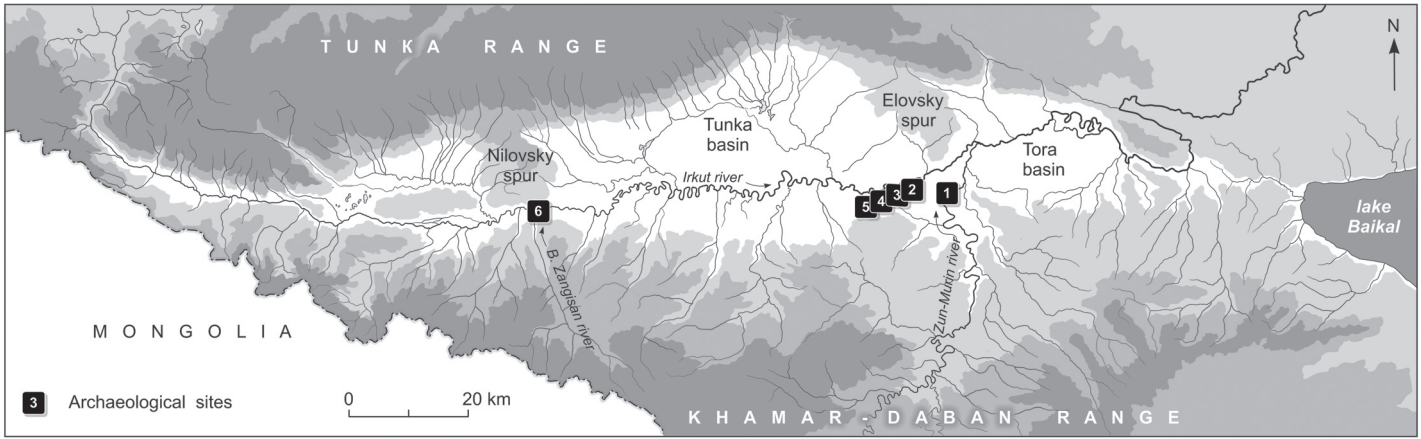


*Fig. 1.* A schematic map of the Tunka rift valley representing the location of archaeological sites.
*1* – Slavin Yar; *2* – Shabartai; *3* – Tuyana; *4* – Zaktui gully; *5* – Zaktui; *6* – B. Zangisan.

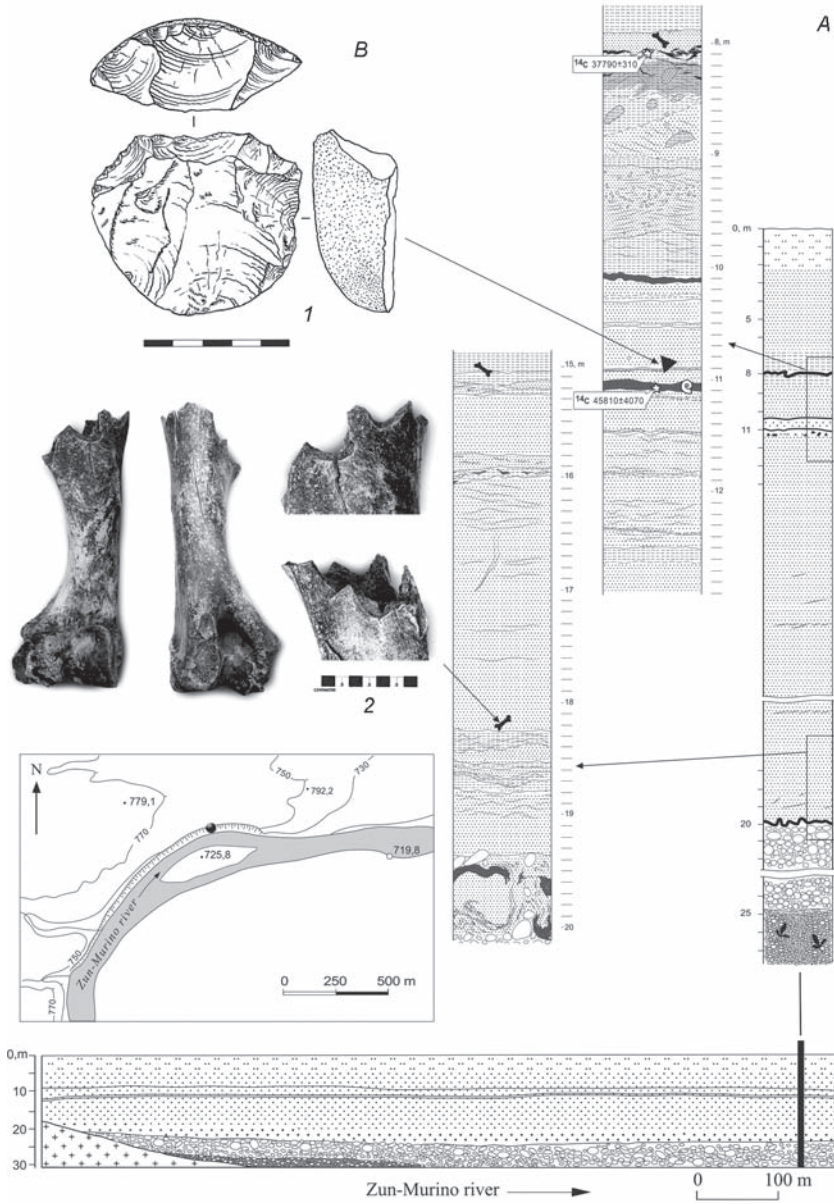


*Fig. 2.* Slavin Yar site. Lithologic-stratigraphic column from cross-section (*A*) and archaeological material (*B*).

*1* – high-form scraper of vein quartz; *2* – split bone.

date of 37 790 ± 310 BP (Shchetnikov et al., 2012) and that found in another buried soil horizon at a depth of 11 m has provided a $^{14}C$ date of 45 810 ± ± 4 070 BP (IGAN 3133).

The artifact – a high-form scraper made from a thin slice of the cortex of a large white vein-quartz pebble, – has been found in the floodplain consertal sands at a depth of 10.9 m, i.e. directly above the layer whose radiocarbon age is 45 810 yr BP (Fig. 2, *B1*). During the 2010 fieldwork, the faunal remains identified as a humerus bone of fossil horse (*Equus* sp.) were already found in the sedimentary section at a depth of 19 m (Fig. 2, *B2*). The edges of diaphysis are sliced at least eight times throughout the perimeter. The sliced surfaces have deep scratch lines typical of an intentional slicing and shell-like fractures made in strokes from the interior part of the bone wall. So far, this is the oldest manifestation of human activity within the Tunka valley, reliably stratified and providing a basis of search for archaeological sites that belong to the Murukta time (MIS4) or, perhaps, even older. The "Slavin Yar" cross-section may be chosen as a test area to perform integrated correlations – geological, paleontological, and archaeological.

## STRATIGRAPHIC, PALEONTOLOGICAL AND ARCHAEOLOGICAL SITE ZAKTUI GULLY

The "Zaktui Gully" location is situated on an inclined piedmont plain at the base of the slope of the Khamar-Daban Range on the eastern margin of the Tunka basin. The cross-section is at a distance of 500–700 m from the Paleolithic-like Zaktui artifacts' detection point in the loess-shaped deposits (Lbova et al., 2005). The more than 4-m thick unit of loess-shaped, intensively cryoturbated deluvial deposits with the ice-wedge pseudomorphs has been penetrated at the considered "Zaktui Gully" location.

The bone bed found in the cross-section at a depth of 2.3–2.6 m has provided us with a rich paleontological assemblage. Among the finds were the remains of teriofauna: *Ochotona* sp., *Sciurinae* gen. indet, *Spermophilus (Citellus) undulatus, Clethrionomys rutilus, Clethrionomys rufocanus, Clethrionomys* sp., *Cricetulus barabensis, Lemmus amurensis aut Myopus schisticolor, Lemmus amurensis, Lemmini* gen. indet., *Alticola argentatus, Lagurus lagurus, Lasiopodomys brandti, Microtus gregalis, Microtus* cf. *gregalis, Microtus mongolicus, Microtus maximowiczii, Microtus arvalis, Microtus oeconomus, Microtus* sp., *Microtinae* gen. indet., *Mammuthus primigenius, Coelodonta antiquitatis, Bison priscus, Cervus elaphus, Capreolus pygargus, Alces* sp., *Crocuta spelaea*. The bone of *Crocuta spelaea* yielded the radiocarbon AMS date of 35 560 ± 300 BP, the bones of mixed-age *Mammuthus primigenius* also yielded AMS $^{14}C$ dates of 33 090 ± 250 BP, 33 190 ± 240 BP and 36 800 ± ± 1 200 BP (Shchetnikov et al., 2012).

In 2011, four flint artifacts – a trihedral microplate (20 × 4 × 2 mm), a proximal segment of similar microplate (8 × 7 × 2 mm) and two microflakes of stone and rauchtopaz materials, – were found in coarse-grain sands at a depth of 4.2 m during the elutriation of sediments for definition of the checklist of the microteriofauna living in the area of study. Here, too, were found

the fragments of a mammoth humerus and a hipbone of a woolly rhinoceros. The stratigraphic position of these finds in the cross-section suggests that they are older than a 2.3–2.6 m deep bone bed dated to 33–36 kyr BP.

## PALEONTOLOGICAL AND ARCHAEOLOGICAL SITE TUYANA

A new archaeological site named “Tuyana” has been found on the eastern margin of the Tunka basin on the right bank of the Irkut River near the Elovsky intrabasin spur (Fig. 3).

The location is situated where the Irkut River enters a narrow antecedent valley cutting the conjunction zone between the Khamar-Daban Range and Elovsky Spur that separates the Tunka and Tora basins. The foot of the Khamar-Daban is the northern border of this antecedent narrowing. The macroslope of the range therein is cut by short river and creek valleys running down the Irkut River. The archeological site is located just in the mouth of one of these creek valleys named Chasha.

The archaeological material from this site has been found during the stratigraphic studies by scraping the roadside quarry outcrop. Artifacts and numerous faunal remains have been discovered in situ in the scraped incision 6 m$^2$ in area and exposed on the surface debris of quarry walls later on.

Loose formations quarried along the road are represented by two main subdivisions – weathered saprolitized gneiss-granites of penetrated thickness

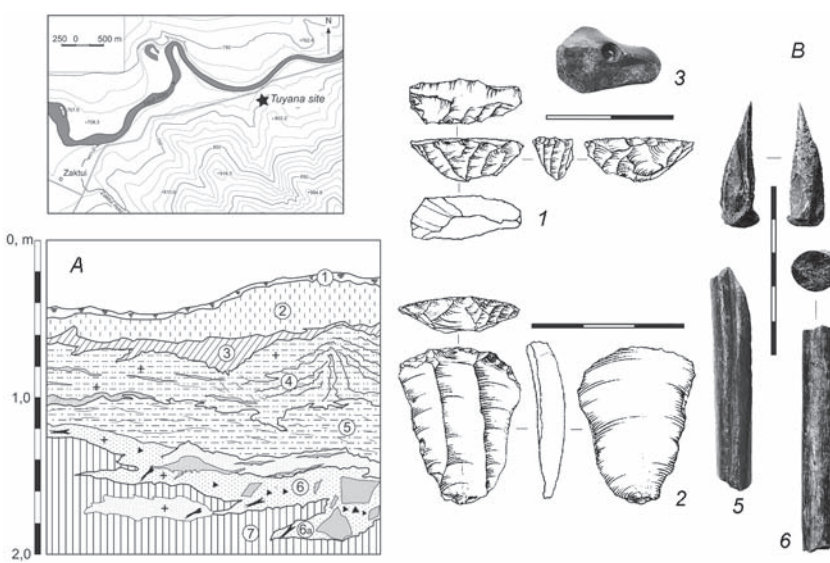


*Fig. 3.* “Tuyana” site. Lithologic-stratigraphic column from cross-section (*A*) and archaeological material (*B*).

*1* – wedge-shaped micronucleus-biface; *2* – end scraper; *3* – pendant; *4* – piercing tool; *5* – fragment of bone with traces of drilling; *6* – fragment of cylindrical tool made of bone.

ranging from 3 to 5 m and its overlying Pleistocene member of indistinctly laminated sandy loams and loams of slope genesis; their average apparent thickness is about 0.5–2 m. Most of the faunal remains and artifacts have been found in the body of deformed paleosoil formation with the maximum concentration in an interlayer of sand and gruss at the bottom.

The determination of fauna of large mammals has shown the presence of remains of hoofed and carnivorous mammals and birds in the assemblage. The information reported below is for the species: manul (*Felis manul*), cave lion (*Panthera spelaea*), sable (*Martes zibellina*), fossil horse (*Equus* sp.), and woolly rhinoceros (*Coelodonta antiquitatis*). Species in the Cervidae family include musk deer (*Moschus moschiferus*), roe deer (*Capreolus pygargus*), and red deer (*Cervus elaphus*). The bones of bison (*Bison/Bos* sp.) are the most numerous.

Therefore, the assemblage includes nine species of large mammals. The list of species is specific, the presence of woolly rhinoceros and cave lion indicate a Pleistocene age for the site, and considerable richness of cervids (especially the presence of musk deer) testifies to the interglacial character of the fauna. The available materials have also made it possible to identify the presence of ten species of small mammals: *Sorex* sp., *Lepus* sp., *Ochotona* cf. *hyperborea, Spermophilus undulatus, Clethrionomys rutilus, C. rufocanus, Clethrionomys* sp., *Lemmini* gen. indet., *Arvicola terrestris, Lasiopodomys brandti, Microtus gregalis,* and *Microtus oeconomus*. This list suggests the existence of various landscapes during the cultural layer formation. The relationship between the species with wide ecological confinedness shows the steppe dominance.

Of all the rock fractions documented during scraping 6 $m^2$ area 48 artifact units, 4 bone artifacts and undamaged and broken paleontological remains of large mammals in amounts of 889 units may be assigned to the category of real, technological products of lithotechnoindusry.

Described below is an artifact documenting the micro-splitting technology serially represented in the “Tuyana” lithoindustry. Wedge-shaped microcore made of dark-gray flint (7 mm high, 17 mm long, 7 mm wide) (Fig. 3, *B1*): wedge-shaped, showing a triangular contour, striking blade is smooth, bevelled at the edges, frontal facial processing of the laterals allows characterizing the tool as core-biface. The core front shows distinctly the signs of five slices oriented to obtain microplates. The signs of parallel slicing oriented to obtain microplates are also seen on the left lateral. The height of slicing signs along the front is 5–10 mm, the width is 1–2.5 mm. The angle between the striking blade and the front is 45°. The tool is admired for its perfect and graceful making and documents the development of techniques and methods involved.

The “Tuyana” artifact assemblage is characterized by the presence of macroforms represented by processed pebbles and quartz, quartzite and granite nodules in combination with developed technology for terminal-marginal splitting. The mode of occurrence of the cultural deposits and species determinations of fossils from the paleontological assemblage suggest that the new site can be reliably assigned to the Karga time (MIS3).

Because the upper middle Pleistocene microsplitting in North-East Asia enters only an active study phase (Derevyanko, Volkov, Lee, 1998; Kato et al., 2004; Tabarev, 2008), noteworthy is the discovery of a new archaeological site,

even regarding that the Karga age of the “Tuyana” industry is yet relatively determined. The “Tuyana” meets all the criteria for geoarchaeological sites. The priorities of its research in the future must be associated with legislative integrated archaeological, stratigraphic and geomorphologic studies and measures the for protection of archaeological heritage site.

Therefore, stratigraphical research of the Tunka rift basin geological sections has determined the archaeological component for three geological sections, species composition for paleofauna from cultural formations, its paleoecological environment, and chronostratigraphical framework. First experience has been obtained with radiocarbon method for dating the Late Pleistocene archaeological materials within the Tunka valley, geomorphological trends have been found in location and identification of the Late Pleistocene archaeological sites, and some other evidence has been found for the time of primitive habitation in the Tunka rift valley.

Therminal-marginal microsplitting at the “Tuyana” and “Zaktui Gully” sites can be reliably assigned to the Karga age (MIS3). Technomorphological features and serial representativeness of the artifacts indicate the development and perfection of microsplitting strategy, and their associated Karga time interval assigns them to a specific geoarchaeological position. The discovered archaeological materials of “Tuyana” and “Zaktui Gully” together with the “Big Zangisan” industry form the “Tunka geoarchaeological area” whose basic feature is the combination of the Karga locations with lithoindustries representing a developed terminal-marginal microsplitting.

The considered locations are a promising field for research of the Late Pleistocene lithoindustries within the Tunka valley and southern East Siberia as a whole.

## REFERENCES

**Derevyanko A.P., Volkov P.V., Lee H.J. 1998**

Selemdzhin Late Paleolithic culture. Novosibirsk: Izd. IAE SO RAN (in Russian).

**Kato Kh., Kogai S.A., Lipnina E.A., Medvedev G.I., Zheglova T.G., Rogovskoi E.A. 2004**

About geography, age and terminology of the Pleistocene plate microsplitting forms in the eastern North Asia. In *Problems of archeology, ethnography and anthropology of Siberia and adjacent areas*, vol. X, pt. I. Novosibirsk: IAE SO RAN, pp. 105–110 (in Russian).

**Lbova L.V., Lipnina E.A., Medvedev G.I., Novoseltseva V.M., Postnov A.V., Fedorenko A.B. 2005**

Preliminary archeological zoning of the East Sayan areas and the problems and prospects of the search for Stone Age sites. In *Problems of archeology, ethnography and anthropology of Siberia and adjacent areas*, vol. XI, pt. I. Novosibirsk: IAE SB RAS, pp. 150–156 (in Russian).

**Shchetnikov A.A., White D., Filinov I.A., Rutter N. 2012**

Late Quaternary geology of the Tunka rift basin (Lake Baikal region). *Journal of Asian Earth Sciences*, vol. 46: 195–208.

**Tabarev A.V. 2008**

Splitting of microwedge-shaped nuclei (a hypothesis for the use of portable tools in the Northeast Asian Stone Age). In *Anthropogene. Paleoanthropology, geoarchaeology and ethnology of Asia*. Coll. Sci. Pap. Irkutsk: Ottisk, pp. 172–178 (in Russian).

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# THE ARCHAEOLOGY OF THE EASTERN SIKHOTE-ALIN′ (Russian Primorye, Zerkal′naya valley)*

Archaeologists have long recognized the Primorye Territory, Russian Far East, as a region in which, in the mists of time, important human migration, cultural diffusion, and regional adaptations occurred.

Investigation of the ancient period of Russian Primorye is of prime importance for the understanding of the historical sequence in the Asian-Pacific Region. New discoveries and annual research results prove this.

Primorye is a mountainous region with a developed river system (the Amur-Ussuri) in the west, and a long coastal zone in the east. The Sikhote-Alin' mountain ridge divides Primorye into two big parts – Western Sikhote-Alin' and Eastern Sikhote-Alin'.

The eastern face of the Sikhote-Alin' mountain system is a territory which yields evidence of permanent population over a period of 20 000 years. During this period changes in the environment influenced the location of sites and the technico-typological peculiarities of toolkits. Eastern Sikhote-Alin' is also of special interest to archaeologists because two types of adaptation – forest-mountain and maritime – come together there.

The archaeological records from several river valleys in the coastal zone of the Russian Primorye Region provide the basis for reconstructing paleo-adaptive strategies. An overview of the paleo-ecology, as reflected in the late Pleistocene and early Holocene archaeological records, will be presented here. As demonstrated by regional investigations, economic adaptations were flexible, oriented around seasonal salmon runs, hunting, and gathering activities, both in the forest and along the sea coast. As a result of the abundance of food resources present in the environment, the development of agricultural activities was limited, and peripheral in importance.

This process is clearly illustrated by the results of the complex study, conducted over more than 50 years, in the Zerkal'naya River valley. Wide-ranging

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archaeological work has uncovered a high concentration of sites and localities, their density being attributable to the comfortable environment (Krupyanko, Tabarev, 2004).

The Zerkal'naya is one of several rivers that flow across southeastern Primorye. It originates on the eastern slopes of the Sikhote-Alin, Range and flows eastward for some 70 km, when it empties into the Sea of Japan. Although a complete geomorphologic assessment of the valley has yet to be conducted, Pleistocene terrace remnants are recognizable along the length of the valley. The terraces range between 10 and 40 m above the modern flood plain, but most occur between 12 and 16 m. Although there is evidence of ancient human occupation on both the terraces and on the valley bottom, the spatial and temporal distribution of the sites is not uniform, and sites of different ages appear to have distinctive terrace associations.

Most of the archaeological sites (there are more than 40) are concentrated in the middle-stream, at about 25–35 km from the river mouth. River valleys are comparable with the productive sea coasts in terms of rich and predictable resources, but possess additional advantages – fresh water and easily negotiated pathways along the streams. The sea stimulates the microclimate of the river valley. The Sea of Japan in the east and mountain ridges of Sikhote-Alin' in the west brings about a monsoon-type climate and determines seasonal air movement in the coastal zone. The sea brings fairly cool, humid summers with low to mild snow covering the river valley in winter.

The history of the archaeological investigation of the Paleolithic in the Zerkal'naya valley started in 1954 with the discovery of the Ustinovka I Site by geologist V.F. Petrun'. This led to the discovery of a series of sites dating to the Ustinovka Upper Paleolithic industry around the villages of Ustinovka and Suvorovo. The archaeological sites are located close to the river and tributary mouths in the middle-stream which are traditionally the best place for seasonal salmon-fishing. Stone tool kits include large quantity of wood-working instruments – axes, adzes, chisels, drills, scrapers etc. All of them may be successfully used in traps and weirs construction along with the creations of light dwellings (shelters) for fishers.

It is our view that the most ancient period of the population of this territory is illustrated by the liparite complex found at the Ustinovka V Site – massive cores and adze-scraper tools (Krupyanko, 2002).

The time of the Ustinovka industry – the microblade stage – has been wellstudied on the basis of materials from multiple sites. These have been dated by $^{14}C$ to 15 – 11 000 BP. Sites of this age constitute the bulk of known archaeological deposits in the valley, and have been the major focus of research because they are very similar in content to assemblages from Siberia, northern China, and Japan (Vasilievsky, Gladyshev, 1989; Vasilievsky, Krupyanko, Tabarev, 1997; Krupyanko, Tabarev, 2001).

The new materials of the Suvorovo III Site investigations let it possible to be back to the early concept of the two chronological and technological episodes at the site.

The results of the research of recent years allow us to take a fresh look at some ideas which had previously been advanced:

• the division of the stratigraphical column of a site into lithic complexes with a layer of pebble between them is again becoming relevant;

• an attempt is being made to divide to divide also the collection of artefacts uncovered into distinct complexes, as follows;

• the upper complex, characterised by the abundance of small and medium-sized secondary flakes, by the presence of composite scrapers on flakes, poly-functional unifacial tools on flakes, and by the variety of raw materials used;

• our observations suggest that the lower layer is associated with transversal burin, end-scrapers on blade blanks, microblade cores industry on boat-shaped blanks, big cores for blades, the preponderance of blade forms in the debris, a preference for certain raw materials, viz. light- and green-coloured siliceous stones, the presence of large flakes, including primary ones, in the waste material, production complexes recordable by the nuclear chip, and the presence of patinated artefacts made of basalt.

The uncovering of production complexes with marked raw-material characteristics, the nature of the distribution within the layer of easily moved objects, and the almost complete absence of sloping subsidence at the area of the site being investigated, point to the conclusion that the horizontal movement of artefacts within the layer is either insignificant or totally absent.

The morphology of the debris suggests that tested raw – material was being brought to the site. However, the upper level of deposits that we are uncovering is distinguished by the great variety of raw material being brought and the preponderance of secondary debris.

General observations only reinforce the way we see the site – as a temporary hunters' camp. We take the view that the unanimity in attributing fragments of beads and missile points to a later complex requires additional substantiation.

Radiocarbon dates for the Palaeolithic complex at the Suvorovo III have not yet been obtained. The opinions of the experts differ as to its age. In their opinion, it might correspond either to the end of the Pleistocene (11 500–13 000 and even 13 000–15 000 years ago), or to the start of the Holocene – 10 000–8 000 years ago.

It is our view that the peculiarities of the typology of the artefacts and of their stratigraphical distribution justify consideration of the chronological proximity of the lower complex of the Suvorovo III site to the 3rd-horizon site at Ogon'ki V (Sakhalin) with the carbon dates in frames of 19 000 – 18 000 BP.

The possibility of a much earlier Paleolithic occupation is very real, but not securely documented.

In 1999 at Suvorovo IV Site the stone rod with hexagonal cross-section was found near the remains of small fire-place ($^{14}C$ data – 15 900 BP). It was carefully erected on the highest spot of the site and may be interpreted as a tribe symbol. Taking into consideration the position of Suvorovo IV Site on the fishing place it may be an example of "ancient rights' illustration" (the sign of possession). In 2002 one more ritual complex with hexagonal rod and flat pebbles were placed above the bifacial fish-knife was found at Bogopol' IV Site which

is located on the opposite bank of Zerkal'naya River (Krupyanko, Tabarev, 2005). Several years earlier V.I. Dyakov described interesting feature of the 8 bifacies at Ustinovka IV Site: the 7 bifacies were place around central one in the central territory of the site not far from living places (Dyakov, 2000).

The subsequent stage – interpreted by some authors as the "Transitional period" or "Mesolithic" – is represented by the sites which have yielded archaic pottery and stone tools of the Paleolithic type (Ibid.; Kononenko et al., 2003). This determination is still the subject of discussion, but in our view it is possible to make ascent on the complexes with small-size bifaces of greenish chert. Such bifaces and the by-products of their manufacture are known to occur regularly at almost all the sites of the Ustinovka industry. One of the best examples is the Bogopol' IV Site.

There was, for long enough, insufficient evidence to found a discussion about the presence of Neolithic sites in the Zerkal'naya River valley. However, recent discoveries made during archaeological work on new sites, above all, the Ustinovka VIII Site have rectified this situation. (Krup'anko, 2003).

The Ustinovka VIII Site was initially located and tested in 2003 and excavated in 2004–2005 by the joint Russian – Japanese expedition. On the base of the artifacts' assemblage and several $^{14}C$ dates it was preliminary described as the multicomponental site with the cultural sequence from the Neolithic Age to the Paleometal Age which is extremely rare for this part of the eastern Maritime Region (Kobayashi Tatsuo et al., 2005; Krupyanko, 2006).

This site is located on a cape-like cliff about 2 km west from Ustinovka village on the plateau at a height of 135 m above sea level in the north of Zerkal'naya River (the difference between the highest and lowest points of river is 20 m). It lies in the zone of the broad – leaved deciduous forest, mainly composed of Mongolian oak (*Quercus mongolica*).

The stratigraphical situation demonstrates several horizons of habitation from the rock bed up to the modern surface. The cultural remains include the collection of pottery fragments, collection of stone artifacts (fragments of cores, wide range of retouched and polished instruments, ground tools, flakes and scars), fire-place features, and the burned dwelling construction with recognizable wood structure (planks). Ceramic collection (hand-made pottery) includes varios parts of vessel with elaborated decoration. While stone raw materials were dominated by siliceous shale, only 2 pieces of obsidian were obtained.

The Paleometal (Bronze Age) period is a local (Suvorovo-type) variant of the Lidovskaya culture (3 000–2 400 BP). The collection of artifacts is characterised by profiled vessels bearing a "horse shoe" design; as well as triangular arrow-points and trapezoidal scrapers.

The late Neolithic Zaisanovskaya culture (4 500–4 000 BP) is documented by diagnostic pottery with tooth-like or line stamp, end-scrapers on flakes and multiple pebble tools – hammer stones, abrasives, retouched and polished arrow-points. The same ornamentation was used to decorate tools and other cultural items. It's also very possible that the burned dwelling conctruction belongs to the period of Zaisanovka habitation.

Morphological analysis provides arguments for the existence of one more cultural complex, much older (7 500–6 500 BP), and belonging to earlier stages of the Neolithic in Primorye. It is illustrated by flat-bottomed pottery with an "Amur net" design.

The stone industry is represented by blades and stemmed arrow-points of the "Daurian type" with unifacial retouch, and the awls, drills and bifacial scrapers which are known as the adze-like tools of "Rudnaya type". Similar materials are found in Primorye (Rudnaya Pristan' Site, Chertovy Vorota Cave, Vetka Site) and in the Lower Amur Region (Kondon).

One unique find was a ceramic stamp for decorating pottery. Evidence of art, although sparse, exists in this complex, for example the "figure 8-like" artifact.

The site is located about 30 km from the sea coast but the people were familiar with sea-fishing – fish tooth was found in the cultural level. All of unearther faunal remains were tiny burnt bone fragments. Thus, it was difficult to identify specific names of animals. However, it was decided that they belonged to Zaisanovskaya culture. Based on the results obtained from other sites excavation, conducted simultaneously, a high probability of Manchurian deer bones (*Cervus elaphus*) and wild boar bones (*Sus scrofa*) was recognized.

Finds of blades and prismatic cores are of special interest. There is also a microblade from a typical, wedge-shaped microblade core. These artifacts with some pottery may be part of a new Neolithic culture in Primorye.

The Bronze Age in the Zerkal'naya River valley and the Sikhote-Alin' territory is represented on the whole by the Lidovskaya Culture, which dates to X–IV centuries BC. Bronze Age sites are the second most common category of sites in the Zerkal'naya river valley and are marked by a cultural assemblage that includes unembellished cooking pots, spindle whorls, polished and chipped stone tools, and – very rarely – metal artifacts (Suvorovo VI Site). The culture is characterized by subterranean and surface carcass dwellings, profiled vessels, polished axes and knives, a small quantity of bronze items and imitations there of, retouched stone arrow points and scrapers and human-like ceramic figurines (Dyakov, 1989; Krupyanko, Yanshina, 2002; Yanshina, 2004).

At this point, it would be useful to stress the find of two figurines near Olga village (70 km to the south of the Zerkal'naya River). Unlike many finds in the Russian Far East and neighboring territories, these have faces.

Most of the known Bronze Age sites occur on the 12–16m terrace and are commonly found overlying Paleolithic deposits.

Some very interesting results of the archaeological work in Eastern Primorye are connected to the research into the Paleometal period. They give strong evidence that allows to define the local cultures of the Bronze Age, and to hypothesise about their connection to the subsequent cultures of the Iron Age. These complicated cultural processes took place in the archaeology of Eastern Sikhote-Alin'. Intensive migrations, cultural mixture, adaptation and assimilation may be traced in the materials from Ust'-Zerkal'naya IV, Zerkal'noe Lake IV and Bogopol' III–IV Sites (Semin, 1985; Krupyanko, Yanshina, 2002; Sidorenko, 2007).

Only a few Medieval Age sites dating from early in the second millennium AD have been discovered in the Zerkal'naya valley. Archaeologists know little about these sites, but most include substantial farmsteads and at least one stone-walled "castle". All known Medieval sites are located on the valley floor, and are commonly found on land currently cultivated by Russian farmers who have occupied the Basin for the past century.

Footprints of the Medieval states – their rise and fall – are have been found on the slopes of Eastern Sikhote-Alin'. In spite of periphery these footprints are of various types – pathways, fortresses, settlements, burial and ritual complexes, multiple individual finds.

As a part of an integrated study of this territory, we are gathering materials on the process of the peopling of the valley from the western regions of Russia. This may be traced in the documents to a time as early as the very beginning of XX century with the foundation of first villages. The new settlers moved not on to wild land but on to a territory that possessed its own culture and economy. This knowledge creates the basis for a new and promising direction for our studies – ethnoarchaeology.

In conclusion, the outlook for research into the eastern Sikhote-Alin' match the general directions of the archaeology of the Russian Far East:

• the quest for sites relating to the initial peopling of the area;

• correction of the dating of the Stone Age sites investigated heretofore;

• the problem of the "Transitional period" between the Paleolithic and the Neolithic;

• further study of the Neolithic period;

• the local peculiarities of the sites of the Paleometal period;

• an integrated study of the sites connected to the Mediaeval states;

• the development of ethnoarchaeological research (from the time of the collapse of the medieval states up to the peopling of the territory by settlers from Russia).

## REFERENCES

**Dyakov V.I. 1989**

Primorye in the bronze age. Vladivostok: Publishing House of Fare Eastern State Univ.

**Dyakov V.I. 2000**

Primorye in the Early Holocene (The Mesolithic Settelement of Ustinovka IV). Vladivostok: Dalnauka.

**Kobayashi Tatsuo, Fujimoto Tsuyoshi, Ito Shinji, Kuznetsov A.M., Krupyanko A.A., Tabarev A.V. 2005**

Report on the Archaeological Investigations in Primorye, Russia (Ustinovka 8 Site). In *Comparative Study on the Neolithic Culture between East Asia and Japan. International Symposium.* Tokyo: Kokugakuin Univ., pp. 9–142. (21st Century COE Program Archaeology Series; vol. 4).

**Kononenko N.A., Kajiwara H., Garkovik A.V., Korotky A.M., Kononnko A.V., Yokoyama Y., Takahara Y. 2003**

Foraging population of the Sea of Japan during the Late Pleistocene – Early Holocene. Novosibirsk: IAE SB RAS Press.

**Krupyanko A.A., 2002**

The questions of “preuvstinovsky” settlement of the Zerkal’naya River’s Valley. In *Blade and Microblade industries in Asia and America. Materials of International Scientific conference*. Vladivostok: Publishing House of Fare Eastern State Univ., pp. 55–58.

**Krupyanko A.A. 2006**

New Data on the Archaeology of the Eastern Sikhote-Alin’ (Russian Primorye). In *Archaeological Elucidation of the Japanese Fundamental Culture in East Asia. International Symposium*. Tokyo: Kokugakuin Univ., pp. 89–109. (21st Centure COE Program Archaeology Series; vol. 7).

**Krupyanko A.A., Tabarev A.V. 2001**

Stone Age Archaeological Complexes in the Earstern Maritime Region. 1996–2000 field works. Novosibirsk: Siberian Univ. Press.

**Krupuanko A.A., Tabarev A.V. 2004**

Antiquities of Sikhote-Alin’. Archaeology of Kavalerovsky district. Vladivostok: Publishing House of Fare Eastern State Univ.

**Krupuanko A.A., Tabarev A.V. 2005**

Ritual Complexes with Bifacies and Sixfacies in the Final Paleolithic of Maritime Region, Russian Far East. In *Art and Ritual of Ice Age.* Lugansk: Publishing House «Vega», pp. 91–99.

**Krupyanko A.A., Yanshina O.V. 2002**

Suvorovo VI Site and its place in archaeology of Pimorye. In *Archeology and cultural anthropology of the Far East.* Vladivostok: Publishing House of Institute of history, archaeology and ethnography of Fare Eastern Branch of Russian Academy of Sciences, pp. 57–74.

**Krup’anko A.A. 2003**

Ustinovka 8 Site and its place in the archaeological context of Primorye, Russia. In *Formation and Expansion process of the East Asian Neolithic Culture. International Symposium*. Tokyo: Kokugakuin Univ., pp. 31–33.

**Semin P.L. 1985**

Bronze age complex in Ust’-Zerkal’naya IV Site (In Primorye). Ussuriisk, pp. 89–90.

**Sidorenko E.V. 2007**

North-Eastern Primorye in the paleometal age. Vladivostok: Dalnauka.

**Vasilievsky R.S., Gladyshev S.A. 1989**

Late Paleolithic of Southern Primorye. Novosibirsk: Nauka.

**Vasilievsky R.S., Krupyanko A.A., Tabarev A.V. 1997**

The genesis of the Neolithic age in the South of the Russian Far East (stone industry and the problem of early settlement). Vladivostok: Publishing House of Fare Eastern State Univ.

**Yanshina O.V. 2004**

Problem of attribute of the bronze age in Primorye. St. Petersburg: Publishing House «Lema».

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# LATE GRAVETTE OF THE MIDDLE DNIESTER: NEW VIEWS*

The Dniester valley is one of the richest Paleolithic region of Eastern Europe with numerous, mainly stratified multilevel sites which are including culturally different Middle and Upper Palaeolithic industries as Levallois (Molodova I and V, Ketrosy), industry with bifacial tools (Ezypol, Lev 2, Kolodiiv), Aurignacian (Gannusivka), Gravettian/Epi-Gravettian (Mezhygirtsy, Molodova I and V, Korman IV).

The Upper Palaeolithic site of Dorochivtsi is located along the Dniester, to the North of Chernivtsi (South-Western Ukraine), ca 90 km upstream of Molodova (Fig. 1). At this spot a 10 m thick loess cover is preserved on


*Fig. 1.* Map of sites.
*1* – Doroshivtsy III; *2* – Zamostje I; *3* – Molodova V.

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**Archaeological stratigraphy**

| Archaeological layer | Depth (m) | Number of artifacts | Faune | Hearth | Cultural identity |
|---|---|---|---|---|---|
| 1 | 6.3–6.5 | 5 | + | – | Upper Paleolithic |
| 2 | 6.6–6.7 | 19 | + | – | Upper Paleolithic |
| 3 | 6.7–6.9 | 3981 | + | + | Upper Paleolithic |
| 4 | 6.9–7.15 | 604 | + | + | Upper Paleolithic |
| 5 | 7.3–7.5 | 19 | + | – | Upper Paleolithic |
| 6 | 7.9–8.1 | 23 286 | + | + | Upper Paleolithic |
| 7 | 8.4–8.6 | 6 | + | – | Upper Paleolithic |

top of the first Dniester terrace, along the southern slope of a large meander. The pedosedimentary sequence records a complex stratigraphic succession of 14 units. The lower part, which consists of ca 3 m of sandy loess with several tundra gley horizons (units 14 to 9), encompasses 7 Upper Paleolithic cultural levels dated respectively 23 330 uncal BP (c.l. 5) and 20 740 BP (c.l. 2) on charcoal. The middle part of the sequence records a succession of loessic deposits alternating with 7 bioturbated humic horizons (units 8 to 4) most probably related to short interstadial events; it is capped by a 2 m thick homogeneous loess cover (units 3 and 2) Teriocomplex of all units of Doroshivtsi III site is monotonous, and almost is represented by two animal species (mammoth and reindeer). Everywhere mammoth (*Mammuthus primigenius*), and reindeer (*Rangifer tarandus*) prevail. The arctic fox (*Alopex lagopus*) (layers 2 and 3), and horse (*Equus* sp.) are represented by single specimens (units 4 and 5) (Fig. 2).

According to a local subdivision of Late Palaeolithic tericomplex of the South-Eastern Europe, it can be attributed to rangifer-equidae-mammoth (Volyn – Dniester – Middle Bug) variant.

Some new data was obtained as a result of investigation excavations of open-air site Doroshivtsy III site. With the exception of Level 1 with very few artifacts all other cultural levels could be determined as Gravettian. The richest collections belong to Level 3 and 6.

The most iportant from the point of cultural features industry of Level 6 (lithological layer 12) dated to 22 330 ± 100 BP and represents original UP industry with shouldered points, small amount of burins and numerous backed tools made on microblades mainly. The collection of 23 000 of artifacts is including 18 906 chips and 700 undetermined fragments. The primary flaking characterized by uni- and bidirectional blade/bladelet cores of cylindrical, subcylindrical, narrow working surface and wage shapes. Crested blades and core tablets are present. Reduction strategy was oriented on bladelet and microblade production. Lineal and punctiform platforms show usage of hard hammer. There are practically no lipped platforms.

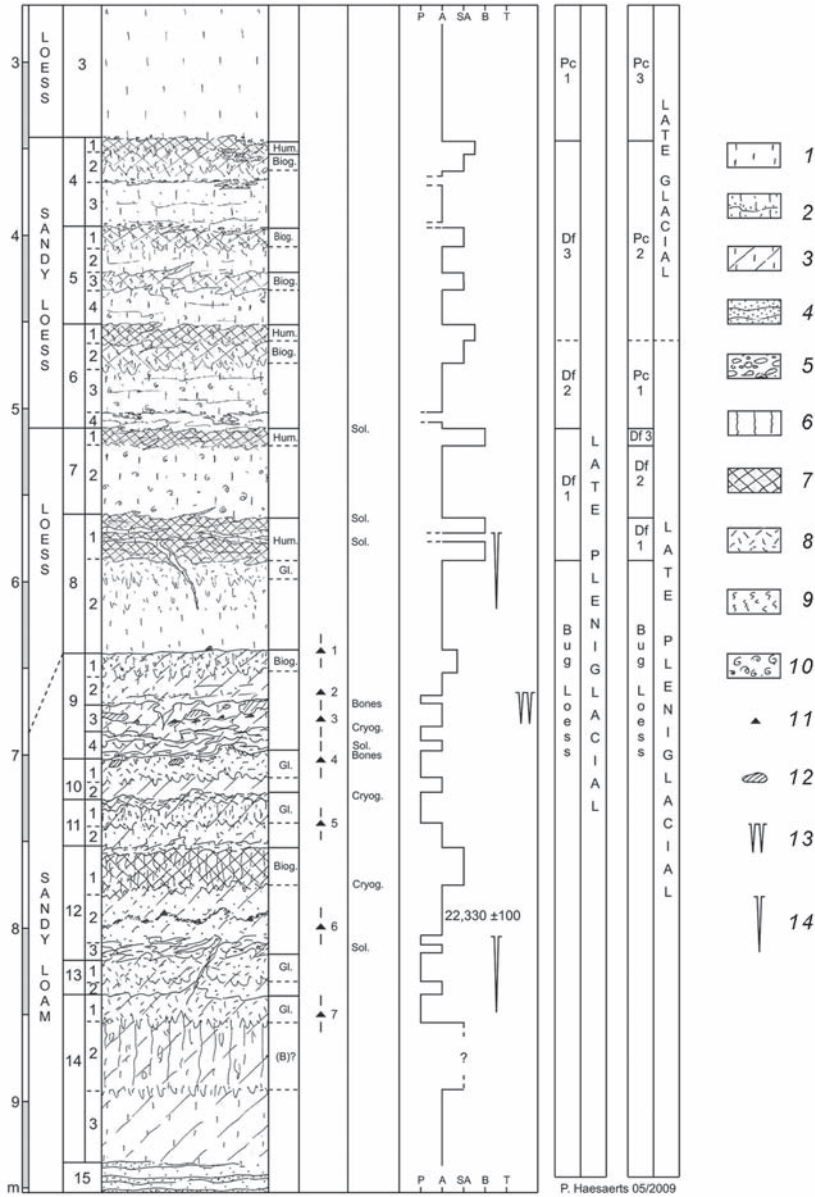


*Fig. 2.* Doroshivtsy III site. Stratigraphy: lithostratigraphical, paleogeographical and chronostratigraghical context.

Abbreviations: Hum. – Topsoil; Biog. – Biogaleries; Sol. – Solifluction; Cryot. – Cryoturbation; T – temperate; B – Boreal; SA – sub-Arctic; A – Arctic; P – permafrost.

*1* – loess; *2* – sandy loess; *3* – loess loam; *4* – sand; *5* – gravel; *6* – ocher clay (B horizon); *7* – humus loam; *8* – gray silt (tundra gley); *9* – biogaleries; *10* – molluscs; *11* – artifact; *12* – bones; *13* – frost cracks; *14* – piece of ice.

The tool-kit of 491 tools represented by ednscrapers between of which ogival are characteristic, a few burins on a brake, shouldered points, troncated items etc. The most numerous tools (138 samples) are backed bladelets and micromlades with steep/semi-steep, but not abrupt retouch. For classification of very small pointed backed microblades it looks not really possible to use term “microgravette point”! It should be stressed that “guiding” for Gravettian industries shouldered points (3 samples) and its fragments (5 samples) in Level 6 of Doroshivtsy III have small size too and made on bladelets and microblades (Fig. 3, *10, 11*). Microlithic character of blank production and tool blanks selection selection of this industry is prominent. At the same time endscrapers/burins ratio and lacking of burins on troncation do create quite unusual “face” of this industry (Fig. 3, *3–5*). The industry of level 6 bears little resemblance to the overlying materials. Apart of shouldered points there are almost nothing in common with Gravettian techno-complex. Moreover, at first view, this material is closer to epi-Gravettian from the point of the core reduction strategy, typology of backed tools and art objects. And in terms of finding of some individual analogies rather be seen in epi-Gravettian, younger age sites of Eastern Europe (Mezin, Amvrosievka-bone-bed), Borschevo I, Kostenki 21) (Shovkoplyas, 1965; Krotova, 2013; Praslov, Ivanova, 1982; Rogachev, Kudryashov, 1982; Amirkhanov, 1988).

Besides of bone tools (points (Fig. 3, *12*), awl (Fig. 3, *13*)) the ornamented ivory rod (15 cm in length, 2–5 cm in cross-section) belongs to this level. There are meander ornament and zoomorphic images on the surface made by very fine

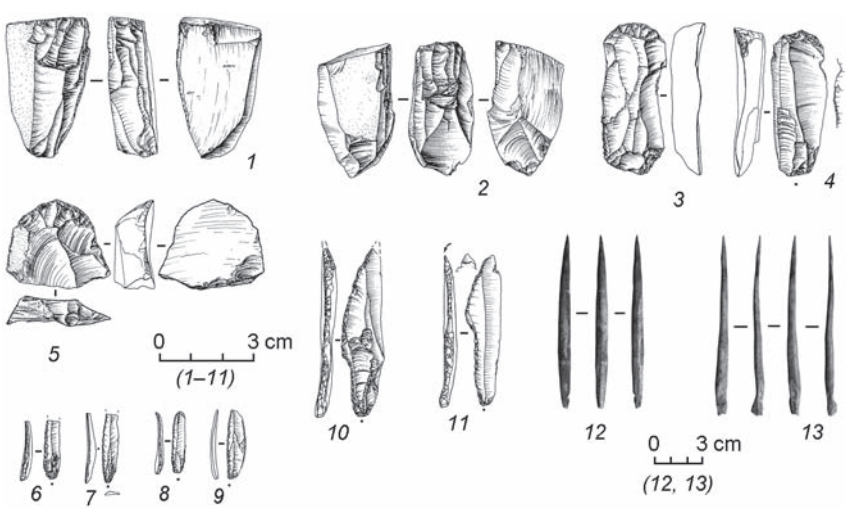


*Fig. 3.* Doroshivtsy III site. Inventory of cultural layer 6.

*1, 2* – cores; *3–5* – end scrapers; *6–9* – non-geometric microliths; *10, 11* – shouldered points; *12* – point; *13* – awl.

engraving. One of that represents animal head with long neck (probably Rangifer?) (Fig. 4). This art sample is unique for Middle Dniester Upper Palaeolithic (Kulakovska, Usik, 2013).

Doroshivtsy III together with Molodovo V (Level 7 and 8) and Zamostje I with shouldered points in tool-kit, which are usually, was named "atypical", but in reality are sub-type of this specific kind of tool one more time give evidence of originality of Dniester Gravettian industries and its distinction from Willendorf-Pavlov-Kostenki group as well.

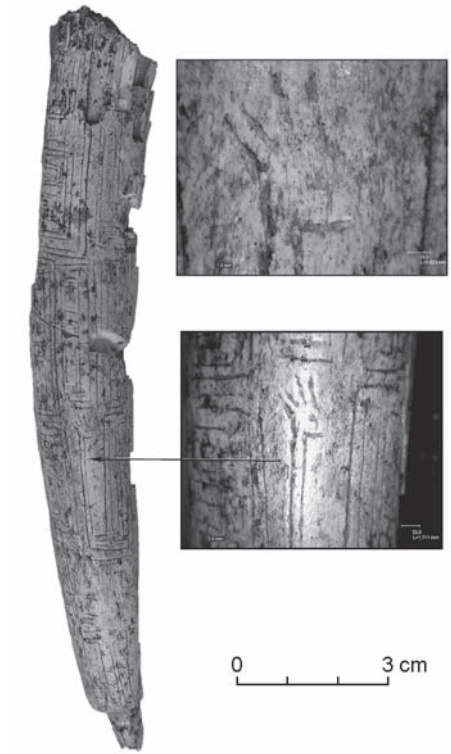


*Fig. 4.* Ornamented ivory rod.

The Dorochivtsy loess sequence, will give access to a large set of complementary data, including archaeology, pedosedimentary record, palynology, mollusc's and different chronological approaches, allowing a better understanding of the Late Glacial Maximum, a period poorly documented in Central and Eastern Europe. This sequence also provides a new insight on the transition from the Late Gravettian to the Epigravettian cultural assemblages.

## REFERENCES

**Ambrojevici C., Popovici R. 1938**

Zamostea 1 am Ceremus, Eine jungpalaolitische Fundstelle Nord-Rumaniens. *Dacia. Bucuresti*, vol. V-VI: 23–39.

**Amirkhanov H.A. 1998**

The Eastern Gravettian or Gravettoid industry in Central and Eastern Europe. In *The Eastern Gravettian*. Moscow: Scientific World, pp. 15–35 (in Russian).

**Bibikova V.I., Belan N.G. 1979**

Local variants and groupings Upper Paleolithic teriokomplex of southeastern Europe. *Bulletin of Moscow Society of Naturalists*. Dep. biol., vol. 84 (3): 3–14 (in Russian).

**Borziak I.A. 1998**

Dniester Gravettian and its connection with the "unity of Willendorf-Pavlov-Kostenki". In *The Eastern Gravettian*. Moscow: Scientific World, pp. 135–142 (in Russian).

**Borziak I.A., Kulakovska L.V. 1998**

Gravettian of the Dniester area. Overview. *Archaeology* (Kyiv), No. 4: 55–64 (in Ukrainian).

**Chernysh A.P. 1987**

The standard multilayered Site Molodova V. Archaeology. In *The multilayered Paleolithic Site Molodova V. The Stone age Men and environment*. Moscow: Nauka, pp. 7–94 (in Russian).

**Gvosdover M.D. 1998**

Flint inventory of Avdeevo Upper Paleolithic Site. In *The Eastern Gravettian*. Moscow: Scientific World, pp. 224–279 (in Russian).

**Krotova O.O. 2013**

The Upper Paleolithic Hunters of Azov-Black Sea steppes. Kyiv (in Ukrainian).

**Kulakovska L., Usyk V. 2013**

Palaeolithic of the Middle-Dniester Region: New Materials. In *International scientific conference "Northern Azov in the Stone Age – Chalcolithic"*. Melitopol, pp. 93–99 (in Russian).

**Kulakovska L., Usik V., Haesaerts P. 2012**

Dorochivtsi III – Gravettian Site in the Dniester Valley (Ukraine). *Stratum plus: Archaeology and Cultural Anthropology*, No. 1: 131–150 (in Russian).

**Praslov N.D., Ivanova M.A. 1982**

Kostenki 21 (Gmelin Site). In *Palaeolithic of the Kostenki-Borschevo area on the river Don. 1879–1979. Results of field investigations*. Leningrad: Nauka, pp. 198–211 (in Russian).

**Ridush B.T. 2008**

New find of Upper Paleolithic mobile art from Middle-Dniester Basin. *Stone age Ukraine*, vol. 11: 188–190 (in Ukrainian).

**Rogachev A.N., Kudryashov V.Ye. 1982**

Borshcevo 1. In *Palaeolithic of the Kostenki-Borschevo area on the river Don. 1879–1979. Results of field investigations*. Leningrad: Nauka, pp. 211–217 (in Russian).

**Shovkoplyas I.G. 1965**

The Mezin Site. Kyiv: Naukova Dumka (in Russian).

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# RAW MATERIALS FOR PREHISTORIC TOOL MANUFACTURING AS AN ECOLOGICAL FACTOR OF THE ALTAI PALEOLITHIC

The contemporary conception of the lithic raw materials for tool manufacturing as one of the elements of the environment and as one of the most important ecological factors of human subsistence in the Stone Age stipulate the emergence of petroarchaeology as a new branch of knowledge. Pertoarchaeology is the geological and petrographic study of lithic artifacts and the relevant raw materials. The new branch of research provides good results in the areas where lithic industries represent the major evidence of human habitation in the prehistoric times. Paleolithic sites of the northwestern and central Altai Mountains belong to this category. The author is going to present a summary of the long term geological and petrographic studies in the Altai.

1. All the Paleolithic sites of the region under study have been located within a single geological macrostructure of the Altai Mountains. It concerns the Anuy – Chuya structural-fascial zone delimited by the long existing regional faults (Fig. 1) (Kuznetsov, 1963). The area is united by a common history and is comprised of the similar rock types. This area of the Altai Mountains is composed of thick layers of sandstone with the marble structure originating during the Paleozoic Period. Caves suitable for the durable human habitation can be formed only in such rocks. This inference is supported by the discovered Paleolithic cave sites like the Denisova, Kaminnaya, Iskra, Okladnikov, Chagyrskaya and Strashnaya in the northwestern Altai and Ust-Kan in the Central Altai. However, the same area contains numerous open-air Paleolithic sites, like Kara-Bom, Tiumechin, Ust-Karakol-1, Anui-2 and -3 and the Lower Pleistocene Karama site. This fact suggests that given the common ecological conditions, availability of raw material might have been a more important factor than durable shelter.

2. This part of the Altai Mountain range represents the area with various raw materials. Flint, as a universal high-quality raw material, which was used for tool manufacturing in Europe and the Near East, is not found in the Altai. Within a single structural-fascial zone, the predominance of particular rocks, diversity of available rocks and their quality are stipulated by the local geo-

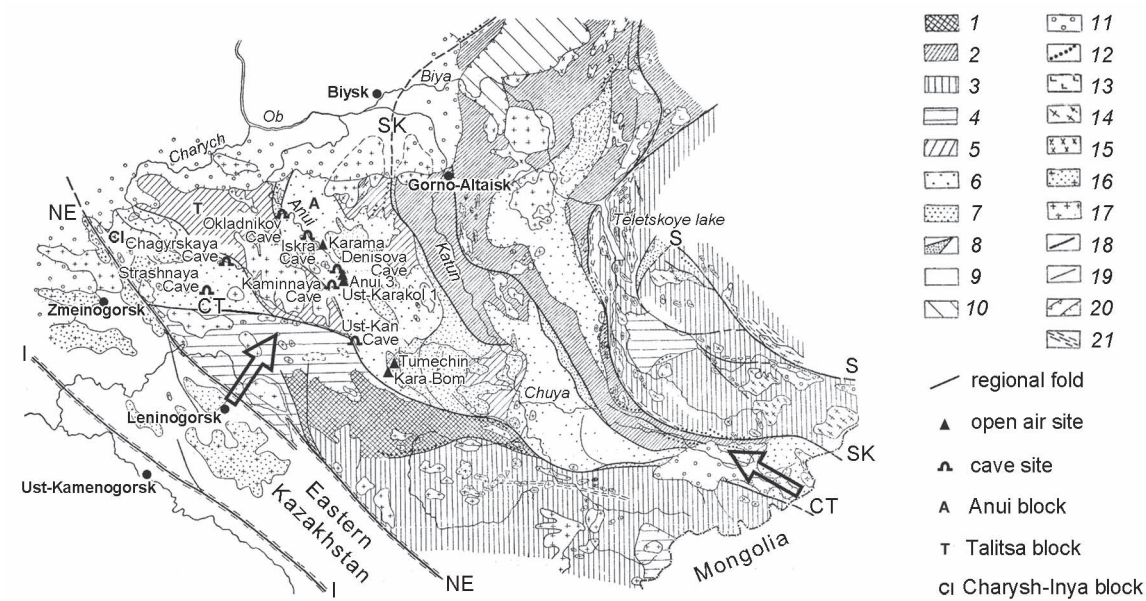


*Fig. 1.* Techtonic scheme of the Altai Mountains (after Kuznetsov, 1963), Paleolithic sites and the routes of import of the row materials of items of personal decoration (the routes are shown by the arrows).

*1* – Pre-Cambrian protuberances; *2* – structural-fascial zone of the Salair stage of consolidation; *3, 4* – structural-fascial zones of the Caledonian stage; *5* – the lower structural stage of the Variscan orogenic zone in the Anui-Chuya basin; *6* – the medial structural stage of the same zone; *7* – the upper stage of the same zone; *8* – deflection areas; *9* – structural-fascial zone of the southwestern part of the Altai (Ore Altai); *10* – the southern border of the Kuznetsk deflection; *11* – Cenozoic deflections; *12* – hiperbasite layers of the Salair stage; *13* – Salair granitoid complexes; *14* – Caledonian granitoid complexes; *15* – Devonian granitoid intrusions; *16* – Variscan granitoid of the Zmeinogorsk complex; *17* – Variscan granitoid of the Kalbin complex; *18* – regional folds; *19* – other large folds; *20* – deflection boundaries; *21* – shear and metamorphism zone.

Deep folds: I – Irtysh fold; NE – the northeastern shear zone; CT – Charysh-Terekta fold; SK – Sarasinsko-Kuraisky fold zone; C – Chokraksky fold; S – Shapshalsky fold.

logical and geomorphological features of the area contains a Paleolithic site (Derevianko, Kulik, Shunkov, 2000).

3. The quality of raw materials is heavily affected by the tectonic processes. Repeated renovation of the rocks caused their fracturing and further modifications. Young tectonic movements caused potential fractures in the rock structure. When the rock is decomposed, this fractured structure stipulates the size and shape of separate blocks (Postnov, Anoikin, Kulik, 2000). These processes led to either deterioration or to improvement of the petrophysical characteristics of the rocks. For instance, diverse characteristics of the Devonian volcanic rocks and the features of post-magmatic changes make the raw materials, on which artifacts were made, a specific feature for a particular archaeological site in the basins of such rivers as the Anui, Charysh and Ursul. Green porphyrite and tuff from the Ongudai suite in the upper Charysh (Kulik, Postnov, 2001) are more homogeneous and less anisotropic than the Kuratinsky acidic volcanic rock from the Anui basin. The noted differences between the volcanic rocks of the Kuratinsky suite and their post-magmatic modifications represent major distinctions of various sites from the Anui valley and the Anui sites from the monuments in the Ursul valley (Kulik, Shunkov, Petrin, 2003). The artifacts from the Strashnaya Cave were made on Devonian volcanic rocks (Kulik, Zenin, 2005).

4. The noted residual pebble cortex on the majority of artifacts suggests that all the Paleolithic industries of the region were based on the usage of the local pebbles. The pebbles were collected at the distance not exceeding 2–3 km from the sites. The origin places of pebbles have been established.

5. The lack of a universal and high-quality raw material in the study region stipulated the necessity for adaptation to various types of raw material and its premeditated choice. This strategy can hardly be detected and proved in the regions with a single raw material. In the Altai, the choice of raw materials can be traced through comparisons of the rate of occurrence of various rocks in pebble sources with the rate of particular rocks in the Middle Paleolithic artifact assemblages (Postnov, Anoikin, Kulik, 2000; Kulik, Postnov, 2001; Derevianko et al., 1998; Kulik, Shunkov, Petrin, 2003; Kulik, Markin, 2003, 2009) (Fig. 2; 3). However, the premeditated choice of raw materials have been noted as early as in the Lower Paleolithic at the Karama site aged to 600 – 800 yrs BP, which assemblages show the preferred usage of the best available raw material (Kulik, Shunkov, 2005).

The usage of pebbles for tool production, though the outcrops of the same rocks are often situated in proximity to the sites, also suggests the intentional choice of raw materials and the empirical knowledge of the masters that the quality of pebbles are generally higher than the bed rock in this particular region. In the course of transportation of rock by the water, the rocks collide and have got cracked along the visible and invisible fissures. The water-worn rocks represent the raw material of the highest quality. In addition, pebbles can be regarded as “natural blanks”: flat, tabular and bar-shaped rock fragments with nearly prepared striking platform. Such “natural blanks” reflect anisotropic and petrophysical features of the rocks and show the preferred directions for stone knapping (Postnov, Anoikin, Kulik, 2000). Analyses of

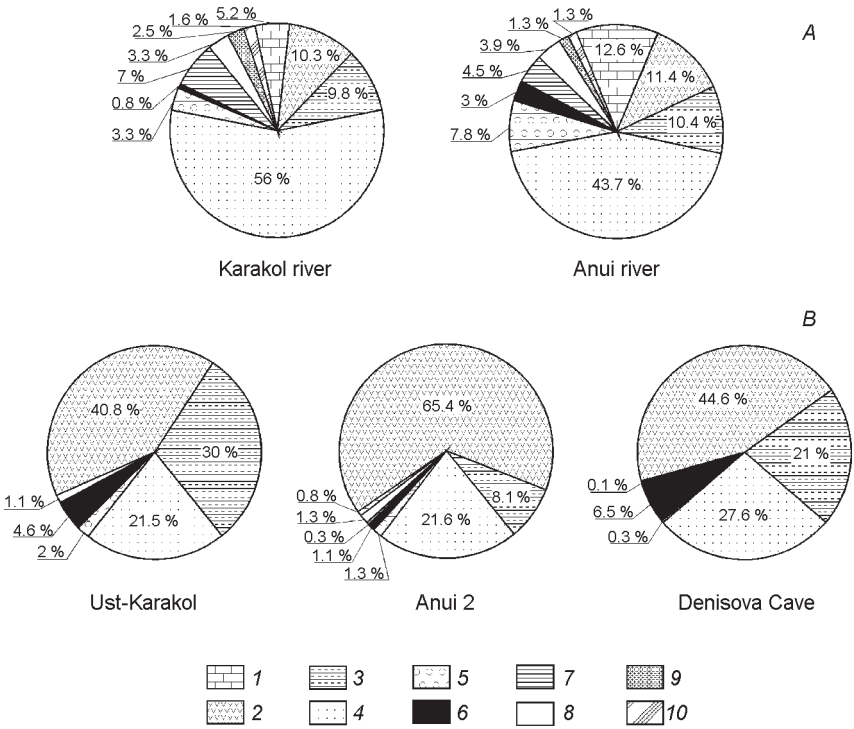


*Fig. 2.* Proportions of petrographic rock varieties in pebble assemblages (*A*) and lithic industries of the Paleolithic sites in the Anui valley (*B*).

*1* – limestone; *2* – volcanic rocks; *3* – aleurolite; *4* – sandstone; *5* – gravelite; *6* – hornfels; *7* – shale; *8* – vein quartz; *9* – granite; *10* – dyke rocks.

lithic industries have shown that the noted beneficial features of the rocks were intentionally used (Derevianko et al., 2003; Kulik, Shunkov, Petrin, 2003).

The intentional choice of raw materials is also supported by the comparative analysis of the petrophysical composition of rock with the relevant features and the tool types. For instance, the Denisova industry includes certain "specialized" tool types that were made of the raw materials of a particular shape and quality (end-scrapers and backed micro-blades) and the tools that were made of various raw materials (side-scrapers, points, burins and others) (Postnov, Anoikin, Kulik, 2000; Postnov, Kulik, 2004).

The used raw materials can be subdivided into three classes:

1) General purpose raw materials, mostly volcanic rocks, with the optimal combination of the good qualities and availability were equally often used in manufacturing various tool types;

2) Specialized raw materials (hornblende, sandstone and aleurolite) was suitable for production only particular tool types because of such specific features as hardness and technical features like fissures and foliation;

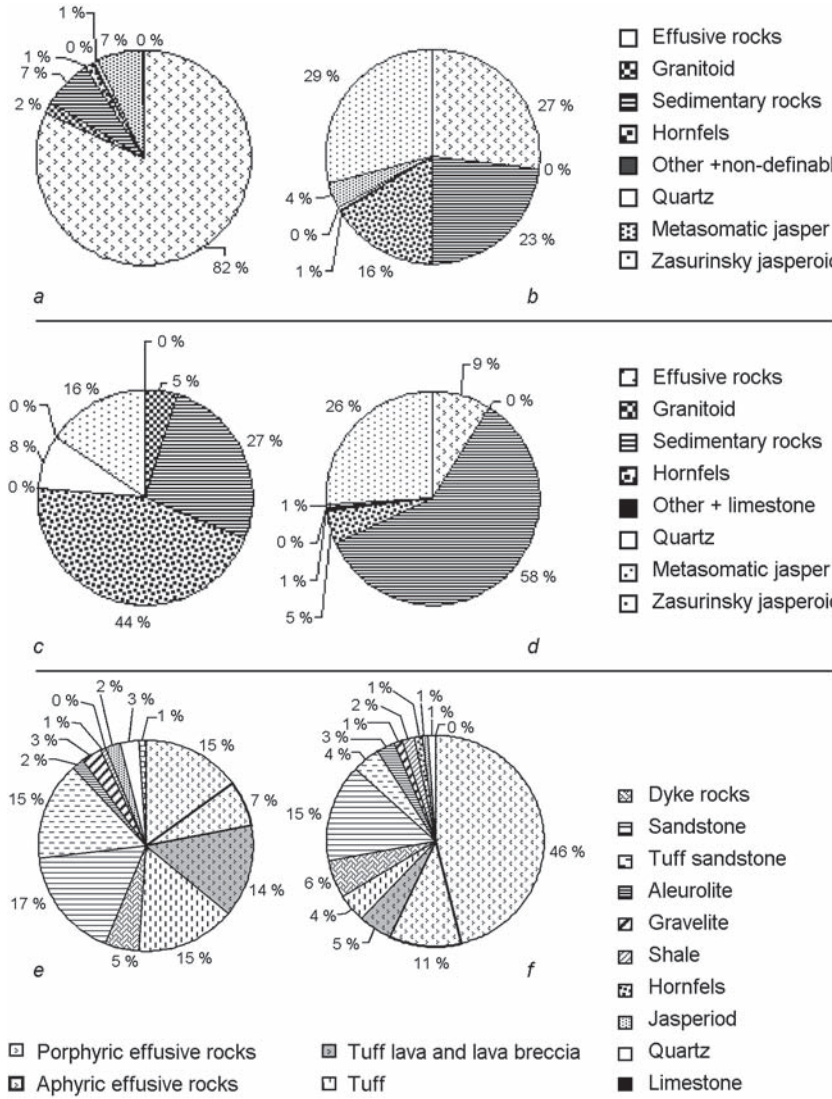


*Fig. 3.* Petrographic composition of the pebble assemblages and artifacts.

*a* – alluvium of the Charysh at Chagyrskaya Cave; *b* – artefacts from the Chagyrskaya Cave; *c* – alluvium of the Sibiriachikha at Okladnikov Cave; *d* – artifacts from Okladnikov Cave; *e* – alluvium of the Charysh at Ust-Kan Cave; *f* – artifacts from Ust-Kan Cave.

3) Rare raw materials for few tool types (jasper-like rocks) were used in manufacturing special tool types that require the highest quality.

Identification of the raw material types in rock fragments makes it possible to define the whole variety of rocks used in the particular industry. It has become possible by defining small chips, while the artifacts from this type of rock have

not been discovered in the industry for some reason. This work also concerns identification of rocks that are present in artifacts, but absent in the local raw material. In some cases, it was established that lithic tools and small chips from a single layers belonged to a single nodule. Hence the artifacts are in situ, which inference is important for the open-air sites (Kulik, Shunkov, 2000).

6. Another important inference is the correlation between the shape of the pebble and its petrophysical qualities. Petrophysical features of a particular rock include the technological (knapping features, the spall size, directions of flaking and working technique) and consuming (hardness, durability of a sharp cutting edge and others) qualities. The ancient masters chose the pebble for tool manufacturing on the basis of the following qualities (Postnov, Anoikin, Kulik, 2000; Kulik, Postnov, 2009).

The size and shape of pebbles suggest the anisotropic and hardness features of the rocks. Hardness depends not only on solidity, but also on viscosity of the rock. Both hardness and anisotropy are important for technology.

Color of pebbles is usually correlated with a particular rock type in a particular region. For instance, red pebbles were not used in the Anui basin, because red pebbles mostly represent clayey and mica schist that are the low quality raw material for lithic tool production.

Features of the pebble surface, like glitter and smoothness reflect such features like grainy structure, homogeneity and firmness. Features of flaking the tips and sides of the pebble demonstrate the technological features of the rock. The pebble surface also suggests the way and distance of transportation thus suggesting the provenance of the rocks.

The sound and smell when striking also provide important information, like the solidity of the rock, absence of inner fractures. “Clayey” and “flinty” smell differentiates between common and high-quality rocks.

Apparently, such qualities as the features of knapping and flaking surface were also taken into account as the features attesting suitability of rocks for knapping. These features are demonstrated in implements and do not need knapping every pebble of the same rock type.

7. The results of our studies of the lithic industries and the used raw materials in the Altai Paleolithic have shown that lithic tool manufacturing was an intended, time- consuming and intellectual activity as early as during the Lower Pleistocene. This activity required also knowledge of the features of raw materials and skills in raw material choice, hence, there should have been teaching and tradition passing on new generations. Lithic collections from multilayered sites serve as a good evidence for the existence of traditions, because they show a predominant usage of the particular raw material types for long periods. Any evidence for teaching is hardly available unless we discuss an ideal bifacial tool made of sandstone that does not show any signs of use-wear and an ideally prepared tiny end-scraper made of volcanic rock. These implements can hardly be interpreted otherwise than “teaching aids” and “models” when compared to abundant rough flakes and few rough tools made of the same volcanic rock. This makes us believe that Anui-2 was not only a workshop but also a “school” (Kulik, Postnov, 2009).

The noted features apparently attest to high cognitive skills and adaptation abilities of Paleolithic humans inhabiting the Altai as early as in the Lower Pleistocene. The absence of the all-purpose and high quality raw material made the humans to use various types of the local rocks, while the quality of one and the same raw material varied in various places. The abovementioned diversity of chemical composition and the post-magmatic alterations of the Devonian volcanic rocks in the basins of the Anui, Charysh and Ursul Rivers made these rocks different from one another in their petrographic qualities and reduction potentials. It should ne noted that this high ability of ancient humans to use various types of rock produced its impact on the chosen strategies of stone reduction and tool manufacturing. It results in certain distinct features in the generally synchronous lithic industry belonging to a single type. For instance, the Devonian acid volcanic rocks in the Central Altai (the sites of Kara-Bom and Tiumechin) represent raw material of high quality. These rocks are fin-grained and monolithic. Natural processes lead to fracturing into lens-shaped pieces that were further fractured in water streams and the resulting negative scars look like the scars of large-scaled "pseudo-retouch" (Petrin, Nikolaev, 1993; Kulik, Shunkov, Petrin, 2003). The low anisotropy of these rocks stipulated the laminar reduction of rocks, which technique is mostly common at these sites. The Devonian acid volcanic rocks in the Northwestern Altai are not homogenous, fragile and do not form either "natural blanks", or long spalls. It is surprising that the sites in the Anui Basin (the cave sites of Denisova and Kaminnaya and open-air sites of Anui-2 and Ust-Karakol-1) have yielded artifacts prepared through various working techniques (Derevianko, Postnov, Kulik, 2004).

8. The noted preferences of the local raw materials in the lithic industries, occurrences of any "imported" materials are highly informative. A new type of raw material suggests the usage of new sources, some of which are located at a distance over 50 km away. Occurrences of new raw materials in the lithic industries of the Northwestern Altai can be regarded as the evidence of considerable climatic changes. For instance, a synchronous occurrences of the artifacts made on siliceous jasperoid of the Zasurinsky suite of the Cambrian-Ordovician period within the lithic industries of Denisova and Kaminnaya caves and Anui-2 and -3 and Ust-Karakol-1 has become possible only upon warming of the climate and melting of glaciers in the Late Ermakovski period, because the source of this raw material is located in the high elevated southeastern part of the Baschelak Ridge (Kulik, Shunkov, 2000). The assumption that this type of raw material was used by the population of the southeastern part of the Anui Basin upon the climatic changes and availability of the raw material is supported by the fact that the same rocks were used by the population of the Okladnikov and Chagyrskaya cave sites in the northwestern part of the Anui Basin as the main raw material because this rock were not covered by the glacier (Kulik, Markin, 2003, 2009).

Usage of a new raw material of a higher quality at the sites like Denisova Cave and others without high quality materials attests to the needs of the ancient population for a new raw material due to the alterations in technologies

resulting from environmental changes. The new raw material makes it possible to execute laminar reduction, produce small tools, which features are apparently Upper Paleolithic. The transportation distance varies from 10 km (at Strashnaya cave site) to 30–60 km (Kaminnaya Cave, Ust-Karakol-1, Denisova Cave, Anui-2 and -3). However, the deficit of the high quality raw material made the people use locally available raw materials for production larger tools. The industries based on the local high quality raw material (Kara-Bom, Tiumechin) or the low anisotropy material (Ust-Kan Cave) developed on the local raw materials. This means that the usage of new raw materials should not be regarded as the evidence of intervention of a new population with their preferable raw material. In contrast, the lithic industries under discussion demonstrate the gradual development of stone working techniques over a long time of existence of these sites.

9. The noted non-local materials on the non-labor artifacts provide the information of the connections of the humans during the Upper Paleolithic. Analyses of the raw materials of the personal ornaments from Denisova Cave have shown that the agamatolite, on which the pendant was made, was imported from the contact area of the acid and alkali volcanic rocks in the Anui Ridge at the distance of 20 km from Denisova Cave (Kulik, Shunkov, 2004). The cloritolite, on which the bangle was made, originates from Leninogorsk in Eastern Kazakhstan and the fossilized ostrich egg shell is from Southern Mongolia. It means that some raw materials were imported from places of more than 200 km away from the site (Kulik, Shunkov, 2011). The special features of such ornaments made on imported materials suggest that there was a hierarchic social structure in the Denisova human community as early as in the early Upper Paleolithic, i.e., 40 ka BP.

10. Raw materials can be listed among the most important environmental factors. Studies of raw materials are equally important together with the geomorphological, paleontological and palynological studies. Petrographic studies provide important information from the Paleolithic period as well as from the Neolithic of the Altai piedmonts (Kungurova, 2005), the Paleometal period in west Siberia (Kulik, Mylnikova, Nokhrina, 2010) and elsewhere.

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## REFERENCES

**Derevianko A.P., Kulik N.A., Shunkov M.V. 2000**

Geologo-petrograficheskiy kontrol' kachestva syr'ya paleoliticheskikh industrii Severo-Zapadnogo i Tsentral'nogo Altaya. In *Tri veka gorno-geologicheskoi sluzhby Rossii*, vol. 1. Tomsk: GalaPress, pp. 5–7.

**Derevianko A.P., Postnov A.V., Kulik N.A. 2004**

Adaptatsiya tekhnologii proizvodstva kamennykh orudii k osobennostyam syr'ya v industriyakh paleoliticheskoi stoyanki Ust'-Karakol-1 (Gornyi Altai). In *Arkheologiya i paleoekologiya Evrazii*. Novosibirsk, pp. 95–117.

**Derevianko A.P., Postnov A.V., Shunkov M.V., Anoykin A.A., Kulik N.A. 1998**
Geologo-petrograficheskoe izuchenie materialov paleoliticheskikh ob'ektov basseyna r. Anui. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. 4. Novosibirsk: Izd. IAE SO RAN, pp. 52–55.

**Derevianko A.P., Shunkov M.V., Agadjanian A.K., Baryshnikov G.F., Malaeva E.M., Ul'yanov V.A., Kulik N.A., Postnov A.V., Anoykin A.A. 2003**
Prirodnaya sreda i chelovek v paleolite Gornogo Altaya. Novosibirsk: Izd. IAE SO RAN.

**Kulik N.A., Markin S.V. 2003**
Petrografiya industrii peschery im. Okladnikova (Severo-Zapadnyi Gornyi Altai). In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 9, pt. 1. Novosibirsk: Izd. IAE SO RAN, pp. 148–153.

**Kulik N.A., Markin S.V. 2009**
Petrograficheskaya kharakteristika srednepaleoliticheskikh industrii iz Chagyrskoy peschery. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. 15. Novosibirsk: Izd. IAE SO RAN, pp. 151–157.

**Kulik N.A., Mylnikova L.N., Nokhrina T.I. 2010**
Syr'evaya baza kamennoy industii v perekhodnoe vremya ot bronzovogo k rannemu zheleznomu veku (na primere poseleniya Linevo-1). *Uralskii istoricheskii vestnik*, vol. 2: 52–61.

**Kulik N.A., Postnov A.V. 2001**
Petrografiya industrii Ust'-Kanskoi peschery. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 7. Novosibirsk: Izd. IAE SO RAN, pp. 146–150.

**Kulik N.A., Postnov A.V. 2009**
Geologiya, petrografiya, mineralogiya v arkheologicheskikh issledovaniyakh: ucheb.-metod. posobie. Novosibirsk.

**Kulik N.A., Shunkov M.V. 2000**
Predvaritelnye rezultaty pertograficheskogo izucheniya paleoliticheskikh izdeliy stoyanki Anui-3. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 6. Novosibirsk: Izd. IAE SO RAN, pp. 156–160.

**Kulik N.A., Shunkov M.V. 2004**
Kamennye ukrasheniya epokhi paleolita iz Gornogo Altaya. In *Tezisy dokladov X s'ezda Rossiyskogo mineralogicheskogo obschestva.* St. Petersburg: Izd. St. Petersburg. Gos. Univ., pp. 245–246.

**Kulik N.A., Shunkov M.V. 2005**
Kamennoye syr'e rannepaleoliticheskoi stoyanki Karama na Altaye. In *"Mineralogicheskye muzei": materialy V mezhdunarodnogo simpoziuma.* St. Petersburg: Izd. St. Petersburg. Gos. Univ., pp. 345–347.

**Kulik N.A., Shunkov M.V. 2011**
Istochniki materialov kamennykh ukrashenii iz paleoliticheskikh pamyatnikov Severo-Zapadnogo Altaya. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 17. Novosibirsk: Izd. IAE SO RAN, pp. 62–66.

**Kulik N.A., Shunkov M.V., Petrin V.T. 2011**
Rezultaty petrograficheskogo analiza paleoliticheskikh industrii Tsentralnogo Altaya. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 9, pt. 1. Novosibirsk: Izd. IAE SO RAN, pp. 154–158.

**Kulik N.A., Zenin A.N. 2005**
Petrograficheskaya kharakteristika industrii peschery Strashnaya (Severo-Zapadnyi Gornyi Altai). In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 11, pt. 1. Novosibirsk: Izd. IAE SO RAN, pp. 113–120.

**Kungurova N.Yu. 2005**

Podelochnyi kamen' kak factor prisposobleniya cheloveka v epokhu neolita (po materialam severnykh predgorii Altaya). In *Sotsiogenes v Severnoi Azii*, pt. 1. Irkutsk: Izd. Irkutsk. Gos. Univ., pp. 109–113.

**Kuznetsov V.A. 1963**

Tektonicheskoye rayonirovaniye i osnovnye cherty endogennoy metallogenii Gornogo Altaya. In *Voprosy geologii i metallogenii Gornogo Altaya*. Novosibirsk: Izd. SO AN SSSR, pp. 7–66 (Trudy IGiG SO AN SSSR, No. 13).

**Petrin V.T., Nikolaev S.V. 1993**

Syr'evye istochniki stoyanki Kara-Bom. In *Okhrana i izuchenie kulturnogo nasledi-ya Altaya*, pt. 1. Barnaul: Izd. Alt. Gos. Univ., pp. 69–73.

**Postnov A.V., Kulik N.A. 2004**

Petrograficheskii analiz i osobennosti drevneishikh tekhnologii proizvodstva kamennykh orudii. In *Tezisy dokladov X s'ezda Rossiyskogo mineralogicheskogo obschestva*. St. Petersburg: Izd. St. Petersburg. Gos. Univ., pp. 249–250.

**Postnov A.V., Anoykin A.A., Kulik N.A. 2000**

Criteria for the selection of raw materials in Paleolithic industries of the Anui river basin (Gorny Altai). *Archaeology, Ethnology and Anthropology of Eurasia*, No. 3: 18–30.

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# TECHNOLOGICAL ASPECTS OF PRODUCTION OF SIMBOL ACTIVITY'S ITEMS IN EARLY UPPER PALEOLITHIC COMPLEXES OF BAIKAL REGION*

Prehistoric behavior, which follows certain intellectual actions, methods, and expressions, can be reflected in the production of artifacts. Also, symbols are special units of thought that stand between specific sensible images, material objects, and abstract concepts. The artifacts, which were identified as personal ornamentations, could be categorized as status symbols, individual or group attributes, spiritual items, adornments, and more (d'Errico et al., 2009). Basically, there is evidence that the Paleolithic populations in North-East Asia had an early form of symbolic activities and behavior. The symbolic behavior typical for early *Homo sapiens sapiens* correlates with the Upper Paleolithic context of the Eurasia.

Some basic features in archaeological assemblages of Early Upper Paleolithic that characterize modern human symbolic behavior are: objects having unusual physical or casual/common anthropo- or zoomorphic properties; pigments (ochre, hematite, limonite, etc.) and evidence of their use; marks (notches, retouches, cavities, use-wear traces, and residue on bones, stones, etc.); personal ornaments with decorations (perforated animal teeth, shells, stones, and bone pendants); art works, expressed in different forms (sculpture, painting, and engraving); musical instruments (whistles or flutes made of bird bones, percussion instruments, etc.); intentional burials of animal bones (storage of bones or secondary burials); human burials; evidence of ritual practices (Mellars, 2005; d'Errico et al., 2003, 2009; Bolus and Conard, 2009; Derevjanko, 2009; etc.). The following are the common characteristics of the Early Upper Paleolithic of the Baikal area: presence of ochre, marks, personal ornaments with decoration, musical instruments, sculpture, engraving and burial of animal parts (Lbova, 2011).

The Baikal region is located in a contact zone of different landscapes in Northern and Central Asia. The territory lies within the limits of the Mongolia-Siberian folded mountain belt. Its environment (geological makeup, climate,

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bodies of water, biogeography and landscapes) shows enormous variation. Studies of key geoarchaeological sections have made it possible to reconstruct the environmental conditions of human occupation during the Paleolithic period. Moreover, it helped in the formulation of a general scheme for the major developmental stages of the Nature and Culture in the region. It is important to note that the majority of the sites mentioned above were studied through a variety of scientific disciplines. Also, the results of have been confirmed by various dating methods (Lbova, 2008, 2011).

Recent discoveries of artifact assemblages from the Early Upper Paleolithic indicate the existence of symbolic activity, especially personal ornamentation (Derevjanko, Rybin, 2003; Derevjanko, 2009; Lbova, Vanchaeren, 2011; Lbova, 2011). Currently, the archaeological assemblage of Baikal zone includes more than 100 items made of bones, stones, and shells. The artifacts were unearthed from stratified sites such as Kamenka, Varvarina Gora, Khotyk (Transbaikalia, excavation of L.V. Lbova), Podzvonkaya (Transbaikalia, excavation of V.I. Tashak), Voennyi Hospital, Pereselencheskyi punkt-1 (sub-Baikal region, excavation of D. Chersky, 1871, G.I. Medvedev, and E.A. Lipnina at present); also on the southern border of the Baikal region – Mongolia: Tolbor, Dorolj (Mongolia, excavation of S.A. Gladishev, J. Jaubert).

The main concentration of objects of personal ornamentation is well known in the Sayan-Altay Mountains District, where the objects of this period are include in well-studied cultural complexes, such as Kara-Bom, Denisova Cave, Strashnaya Cave (Altai-region, excavation of A.P. Okladnikov, A.P. Derevianko, V.T. Petrin, M.V. Shun'kov, and A.N. Zenin), Malaya Syia (Sayan-region, excavation of V.E. Larichev and Y.P. Kholushkin). All those sites are dated within the range of 30 000 to 43 000 years (may be more), and are related technologically to the initial stage of the Upper Paleolithic period.

Basic archaeological research utilizes the chronological context (cultural layer, geology sequence, features, etc.), the morphological, technological image of the all artifacts, and the specific of material and processing of the technology items of personal ornamentation. In our case, we want special attention paid to technological aspects of raw material preparation, roughing blanks, its detailed design and ornamentation (in some cases). This study also follows these approaches. We applied the method of use-wear analysis developed by S.A. Semenov and G.F. Korobkova, as well as micro polish wear analysis by L. Keeley, to study artifact function. We also applied the synthesized tracing technique developed by Dr. P.V. Volkov, which was used in the analysis of the Paleolithic and Neolithic archaeological assemblages of North Asia. The study of artifact manufacture and traces of use-wear, along with experimental techniques, allows us to reconstruct the technological process of stone artifact manufacturing (Volkov, Lbova, 2009).

In the course of studying the archaeological assemblage of Khotyk (Western Transbaikalia), dated to 35 000–40 000 to 25 000–28 000 years (Kuzmin et al., 2006; 2011) identified their manufacturing technologies, including flaking, drilling and carving, grinding, and polishing. A number of tools were employed for the manufacture of artifacts: hammer stones, retouches,

bow-shaped and lathe drills, perforators, reamers, engravers, grinding tablets and hide scrapers. Judging by the impact marks on the working surface of the artifacts, advanced tools – such as drills with relatively narrow elaborated working edge – were used. All the remaining tools mentioned above were used in retouching and refining the edges. The time spent for the manufacturing of the examined tools was probably relatively short.

The artifacts can be divided in the following general variants, based on morphology and technology. Provisional classification allows dividing the entire collection of products by function into three groups: jewelry worn under clothing with drilling (beads, pendants, rings, bracelets and tiaras), objects of unknown function (simple and complex shapes, also with decoration) and sculpture (Lbova, 2011).

Variant 1 – simple flat shapes – consists of rounded beads with holes in the center, which are manufactured from different raw materials – stones (rhyolite), bones, tusk, shell (ostrich or bustard), shellfish. These are small flat pieces, about 5–7 to 15 mm in diameter. The holes were usually made by perforators (themselves made from relatively hard material), probably using a bow drill device. The artifacts were then ground with a hard abrasive and polished with soft skin. This form is usually found in Baikal-region assemblages (Kamenka, Podzvonkaya, Khotyk, Voennyi Hospital, and so on) in the beginning of the Upper Paleolithic. It existed for a longer period of time; it is also a characteristic of Mesolithic and Neolithic decorations, as seen at many site collections and assemblages in Eurasia, Africa and America.

As a variety of options there are some forms has the same form as the previous variant, but it differs in size and technology, material – soft stone. This variant – variant 2 – consists of rings with holes of 10–30 mm in diameter. The production process includes drilling and carving of the center hole with an engraver using linear motions. This is followed by reduction along the perimeter. The item is then ground on a coarse-grained abrasive surface through alternating motions. Finally, it is polished on a relatively soft hide. Such items (or fragments of them) were found in Baikal and Altai assemblages.

Next variant – variant 3 – consists of items of oval form made from small and medium pebbles (or from halves of pebbles, made by longitudinal splitting), and blades. These artifacts were manufactured from soft rocks such as talc, agalmatolite and steatite of varying colors (milk-white, yellowish, pink, greenish, and black). It is interesting to note that practically all of the rocks possess the property of iridescence (mother-of-pearl surface), which is enhanced by water. All items were made using a similar technique: reduction of pebble surface (splitting or flattening), polishing of convex surface, and intentional drilling of hole(s) so that the item's lateral is parallel with the hole's rim or its center. Such objects have a crescent form, the shape of letter "C", or horned oval. Also in this group are include simple three-dimensional shape round or square beads or harvesting of ivory, egg shell. But as a rule, there are perforated small pebbles of talc, soapstone, perforated teeth, bones, including tubular.Variant 4 is comprised of flat polished objects with symmetrical shapes that are cut decorated along the edge (Pereselencheskyi

punkt-1, Malaya Syya). Some similarities can be found with the artifacts from the early Upper Paleolithic sites of South Siberia and Dnieper area (Eastern Europe).

Next variant consists of objects made of the cortical bones of birds, representing cylinders with rhythmic notches and with traces of polishing (both on the artifacts and their debitage). Their lengths vary from 3 to 35 mm while the sizes of the rhythmic marks made with a graver range from 1 to 2 to 5 to 7 mm. The notches and the cuttings, distinguishable technologically, have a clear geometrical rhythm of intervals and form various compositions of graphic lines (Kamenka A, Denisova Cave, Podzvonkaya, and so on).

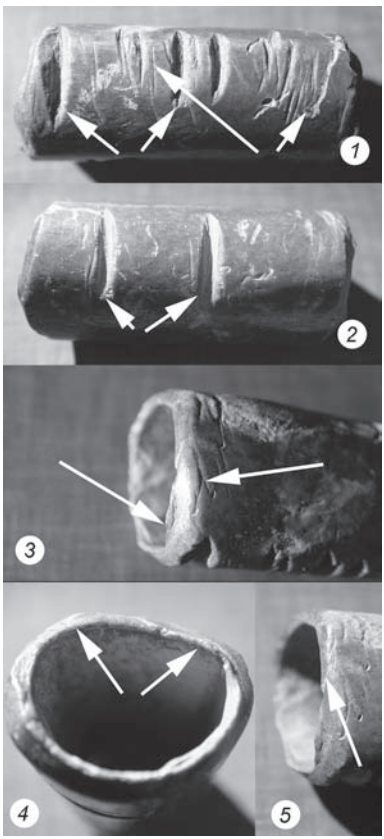


*Fig. 1.* Kamenka-site (A). Ornamented whistle of the tubular bones.

*1, 2* – a general view of the product with two types of technology cuts; *3* – slicing tracks produced before the tubular bone was broken; *4* – polish location at the end of the entire circumference of the product; *5* – polish location on one of the ends of the tubular goods.

According to opinion of Dr. P. Volkov, considered an artifact is part of the tubular bones, which was fragmented by using a tool with a relatively narrow, typical of a knife, cutting working edge. Operating the tool back and forth and it is typical for such a process as a cut. The formation of the channel is not adjusted to cut the bone perforation, fragmentation of which was completed at the end of parts of the product. Technology of deep parallel scratches on the two side sections are not established, but it is likely that their formation was produced by the same instrument and method that was used and the fragmentation of the bone. By the footsteps of recycling products include sites polish on one of the ends of the tubular item adjacent areas. Judging by the nature of the surface, this polish could be formed by contact with a relatively soft, resilient organic matter (Fig. 1).

Early, we assumed that the major products can be decoration bead. Today, our ideas have changed. We believe that such objects or fragments of them can be interpreted as whistles. This assumption is confirmed trasological (micro wave) and functional analysis (Kozhevnikova et al., 2011).

Several unique artifacts with different geometrical forms and morphological features form a special group. The group includes a unique elongated

pendant with central biconical hole, radial incisions on the “head,” and an ornamented “body” that resembles an anthropomorphic figurine (Khotyk, level 2) (Fig. 2). The other artifacts are a figurine pendant with a notched decoration along the edge and a biconical hole (Pereselencheskyi punkt 1), and a squarish bone bead (Strashnaya Cave, Tolbor). Decorated stone pendants appear in the archaeological collection dated between 25–30 ky (Khotyk, level 2, Pereselencheskyi punkt 1). A sense of rhythm, counting, and abstraction, demonstrated through graphic marks, point to the generated area of elementary

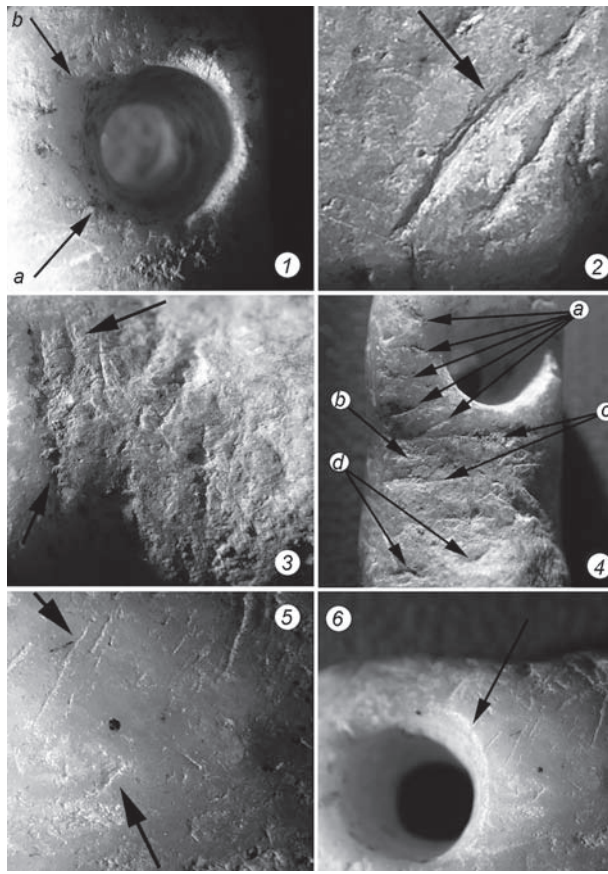


*Fig. 2.* Hotyk-site, layer 2. Micro traces on the surface of the artifact (pendant).

*1* – traces of the reamer (beginning and end of the stroke tool); *2* – traces of the contact of burin on the outer surface of the treated pendant; *3* – traces of the work of burin with a sample of the material in a transverse recess on the outer side of the pendant; *4* – zone of the using of the burin on the outer surface of the pendant: *a* – “engraved” radial cuts around the opening of the pendant, *b* – in the area of picking out a broad “cross-deepening” of the artifact, *c* – linear delineation of the border “of deepening cross”, *d* – the formation of a speaker of relief at the bottom of the pendant. (Photo and analysis by Dr. P. Volkov, 2010).

aesthetic perception of reality. There are various analogies in a wide chronological and territorial context.

However, the use of decorations did not occur in the earlier assemblages, dating between 35 000 and 40 000 years. A considerably primitive type of decorative pattern is evident; it is characterized by regular notches that shape or alter the basic elements of the item. By treating the decorative pattern as a special form of art, one can argue that it is the most expressive, clear, and frequent method used to express abstractions on objects in the classic stage of the Upper Paleolithic.

It should be noted, the initial stage of product ornamentation of the Upper Paleolithic is a rare phenomenon. The decor is found in complexes Khotyk, level 2 (Volkov, Lbova, 2009), Malaya Syya (Kholyushkin, 2009), Podzvonkaya (Tashak, 2009), Pereselenchesky punkt 1 (Gerasimov's site). In these cases, the recorded version of the ornament is fairly simple – regular notch, radial drawing up the body or elements of the product (flat and three-dimensional versions). Interior decoration and morphology of the product and assumes special interest to the entire cultural complex of monuments. It should be noted technological stability decorating items, the completeness of the composition and shape as a whole.

The highlighted elements of the decorative pattern correlate with the anthropomorphous elements of the "Gravettian Venus". Among the known samples of cultural communities (Pavlov – Villendorf – Kostenki – Avdeevo) the following parts of clothing were ornamented: bosoms, belts, and caps. It can be assumed that anthropomorphism appeared, as shown by the belt image on an object from Khotyk (level 2) on the bosom and a hair-do image (or a cap). The discovery of such ancient ornamented items is a unique occurrence in the Paleolithic period in Siberia. The decorative elements and morphology of the pendants add to the importance and relevance of the Khotyk and Pereselencheskiy punkt-1 site assemblages for the Upper Paleolithic.

The decorative patterns on bone items from Siberian sites – such as Voenniy Hospital, Malta, Ostrovskaya (Stoyanka Talickogo), Achinskaya sites, and others – include: spirals on the surface that were made with stroke-ornamented technique, and spiral lines, girded stems, wave and parallel lines that were made in a thin continuous line. These designs demonstrate a diversity and variability in geometric form. Compositions of flat pit-point rows, regular rhythmic cuttings, oblique and straight lines, chevrons, zigzags, filling certain surfaces and belts are numerous. The organized decorative pattern adorns bone and tusk items, disks and laminates, spatulas and awls, and the so-called "rod of chiefs" artifacts of Upper Paleolithic in Eurasia (Abramova, 1995).

## CONCLUSION

The decorative complex, along with the evidence of symbolic behavior, sets the early stage of the culture formation of early modern man in the Baikal region to approximately 35 000–40 000 years ago. The early Upper Paleolithic materials in Siberia fit into the regional context. The appearance of decorative

traditions in the Early Upper Paleolithic accompanies the development of early figurative art and numerous other innovations, including a wide array of new forms of personal ornaments, and new litho and organic-material technologies. These artifacts indicate the presence of an advanced manufacturing and processing system for the most ancient assemblages of objects in North-East of Eurasia. The evidence of symbolic activity in the lives of early Upper Paleolithic people does not directly suggest a more effective subsistence economy and greater reproductive fitness. However, viewed in a wider behavioral context, early Upper Paleolithic symbolic activities could have contributed to the maintenance of larger social networks, and have helped facilitate the demographic and territorial expansion of modern humans in Siberia in relation to the culturally more conservative and demographically more isolated populations.

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## REFERENCES

**Abramova Z.A. 1995**

L'art paléolithique d'Europe orientale et de Sibérie. Grenoble: Ed. Jérôme Millon.

**Bolus M., Conard N.J. 2009**

What can we say about the spatial-temporal distribution of early Aurignacian innovations? *Eurasian Prehistory*, vol. 5: 19–29.

**D'Errico F. et al. 2003**

Archaeological evidence for the emergence of language, symbolism, and music – an alternative multidisciplinary perspective. *Journal of World Prehistory*, vol. 17: 1–70.

**D'Errico F., Vanhaeren M., Henshilwood C., Lawson G., Maureille B., Gambier D., Tillier A., Soressi M., van Niekerk K. 2009**

From the origin of language to the diversification of languages: What can archaeology and palaeoanthropology say? In *Becoming Eloquent: Advances in the emergence of language, human cognition, and modern cultures*. Amsterdam: John Benjamins Publishing Company, pp. 13–68.

**Derevianko A.P. 2009**

The Middle to Upper Paleolithic transition and formation of *Homo sapiens sapiens* in Eastern, Central and Northern Asia. Novosibirsk: Izd. IAE SB RAS.

**Derevjanko A.P., Rybin E.P. 2003**

The earliest manifestation of symbolic activity of Paleolithic man in the Gorny Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 15, iss. 3: 27–50.

**Kholyushkin Y.P. 2009**

Malaya Syya-site – early stage of the Upper Paleolithic of Siberia (the problem started a culture of *Homo sapiens* in North Asia). In *Astroarheologiya – natural-scien-*

*tific tool for learning protoscience and astral religions of priests of the ancient cultures of Khakassia*. Krasnoyarsk: Krasnoyarsk Univ. Press, pp. 137–145.

**Kozhevnikova D.V., Lbova L.V., Volkov P.V. 2011**

Simple type of earphones in complexes of Upper Paleolithic (materials of Transbaikal zone). *Vestnik of Novosibirsk State University. Ser.: History and Philology*, vol. 10, iss. 5: Archaeology and ethnography, pp. 155–161.

**Kuzmin Y.V., Lbova L.V., Jull T.A.J., Cruz R.J. 2006**

The Middle-to-Upper-Paleolithic Transition in Transbaikal, Siberia: The Khotyk Site Chronology and Archaeology. *Current Research*, vol. 23: 23–26.

**Lbova L. 2008**

Problems of dating of the Upper Palaeolithic in the Transbaikal region. In *The current issues of Paleolithic studies in Asia*, A.P. Derevianko, M.V. Shunkov (eds.). Novosibirsk: IAET SB RAS, pp. 78–82.

**Lbova L. 2011**

Evidence of the Modern Human Behavior in the Baikal zone during Early Upper Paleolithic period. *Bulletin of the Indo-Pacific Prehistory Association*, vol. 30: 9–13.

**Lbova L., Vanchaeren M. 2011**

Systems of personal ornamentation in the context of variability in the early Upper Paleolithic cultures in Eurasia. *Archeology of South Siberia*, vol. 25: 36–40.

**Marshack A. 1972**

Upper Paleolithic notation and symbol. *Science*, vol. 178: 40–63.

**Mellars P., 2005**

The Impossible Coincidence A Single – Species model for the Origins on Modern Human Behavior in Europe. *Evolutionary Antropology*, vol. 14: 12–27.

**Tashak V.I. 2009**

Symbolism in the early Upper Paleolithic in western Transbaikalia. *Notes of IMMK. Academy of Sciences*. No 4: 50–62.

**Volkov P.V., Lbova L.V. 2009**

Manufacturing technology wearable jewelry at an early stage of the Upper Paleolithic (based on the western Transbaikal-region). *Vestnik of Novosibirsk State University. Ser.: History and Philology*, vol. 8, iss. 5: Archaeology and ethnography, pp. 62–73.

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# THE MIDDLE TO LATE PLEISTOCENE *MACAQUE* FOSSILS FROM CENTRAL KOREA

## INTRODUCTION

Macaque monkeys, of the genus *Macaca* (family Cercopithecidae, subfamily Cercopithecinae), are widely distributed in South-Southeast-East Asia and in restricted areas of northwest Africa (Delson, 1980; Fa, 1989; Hoelzer and Melnick, 1996). They originated on the African continent during the Late Miocene, and then invaded Eurasia as early as the latest Miocene (ca. 6–5 Ma), diverging into the European and Asian clades (Delson, 1975, 1980, 2000; Takai, 2005). The extant genus *Macaca*, consisting of 20–22 species, has traditionally been divided into four species groups (the *sylvanus*, *silenus*, *sinica*, and *fascicularis* groups), based mainly on tail length and the morphological features of the genital organs (Fooden, 1980; Delson, 1980). This species group classification is supported by recent molecular biological studies (e.g., Morales and Melnick, 1998; Tosi, Morales and Melnik, 2000, 2003; Deinard and Smith, 2001; Li and Zhang, 2005; Li et al., 2009).

Among these species groups, the *sylvanus* group, which includes only one extant species, *M. sylvanus*, inhabits the northwest part of Africa, whereas the other three species groups are distributed in South-Southeast-East Asia. The *fascicularis* group, which consists of *M. fascicularis*, *M. fuscata*, *M. mulatta*, and *M. cyclopis*, is widely distributed in the temperate to tropical zones of East to Southeast Asia. Within this group, the latter three species, *M. fuscata*, *M. mulatta*, and *M. cyclopis*, are more closely related to each other than to *M. fascicularis*. It is generally recognized that *M. fuscata* (the Japanese macaques) and *M. cyclopis* (the Taiwanese macaques) diverged from *M. mulatta* after they invaded the Japanese and Taiwan islands, respectively, in the Early to Middle Pleistocene (Tosi, Morales and Melnik, 2003; Fooden and Aimi, 2005; Li et al., 2009; Chang, Takai, Ogino, 2012).

In contrast, the classification of the fossil macaques in East Asia is still confused. Most of these fossils were discovered in China and have been traditionally classified into two species based on tooth size: *M. anderssoni*, the larger species, and *M. robustus*, the smaller one (e.g., Schlosser, 1924; Young, 1934; Szalay and Delson, 1979; Delson, 1980; Jablonski, 2002). Most fossil specimens discovered in China are usually identified as *M. robustus*

based on tooth size. However, there is no distinct gap in tooth size (most of them are isolated teeth) between the two species, so some researchers insist that they should be treated as the same species, *M. anderssoni*, according to the priority rule (e.g., Jablonski, 2002). Although some workers have advocated new species, such as *M. peii* and *M. jiangchuanensis* (Fang, Gu and Jia, 2002; Fang and Gu, 2007; Pan et al., 1992; Jablonski, 1993), the morphological features of these species are not sufficiently distinct to establish their specific status, and these species are not widely accepted. Although the macaque fossils discovered in the Late Pleistocene and Holocene sediments of China are often identified as an extant species, such as *M. mulatta* or *M. arctoides* (e.g., Gu et al., 1996), the morphological differences between these extant species and *M. robustus* are not well described and their specific identification is rather unreliable (Fooden, 2000). In this paper, we use just three fossil species for our comparison: *M. anderssoni*, *M. robustus* (including *M. jiangchuanensis*), and *M. peii*.

At present, there are no living macaque monkeys on the Korean Peninsula, but many macaque fossils have been reported from Middle to Late Pleistocene archaeological sites (e.g., Sohn, 1984; Park and Lee, 1998). All these Korean fossils have been described as *M. robustus*, but no detailed descriptions of the fossil specimens have been made in which they are compared with living East Asian species. It is widely accepted that the Pleistocene macaques inhabiting the Asian continent invaded the Japanese islands through the Korean Peninsula when the sea level fell sufficiently to connect the Japanese islands with the mainland, and became the Japanese macaques, *M. fuscata* (Fooden and Aimi, 2005).

Therefore, it is important to compare the Pleistocene Korean macaques with living Japanese macaques because these Korean macaques may be members of the ancestral groups of the Japanese macaques. In this paper, we examine the macaque fossils discovered in two Pleistocene archaeological sites in central Korea (Durubong cave and Gunang cave) and compare them with fossil species from China (*M. anderssoni*, *M. robustus*, and *M. peii*) and some living species from East Asia (*M. fuscata* and *M. mulatta*).

Although some macaque fossils have also been reported in South Korea (layer 3 of the Kum-gul site, layers 4–6 of the Chommal Yong-gul site, and the fourth unit of the Guem-gul site) and in North Korea (Komummoru site) (Lee and Cho, 2004, 2005; Sohn, 1984; Nelson, 1993), these materials are not examined in this work.

## MATERIALS AND METHODS

All the macaque fossils examined in this study are housed at the Chungbuk National University Museum (Lee, 1984; Lee and Cho, 2004, 2005): three specimens from the Middle to Late Pleistocene sediments of the Durubong (= Turubong) cave site, Cheongwon, near the city of Cheongju, Chungcheongbuk-do (Chung-dae 12, Chiot-u 2, Chung-dae 1590) and eight specimens from the Late Pleistocene cave sediments of the Gunang (= Kunang) cave site,

Danyang region, eastern part of Chungcheongbuk-do (Chung-dae 1-71, Chung-dae 108, OH8-22-2 954, Gu-1300, OH8-22-2 507, Gu-628, Gu-511).

Among the Durubong specimens, Chung-dae 12 and Chiot-u 2 were collected from the same cave and are considered to be about 200,000 years old, whereas Chung-dae 1590 was discovered in another cave (the Cheonyo cave) and is considered to be about 300,000 years old, slightly older than other specimens in the Durubong cave. Chung-dae 12 is the facial part of a male skull, in which the left $I^2$–$M^3$ and right $I^2$ are preserved. Chiot-u 2 consists of two mandibular fragments from the same individual: the right mandible with $C_1$–$M_3$ (Chiot-u 2-1) and the left mandible with $M_3$ and a distal fragment of $M_2$ (Chiot-u 2-2). Judging from the canine size, it is from an old female, and all the teeth are strongly worn. Chung-dae 1590 is a nearly complete adult female mandible in which the left $I_2$–$M_3$ and right $I_2$–$M_2$ are preserved; all these teeth are strongly worn.

The Gunang specimens are estimated to be 250,000–50,000 years old. Chung-dae 1-71 is an adult female mandible in which the right $C_1$–$M_3$ are preserved; all these teeth are too worn to observe their detailed morphology. Chung-dae 108 is an isolated right $M^3$, which is less worn. OH8-22-2 954 is a partial fragment of the frontal bone, preserving the upper rims of the left and right orbits, where shallow supraorbital incisures can be seen. Gu-1300 is an isolated left $M^1$, the lingual cusps of which are slightly worn. OH8-22-2 507 is an isolated right $P^4$, which is slightly worn. Gu-628 is an isolated right $M_2$, which is not very worn, but the enamel may be chemically damaged. Gu-511 is an isolated right female $P_3$, and Gu-527 is an isolated, slightly worn right $M_1$.

All the fossil specimens were identified as *Macaca* based on their overall structure, and only Chung-dae 12 was identified as a male tooth based on its mesiodistally elongated, typical sectorial tooth form. However, most teeth display a strongly worn condition, suggesting a diet of fibrous materials in a relatively poor, deteriorated environment.

## DENTAL MORPHOLOGY AND ACCESSORY CONULES

The upper and lower molars of macaque monkeys retain four main cusps ($M^{1–3}$, $M_{1–2}$) or five cusps ($M_3$). The two mesial and distal cusps are connected respectively by distinct two transverse ridges (= lophs), which is called “bilophodonty”. In addition to these main cusps, some accessory conules (or cusps) occasionally occur on the molars, and some researchers have studied the patterns and occurrence rates of these accessory conules in living macaques (Saheki, 1966; Swindler, 2002). For example, on the upper molars, accessory conules occasionally appear at the distal margin (“distoconulus”), at the base of the median lingual groove (“interconulus”), or at the mesiolingual base (“Carabelli’s cusp” or “mesiolingual notch/cingulum”).

The mesiolingual notch/cingulum is usually called “Carabelli’s cusp” in dental anthropology because the stylate conule often occurs at the mesiolingual cingulum in human teeth. However, in macaque monkeys, this morphol-

ogy seldom occurs, although a kind of notch with the cingulum occasionally appears at the mesiolingual base of the tooth. In contrast, in the lower molars, accessory conules occasionally appear at the distolingual margin ("6th cusp" or "tuberculum sextum") or at the median lingual groove ("7th cusp" or "tuberculum intermedium").

A distinct notch also sometimes occurs at the mesiobuccal base of the lower molars. In this study, we recorded the patterns of accessory conules on the upper and lower molars of the Korean fossil specimens and compared them with those of some living and fossil *Macaca* species.

In Chung-dae 12 (facial part of a cranium), there is neither a distoconulus nor an interconulus on $M^1$ or $M^2$, but there is a small mesiolingual notch with a rudimentary cingulum. On $M^3$, there is a large distoconulus in the distobuccal area, a small conule between the metacone and distoconulus, three tiny conules (interconulus) at the base of the deep median lingual groove, and a distinct mesiolingual notch with a small cingulum, which is less well developed than on $M^2$. Both $P^3$ and $P^4$ are bicuspid, and a cylindrical concavity is present between the left $P^3$ and $P^4$. The upper canine is strongly worn, with a deep mesial groove continuing to the tooth base, and the distal conule is well developed, forming a heel-like structure. The lateral incisors ($I^2$) are strongly worn and the labial enamel is well developed. Unfortunately, both central incisors are missing.

In Chung-dae 108 (right $M^3$), a large distoconulus is present on the midline of the tooth, there is no interconulus, and a small but distinct notch is present at the mesiolingual base. The tooth is mesiodistally elongated by the development of the distoconulus.

OH8-22-2 507 (right $P^4$) is bicuspid with a shallow distolingual notch. On Gu-1300 (left $M^1$), neither an interconulus nor a distoconulus is present, but there is a small mesiolingual notch. On Gu-628 (right $M^2$), there is neither an interconulus nor a distoconulus, although the detailed morphology cannot be seen because the lingual enamel of the tooth is flaking. A rudimentary small notch may have been present at the mesiolingual base, but this is unclear.

In Chung-dae 1590 (nearly complete mandible), the buccal cingulum is well developed on $M_2$ and $M_3$, and a 6th-cusp-like structure is observed on the left $M_3$, although the tooth is strongly worn. In Chung-dae 1-71 (right mandible), $M_2$ and $M_3$ have a distinct buccal cingulum, and $M_3$ probably has rudimentary 6th and 7th cusps, although all the teeth are strongly worn. In Chiot-u 2 (right and left mandibular fragments), all the teeth are too worn to observe their basic structures. Gu-511 (right female? $P_3$) has a large protoconid with a much smaller, bicuspid metaconid, with a small but moderately deep talonid basin. Gu-527 (right $M_1$) is too worn to observe any morphological features.

As mentioned above, the two $M^3$ specimens retain a strongly developed distoconulus, suggesting a strong tendency for the occurrence of accessory cusps on the upper molars, although there are only two samples. Another specimen (No. 947) from Durubong Cave 2 clearly has a large distoconulus on $M^3$ (Lee, 1984, p. 270, fig. 106), although it was not observed directly in this study.

## COMPARISON OF TOOTH SIZES

We compared the tooth sizes of the Korean fossils with those of some fossil (*M. anderssoni*, *M. robustus*, *M. peii*) and living (*M. mulatta*, *M. fuscata*) species from East Asia. The specimens of *M. peii*, which were discovered in the Early Pleistocene of Hubei Province, southern China, consist of only the lower dentition, but they are much larger than the teeth of *M. anderssoni* (Fang, Gu, Jia, 2002; Fang and Gu, 2007). Most of the specimens were measured directly by one author (M.T.) using a digital caliper and some data on the fossil materials are taken from the following literature (Fang and Gu, 2007; Fang, Gu, Jia, 2002; Gu, 1980; Jablonski, Pan, Zhang, 1994; Museum..., 1986; Pan et al., 1992; Qiu, Peng, Wang, 2004; Qiu and Zheng, 2009; Takai, 2005; Teilhard de Chardin and Pei, 1941; Young, 1934; Zhang, Jin, Takai, 1993; Zhang, 2010).

All tooth sizes of the Korean specimens fall within the range variations of the five species compared; they are especially similar to those of *M. fuscata* and *M. robustus*, but show a different pattern in the relative tooth sizes of the upper and lower dentitions. An extremely mesiodistally short lower central incisor (Chun-dae 1590) is considered to be the result of wear on the tooth. A tiny lower canine of Chung-dae 1590 is from a small female individual.

The upper premolars ($P^3$ and $P^4$) are relatively large, larger than the variation ranges for *M. fuscata* and *M. mulatta*, but the sizes of $P_3$ and $P_4$ fall within the ranges of the two species. Therefore, there is no significant difference in the sizes of the anterior teeth (incisors, canines, premolars) between the Korean fossils and the specimens compared.

Compared with the lower molars, the upper molars in the present specimens are relatively large. $M^2$ and $M^3$ of Chung-dae 12 (Durubong) are much larger than those of *M. robustus* but similar to those of *M. anderssoni*. However, the sizes of the two $M^2$ specimens fall within the ranges of *M. fuscata*, *M. mulatta*, and *M. robustus*. In the Korean fossil macaques, as a whole, the anterior upper and lower teeth (incisors, canines, premolars) and the lower molars are relatively small, whereas the upper molars are very large. In particular, the mesiodistal length of $M^3$ is very large, probably because of the development of an additional accessory conule, the distoconulus.

The upper teeth of the facial specimen (Chung-dae 12) from Durubong are almost the same size as those of the type specimen of *M. anderssoni*, the larger fossil macaque from China. However, the lower teeth, especially $M_3$, are much smaller than those of the specimens identified as *M. anderssoni*. Although the upper and lower dentitions from Durubong are not from the same individual, the mandibular specimens appear too small for *M. anderssoni*. Moreover, the facial specimen from Durubong (Chung-dae 12) differs from the type specimen of *M. anderssoni* (PMU M3651) in having a much shorter and higher snout. The superficial morphology of Chung-dae 12 appears more similar to that of *M. fuscata* than to that of *M. anderssoni*.

## DISCUSSION

### Comparisons with extinct and extant macaques from China

The sizes of the tooth specimens from the Korean macaque fossils are very similar to those of *M. fuscata* and *M. robustus*, although $M^2$ and $M^3$ are larger than in those two species and are similar to those of *M. anderssoni*. In contrast, the lower dentition is obviously much smaller than that of *M. anderssoni* or *M. peii*. Therefore, judging from the tooth sizes, it is plausible that the Korean macaques are neither *M. anderssoni* nor *M. peii*, but are likely to belong to a single medium-sized species with relatively large upper molars and small lower dentition.

The occurrence rates of accessory cusps in macaque molars have been studied previously. Because the dentition of living macaques is so similar between species, it is very hard to identify a species based on dental specimens alone, and especially from isolated molars. However, the occurrence rates of accessory cusps may be an effective morphological feature for the identification of some macaque species. Saheki (1966) studied the occurrence rates of accessory cusps in three macaque species (*M. fuscata*, *M. fascicularis*, and *M. cyclopis*): the distoconulus, interconulus, and Carabelli's tubercle (= mesiolingual notch) on the upper molars and the 6th and 7th cusps on the lower molars.

He concluded that the frequency of such accessory cusps is very low in *M. fascicularis*, whereas it is relatively high in *M. fuscata* and *M. cyclopis*. For example, the occurrence rate of the $M^3$ distoconulus is 5.0 % for both "type L" (distobuccal accessory cusps) and "type B" (distolingual accessory cusps) in *M. fascicularis* (N = 181), whereas it is 36.7 % for type L and 40.8 % for type B in *M. fuscata* (N = 49), which includes the two subspecies of *M. fuscata* (Saheki, 1966, table 6). Later, Swindler (2002) reported the occurrence rates of accessory cusps in other macaques, following Saheki's studies: the occurrence rate of the $M^3$ distoconulus is 10 % in *M. nemestrina* (N = 135), 4 % in *M. fascicularis* (N = 115), and 0 % in *M. mulatta* (N = 173). Thus, the occurrence rate of the $M^3$ distoconulus is apparently much higher in *M. fuscata* than in other East Asian macaque species.

In the fossil materials from East Asia, the type specimen of *M. anderssoni* (PMU M3651), a nearly complete cranium, has neither a distoconulus nor an interconulus on the upper molars. Another cranial fossil, *M. speciosa subfossilis*, from the Late Pleistocene of northern Vietnam, also has neither a distoconulus nor an interconulus (Jouffroy, 1959; Fooden, 1990; Ito et al., 2009). Ito et al. (2009), discussed the phylogenetic positions of these fossil macaques based on a morphological analysis of the inner structure of the snout (the morphology of the nasal cavity and maxillary sinus), using X-ray computed tomography. They concluded that both *M. anderssoni* and *M. speciosa subfossilis* belong not to the *fascicularis* group, which includes *M. fascicularis*, *M. mulatta*, *M. cyclopis*, and *M. fuscata*, but to the *sinica* group, which includes *M. arctoides*, *M. assamensis*, *M. thibetana*, and *M. radiata*.

The combination of the absence of accessory cusps and the inner structure of the snout in *M. anderssoni* and *M. speciosa subfossilis* suggests that the Korean macaques are not closely related to these two fossil species from East Asia. Unfortunately, there are few descriptions of the occurrence of accessory cusps in the fossil specimens of *M. robustus*, so it is difficult to discuss the relationships between *M. robustus* and the Korean macaques.

In summary, the combination of dental sizes and the occurrence rates of accessory cusps in the Korean macaques, together with the geographic position of the Korean Peninsula, strongly suggests that the Korean fossil macaques are more closely related to *M. fuscata* than to *M. mulatta* or *M. fascicularis* among living species and are far related to M. anderssoni and M. peii among fossil species. They probably belong to the Pleistocene ancestral group of *M. fuscata*, which became extinct in the Late Pleistocene in northeast continental Asia in response to global cooling and environmental deterioration in the Quaternary glacial stage.

## Comparison with macaque fossils in the Japanese islands

In Japan, fossil specimens of *M. fuscata* have been found in Honshu, Shikoku, Kyushu, and Yakushima islands from the late Middle Pleistocene (e.g., Fooden and Aimi, 2005; Nishioka et al., 2011). At present, it is widely accepted that the oldest macaque fossil in Japan is an isolated $M_3$ discovered in late Middle Pleistocene fissure fillings from the Ando quarry, Yamaguchi Prefecture, western Japan (Iwamoto and Hasegawa, 1972). The age of this specimen is unclear but is estimated to be about 400,000 years old based on the small mammal fossils collected from the same site (Fooden and Aimi, 2005). It is interesting that distinct 6th and 7th cusps are present on this $M_3$ specimen (Iwamoto and Hasegawa, 1972).

Another interesting macaque fossil from Japan is a nearly complete cranium (No. 287) discovered in Late Pleistocene to early Holocene fissure fillings of the Shikimizu limestone quarry, Ehime Prefecture, Shikoku Island, western Japan (Iwamoto, 1975). Although Iwamoto (1975) considered it an intermediate form between *M. robustus* and *M. fuscata* based on the superficial morphology of the cranium, Ito (2012) recently revealed with a geometric morphometric analysis that the facial morphology of the Shikimizu skull falls within the variation range of living *M. fuscata*. In terms of its accessory cusps, $M^3$ retains a distinct mesiolingual notch and probably a distoconulus-like structure, although all the teeth are too worn to confirm their exact morphology. Another mandibular specimen (No. 278) discovered from the same locality in Shikimizu seems to retain the 6th and 7th cusps on $M_3$, although all the teeth are too worn to confirm their original condition.

In Shikoku Island, several macaque fossils have been discovered at the Kamikuroiwa locality, an archaeological site of the Incipient to Initial Jomon Period (Anezaki et al., 2009). Among the fossil materials from Kamikuroiwa, one mandibular specimen (Kamikuroiwa-A) is relatively large, retaining a large 6th cusp on $M_3$ and small but distinct 7th cusps on $M_2$ and $M_3$. Although we

have not yet gathered enough statistical data on the occurrence rates of accessory cusps in the Japanese fossil macaques, the fossil specimens in western Japan tend strongly to have accessory cusps on their molars.

It is interesting that these accessory cusps are often observed in fossil materials from western Japan. Kawamoto et al. (2007), analyzed the phylogeography of the mitochondrial DNA (mtDNA) of the Japanese macaques. They demonstrated that the Japanese macaques can be divided into two main clades, the western and eastern clades, and that the establishment of the ancestral population occurred earlier for the former than for the latter clade. The occurrence of accessory cusps on the fossil specimens from western Japan may be relevant to the phylogenetic analysis by Kawamoto et al. (2007). It should be informative to examine the differences in the occurrence rates of accessory cusps among the local population groups of Japanese macaques, and to compare them with the Pleistocene macaque fossils of China and Korea.

It is generally accepted that during the Pleistocene, the Korean Peninsula and western Japan were connected many times when the sea level became sufficiently low during glacial periods. Most of the animals and plants that are presently distributed in Japan may have invaded the Japanese islands from the Asian continent through the Korean Peninsula (e.g., Dobson and Kawamura, 1998). It is presumed that *M. fuscata* invaded the Japanese islands from the Asian continent, together with other land mammals, through the Korean Peninsula, probably in the Middle Pleistocene, based on the fossil records of the macaque monkeys.

The morphological similarities between the macaque fossils on the Korean Peninsula and in the Japanese islands support the hypothesis that they belong to the same ancestral stock of *M. fuscata*, which was probably distributed in northeast China during the Middle to Late Pleistocene. Recent molecular biological studies also support the hypothesis (e.g., Kawamoto et al., 2007) that the ancestral group of the Japanese macaques originated in northern China and invaded the Japanese islands through the Korean Peninsula during the Middle Pleistocene.

However, morphological analyses of fossil crania from northern China (*M. anderssoni*) and northern Vietnam (*M. speciosa subfossilis*) have revealed that both species belong not to the *fascicularis* group but to the *sinica* group, suggesting a turnover event in the macaque species in East Asia during the Pleistocene (Ito et al., 2009; Ito, 2012). It will be necessary to undertake a fundamental review of the macaque fossils that have been provisionally identified as "*M. robustus*" to shed new light on the evolutionary processes of the macaques in East Asia.

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## REFERENCES

**Anezaki T., Yoshinaga A., Sato T., Nishimoto T. 2009**

Animal bones. In *Study of the Kamikuroiwa Site in Ehime Prefecture*, H. Harunari and K. Kobayashi (eds.). Pp. 325–342. (Bulletin of the National Museum of Japanese History, No 154).

**Chang C.H., Takai M., Ogino S. 2012**

First discovery of colobine fossil from the middle Pleistocene of southern Taiwan. *Journal of Human Evolution*, vol. 63: 439–451.

**Deinard A., Smith D.G. 2001**

Phylogenetic relationships among the macaques: evidence from the nuclear locus NRAMP1. *Journal of Human Evolution*, vol. 41: 45–59.

**Delson E. 1975**

Evolutionary history of the Cercopithecidae. In *Approaches to Primate Paleobiology*, F. Szalay (ed.). Pp. 167–217. (Contributions to Primatology, vol. 5).

**Delson E. 1980**

Fossil macaques, phyletic relationships and a scenario of deployment. In *The Macaques: Studies in Ecology, Behavior and Evolution*, D.G. Lindberg (ed.). New York: Van Nostrand Reinhold, pp. 10–30.

**Delson E. 2000**

Cercopithecinae. In *Encyclopedia of Human Evolution and Prehistory*, E. Delson, I. Tattersall, van J.A. Couvering, A.S. Brooks (eds.). New York: Garland Publishing Inc., pp. 166–171.

**Dobson M., Kawamura Y. 1998**

Origin of the Japanese land mammal fauna: allocation of extant species to historically-based categories. *Daiyonki Kenkyu (Quaternary Research)*, vol. 37: 385–395.

**Fa J.E. 1989**

The genus *Macaca*: a review of taxonomy and evolution. *Mammal Review*, vol. 19(2): 45–81.

**Fang Y.S., Gu Y.M. 2007**

Primates. In *The Early Pleistocene Mammalian Fauna at Tuozi Cave, Nanjing, China*. Beijing: Science Press, pp. 20–24 (in Chinese with English summary).

**Fang Y.S., Gu Y.M., Jia W.Y. 2002**

A new species of fossil monkey from Tangshan, Nanjing. *Longgupo Prehistory and Culture*, vol. 4: 11–15 (in Chinese with English abstract).

**Fooden J. 1980**

Classification and distribution of living macaques (*Macaca* Lacepede, 1799). In *The Macaques: Studies in Ecology, Behavior and Evolution*, D.G. Lindburg (ed.). New York: Van Nostrand Reinhold, pp. 1–9.

**Fooden J. 1990**

The bear macaques, *Macaca arctoides*: a systematic review. *Journal of Human Evolution*, vol. 19: 607–686.

**Fooden J. 2000**

Systematic review of the rhesus macaques, *Macaca mulatta* (Zimmermann, 1780). *Fieldiana Zoology*, vol. 96: 1–180.

**Fooden J., Aimi M. 2005**

Systematic review of Japanese macaques, *Macaca fuscata* (Gray, 1870). *Fieldiana Zoology (New Series)*, vol. 104: 1–200.

**Gu Y.M. 1980**

A Pliocene macaque's tooth from Hubei. *Vertebrata PalAsiatica*, vol. 18(4): 324–326 (in Chinese with English abstract).

**Gu Y.M., Huang W.B., Chen D.Y., Guo X.F., Jablonski N.G. 1996**

Pleistocene fossil primates from Luoding, Guangdong. *Vertebrata PalAsiatica*, vol. 34(3): 235–250 (in Chinese with English abstract).

**Hoelzer G.A., Melnick D.J. 1996**

Evolutionary relationships of the macaques. In *Evolution and Ecology of Macaque Societies*, J.E. Fa, D.G. Lindburg (eds.). Cambridge: Cambridge Univ. Press, pp. 3–19.

**Ito T. 2012**

External and internal craniofacial morphology of Asian macaques and its evolutionary and paleobiogeographic implications. Ph.D. Thesis (Kyoto Univ., Kyoto, Japan).

**Ito T., Nishimura T.D., Senut B., Koppe T., Treil J., Takai M. 2009**

Reappraisal of *Macaca speciosa subfossilis* from the Late Pleistocene of northern Vietnam based on the analysis of cranial inner structure. *International Journal of Primatology*, vol. 30: 643–662.

**Iwamoto M. 1975**

On a skull of a fossil macaque from the Shikimizu limestone quarry in the Shikoku District, Japan. *Primates*, vol. 16(1): 83–94.

**Iwamoto M., Hasegawa Y. 1972**

Two macaque fossil teeth from the Japanese Pleistocene. *Primates*, vol. 13(1): 77–81.

**Jablonski N.G. 1993**

Quaternary environments and the evolution of primates in East Asia, with notes on two new specimens of fossil Cercopithecidae from China. *Folia Primatologica*, vol. 60: 118–132.

**Jablonski N.G. 2002**

Fossil Old World monkeys: the late Neogene radiation. In *The Primate Fossil Record*, W.C. Hartwig (ed.). Cambridge: Cambridge Univ. Press, pp. 255–299.

**Jablonski N.G., Pan Y.R., Zhang X.Y. 1994**

New fossil cercopithecid remains from Yunnan Province, People's Republic of China. In *Current Primatology*, B. Thierry, J.R. Anderson, J.J. Roeder (eds.), vol. I: Ecology and Evolution. Strasbourg: Univ. Louis-Pasteur, pp. 303–311.

**Jouffroy F.K. 1959**

Un crane subfossile de macaque du Pléistocène du Viet Nam. *Bulletin du Muséum National d'Histoire Naturelle* (Paris), No 31: 309–316.

**Kawamoto Y., Shotake T., Nozawa K., Kawamoto S., Tomari K., Kawai S., Shirai K., Takagi Y., Morimitsu N., Akaza H., Fujii H., Hagihara K., Aizawa K., Akachi S., Oi T., Hayashi S. 2007**

Postglacial population expansion of Japanese macaques (*Macaca fuscata*) inferred from mitochondrial DNA phylogeography. *Primates*, vol. 48: 27–40.

**Lee Y.J. 1984**

Early Man in Korea (II): Turubong Cave N 2 at Chongwon. Ph.D. Thesis, Yonsei University, Republic of Korea (in Korean with English summary).

**Lee Y.J., Cho T.S. 2004**

The Paleolithic human exploitation of animals in the Jungwon region, Korea. In *Paleoenvironment and Paleolithic Culture in the Jungwon Region, Korea (International Symposium of Paleoanthropology in Commemoration of the 100th Anniversary of the Birth of Prof. Pei Wenzhong (W.C. Pei) and the 75th Anniversary of the Discovery of the First Pekingman Skull, Beijing, October 18–22, 2004*), Y.-J. Lee, T.-S. Cho, S. Kong (eds). Chungbuk: National University, pp. 15–24.

**Lee Y.J., Cho T.S. 2005**

Paleolithic cave sites in South Korea. In The *Characteristics of the Paleolithic Culture in the Jungwon Region, Korea (Cave Sites and Suyanggae Site). International Symposium "Early Human Habitation of Central, North, and East Asia: Archeological and Paleoecological Aspects," 16–25 August, 2005, Denisova, Russia)*, Y.-J. Lee, T.-S. Cho, S. Kong (eds.). Chungbuk: National University Museum, pp. 3–26.

**Li J., Han K., Xing J., Kim H.S., Rogers J., Ryder OA., Disotell T., Yue B., Batzer MA. 2009**

Phylogeny of the macaques (Cercopithecidae: *Macaca*) based on Alu elements. *Gene*, vol. 448: 242–249.

**Li Q.Q., Zhang Y.P. 2005**

Phylogenetic relationships of the macaques (Cercopithecidae: *Macaca*), inferred from mitochondrial DNA sequences. *Biochemical Genetics*, vol. 43: 375–386.

**Morales J.C., Melnick D.J. 1998**

Phylogenetic relationships of the macaques (Cercopithecidae: *Macaca*), as revealed by high resolution restriction site mapping of mitochondrial ribosomal genes. *Journal of Human Evolution*, vol. 34: 1–23.

**Museum of Liaoning Province and Museum of Benxi City. Miaohoushan: A Site of Early Paleolithic in Benxi County, Liaoning. 1986**

Beijing: Wenwu Press, pp. 1–102 (in Chinese with English summary).

**Nelson S.M. 1993**

The Archaeology of Korea. New York: Cambridge Univ. Press.

**Nishioka Y., Anezaki T., Takai M., Iwamoto M. 2011**

Chronological and geographical variations of the Quaternary Japanese macaques (*Macaca fuscata*) based on molar measurements. *Honyurui Kagaku (Mammalian Science)*, vol. 51(1): 1–17 (in Japanese with English abstract).

**Pan Y., Peng Y., Zhang X., Pan R. 1992**

Cercopithecid fossils discovered in Yunnan and its stratigraphical significance. *Acta Anthropologica Sinica*, vol. 11(4): 303–311, plates 1–2 (in Chinese with English abstract).

**Park S., Lee Y. 1998**

Pleistocene faunal remains from Saekul/Chonyokul at Turupong cave complex with special emphasis on the large mammalian fossils. In *International Symposium for the Celebration of Chinese Academician Jia Lanpo's 90th Birthday: Suyanggae and Her Neighbours*, Q. Xu, Y. Lee (eds.). Beijing: Science Press, pp. 55–70 (in Korean with English abstract).

**Qiu Z.X., Deng T., Wang B.Y. 2004**

Early Pleistocene mammalian fauna from Longdan, Dongxiang, Gansu, China. *Palaeontologica Sinica, New Series C*, vol. 27: 1–198 (in Chinese with English summary).

**Qiu Z.X., Zheng L.T. 2009**

Primates. In *Paleolithic Site: the Renzidong Cave, Fanchang, Anhui Province*, C.Z. Jin, J.Y. Liu (eds.). Beijing: Science Press, pp. 156–162 (in Chinese with English summary).

**Saheki M. 1966**
Morphological studies of *Macaca fuscata*. *Primates*, vol. 7(4): 407–422.
**Schlosser M. 1924**
Fossil primates from China. *Palaeontologia Sinica, Series C*, vol. 1: 1–16.
**Sohn P. 1984**
The Palaeoenvironment of Middle and Upper Pleistocene Korea. The Evolution of the East Asian Environment, vol. 2: Palaeobotany, Palaeozoology and Palaeoanthropology. Hong Kong: Univ. of Hong Kong, pp. 877–893.
**Swindler D.R. 2002**
Primate Dentition. Cambridge: Cambridge Univ. Press.
**Szalay F.S., Delson E. 1979**
Evolutionary History of the Primates. New York: Academic Press.
**Takai M. 2005**
Macaques and baboons: evolutionary history of the cercopithecine monkeys in Eurasia. *Primate Research*, vol. 21: 121–138 (in Japanese with English abstract).
**Teilhard de Chardin P., Pei W.C. 1941**
The fossil mammals from locality 13 of Choukoutien. *Palaeontologica Sinica, New Series C*, vol. 11: 1–103.
**Tosi A.J., Morales J.C., Melnick D.J. 2000**
Comparison of Y chromosome and mtDNA phylogenies leads to unique inferences of macaque evolutionary history. *Molecular Phylogeny and Evolution*, vol. 17: 133–144.
**Tosi A.J., Morales J.C., Melnick D.J. 2003**
Paternal, maternal, and biparental molecular markers provide unique windows onto the evolutionary history of macaque monkeys. *Evolution*, vol. 57: 1419–1435.
**Young C.C. 1934**
On the Insectivora, Chiroptera, Rodentia and Primates other than Sinanthropus from locality 1 at Choukoutien. *Palaeontologia Sinica, Series C*, vol. 8: 1–139.
**Zhang S.S. 1993**
Comprehensive study on the Jinniushan Paleolithic site. *Memoirs of Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica*, vol. 19: 1–163 (in Chinese with English summary).
**Zhang Y.Q., Jin C.Z., Takai M. 2010**
A partial skeleton of *Macaca* (Mammalia, Primates) from the Early Pleistocene Queque cave site, Chongzuo, Guangxi, South China. *Vertebrata PalAsiatica*, vol. 48: 275–280.

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# SUYANGGAE: WHY SO IMPORTANT? (with New Tanged Points from Songam-ni Site, Korea)

Since discovery in July 21, 1980, Locality I of the Suyanggae site has been excavated 4 times from 1983 to 1985. As a result, there were unearthed about 30,000 pieces of artifacts, ranging from 18,600 to 15,600 bp.

Moreover, 50 tool-making workshops were found, where valuable data for reduction process was gained (Lee, 1989). Since then, six more excavation were carried that Localities II and III were newly discovered.

Among the artifacts, tanged points attracted wide attention for the typicality. Suyanggae tanged point is one of the most representative stone tool types of this site we mentioned above. A new analysis of tanged tools permits us to identify the some other types such as tanged end-scraper and tanged truncations. This would mean that the utilization of tang in the Suyanggae Site would be wider than we have presumed.

49 tanged points were discovered at the Suyanggae Site. They were made often on blade and siliceous shale was utilized as main raw material and tuff, quartz, rhyolite and obsidian were used also. In the majority of cases, tanged points are intact. Their average length is 6cm, the width is 2.4 cm, the thickness is 8.2 mm and the weight is 11 g. The dimensions of Suyanggae tanged points are somewhat variable than other Sites.

Thags were formed by direct retouches and their angles are steep. Accoding to the importance of retouched edges, we suggest to divide Suyanggae tanged points into 3 classes:

I. tanged point with natural edge(s);

II. tanged point with partially retouched edge(s):

- a. on the right side;
- b. on the left side;
- c. on both sides;

III. Tanged point with completely retouched edge(s):

- a. on the right side;
- b. on the left side;
- c. on both sides.

First of all, we may notice a great typological variety among them. The most frequent type is tanged point having natural edge (type I).


*Fig. 1.* Tanged point from Suyanggae.

50 % of Suyanggae tanged points belong to this type. Tanged points were retouched partially on edges (type IIa and IIb) are also common, about 31 %. Otherwise, tanged points retouched with continuous manners are relatively rare, especially on both edges: only 1 piece for each. If Suyanggae upper Paleolithic people would pay attention for making tang for hafting, they preferred to let other parts of points brut or slightly retouched (Lee and Kong, 2004) (Fig. 1, 2).

So the Meiji University Museum held a special exhibition *Suyanggae and Her Neighbours* from April 1 to May 31, 2004 (Fig. 3). And recently, while tanged-points from the Doohak-dong site, Jecheon had been ex-

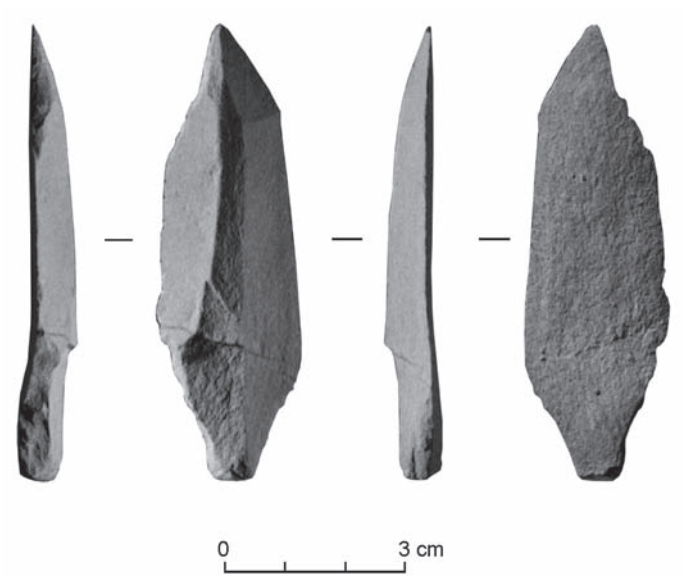


*Fig. 2.* Tanged point from Suyanggae.

cavated, there were found 4 other ones also at the Songam-ni site, Chungju.

Songam-ni site is located at the Songam-ni, Sinni-myeon, Chungju City, Chungbuk Province, 37°00′8″ north latitude, 127°42′19″ east longitude (Fig. 4). Through investigation, it was found that the site formed on the second terrace of upper stream of the Yodo river, a branch of South Han River. The strata consist of 6 layers, where paleosol developed above colluviums of the last glacier. From the paleosol, 2 cultural layers were found (Document…, 2012) (Fig. 5, 6, 7).

The Cultural Layer 2 revealed 133 artifacts including side-scrapers, end-scrapers, notches, chop-


*Fig. 3.* Special exhibition poster (2004).

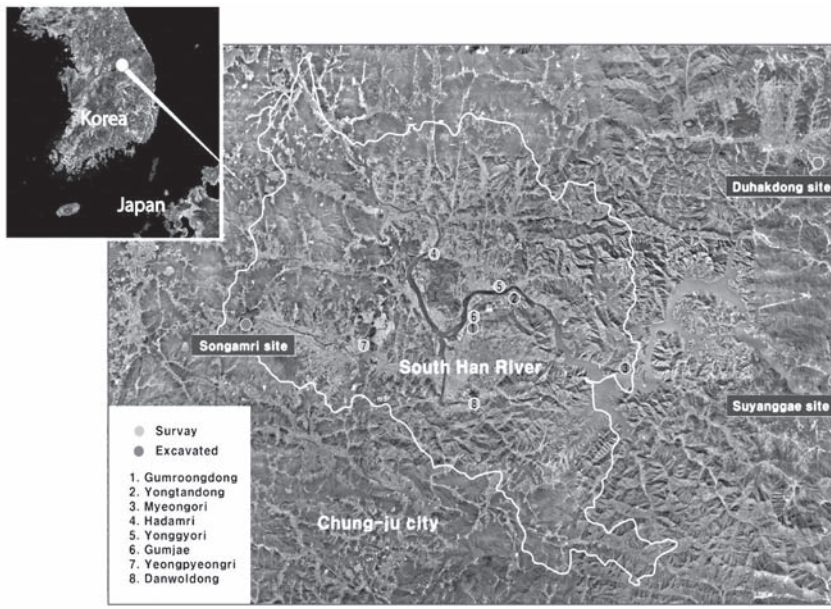


*Fig. 4.* Location map of the Paleolithic Site in Jungwon Area.

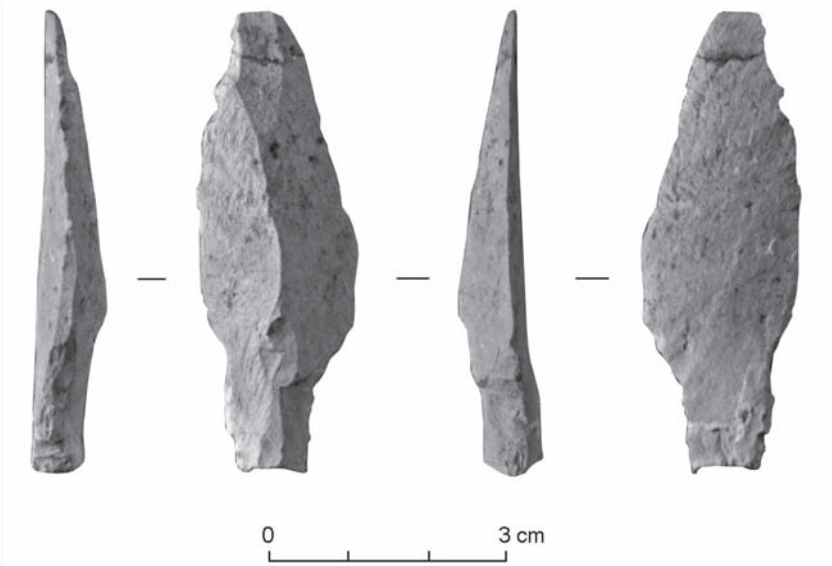


*Fig. 5.* Tanged point (Duhak-dong Site).

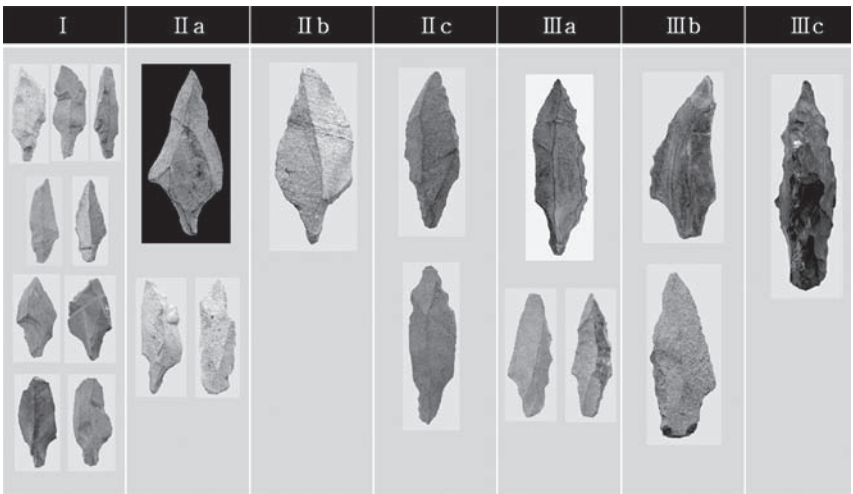


*Fig. 6.* Typological classification of tanged points from Suyanggae Site.

pers, tanged-points, blades, cores, and flakes. It was dated 32,300 (IAAA-120001) and 33,190 BP (IAAA-120002) by AMS dating for the charcoal. And from the Cultural Layer 2, 206 pieces of artifacts were excavated, which were choppers, planes, polyhedral, side-scrapers, end-scrapers, notches, and tanged-point (Fig. 8).

*Fig. 7.* Songam-ni site at excavation (2012).

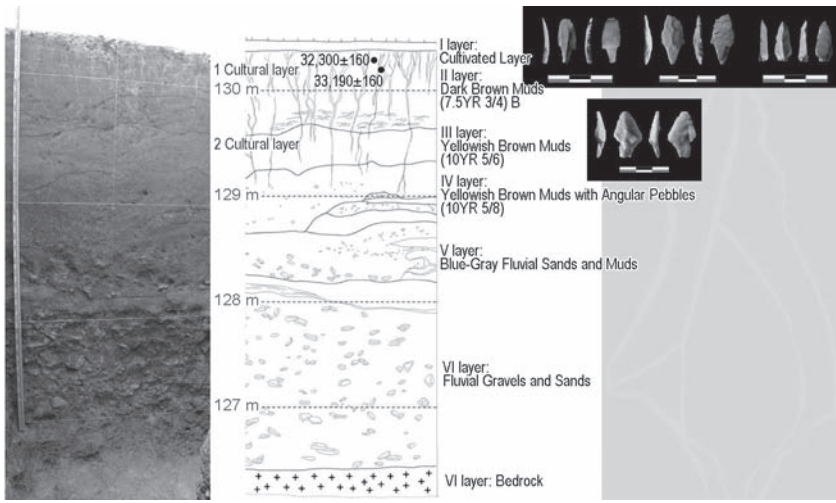


*Fig. 8.* Standard cross-section of Songam-ni Site.

There are 4 pieces of tanged-point, 3 from the Cultural Layer 1 and 1 from the Cultural Layer 2. 3 pieces from the former consist 2 made of porphyry, and 1 made of shale. One of the latter is made of quartz (Fig. 9–12).

The tanged-points from the Cultural Layer 1 is like following. Artifacts shown at picture 5 has one ridge at dorsal face whose both overall edges were

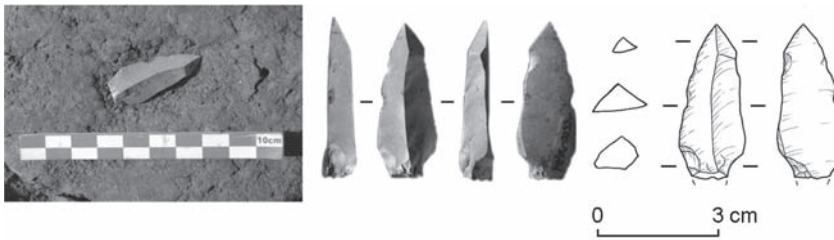


*Fig. 9.* Tanged point (1st cultural layer).

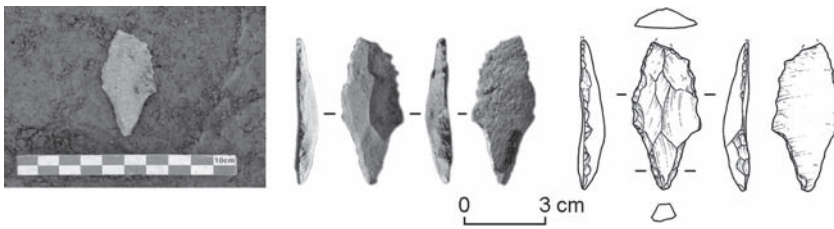


*Fig. 10.* Tanged point (1st cultural layer).

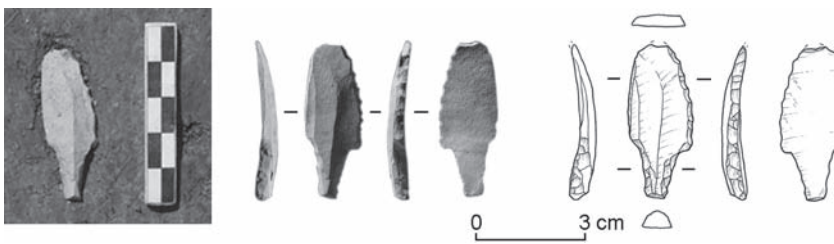


*Fig. 11.* Tanged point (1st cultural layer).

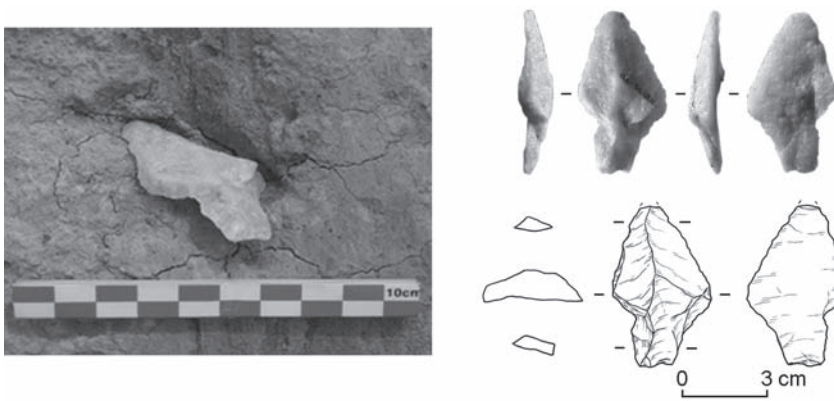


*Fig. 12.* Tanged point (2nd cultural layer).

**Tanged Points from Songam-ni Site**

| Cutural Layer | Raw material | Futures | Size (mm) | | | | Length/width | Width/thicknes | Tool/tang | Fig. No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | total (length × × width × thicknes) | tool length | tanged length | weight | | | | |
| 1 | porphyry | blade | 54.4 × 25.2 × 8.3 | 29.8 | 24.6 | 8.0 | 2.1 | 3.1 | 1.2 | 3 |
| | porphyry | blade | 42.2 × 17.3 × 5.1 | 27.0 | 15.2 | 4.0 | 2.5 | 3.4 | 1.8 | 2 |
| | shale | blade | 33.4(?) × 16.1 × 7.8 | 32.3 | ? | 4.0 | ? | 2.1 | ? | 5 |
| 2 | quartz | flake | 56.1 × 34.4 × 11.1 | 30.6 | 25.5 | 16.0 | 1.6 | 3.1 | 1.2 | 6 |

retouched to produce straight edge and denticulate. Other one of picture 4B has two ridges on dorsal face with straight edge prepared by retouch to edge on the right side. The last one of picture 3B has one ridge at dorsal face with symmetrical shape and unretouched edge. Tanged-point of the Cultural Layer 2, shown at picture 3c, has one ridge at dorsal face made from flake. The edge is not retouched.

Assemblage of the Cultural Layer 2 does not show laminar technology. And the geological occupation stays below the Cultural Layer, which is dated 33,000 bp. Besides, the retouching was treated least with type 3c with assymetrical shape. That is, it appears very different from the Cultural Layer 1.

In that sense, the newly found tanged-points from the Songam-ni site have importance. First, the origin and development process can be traced. Second, the Cultural Layer 1 is 15,000 years older than the Suyanggae. And third, considering typical similarity with tanged-points of Suyanggae, the material culture can be thought related over 15,000 years. Given the significance, it is very fortunate that the aleolithic sites of Danyang were selected to be recommended for the World Heritage with priority by ICOMOS-Korea.

## REFERENCES


**Document on Songam-ni Palaeolithic Site Excavation, Chungju. 2012**
Institute of Korean Prehistory.

**Lee Y.-J. 1989**
Report on the Upper Paleolithic Culture of Suyanggae Site, Korea. Presented Paper to 89 World Summit Conference on the Peopling of the America. Univ. of Maine.

**Lee Y.-J., Kong S. 2004**
Suyanggae Tanged Points: A Compartive Approach on Korean Tanged Points. In *The 9th International Symposium "SUYANGGAE and Her Neighbours"*, A. Masao, Y.-J. Lee (eds.). Meiji Univ. Museum, pp. 173–180.

**SUYANGGAE and Her Neighbours. 2004**
Special Exhibition. Meiji Univ. Museum (ed.).

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# EAST ASIAN LITHIC TECHNOLOGY AND ITS SIMILARITIES BEFORE THE EARLY OIS3: OBTUSE ANGLED FLAKING TECHNIQUES AS A TECHNOLOGICAL MARKER

## INTRODUCTION

The purpose of this study is to analyze East Asian lithic technology, represented by obtuse angled flaking, through technological analyses, including experimental work and comparison of artifacts between the Japanese Archipelago and the Korean Peninsula. This study attempts to interpret technological traits of flake removal in lithic production before the early OIS3.

What is obtuse angled flaking? According to J. Whittaker (1994), it is the degree of angle as measured by the exterior platform angle. If the angle between the platform and working surface is below 90 degrees, it is acute angled flaking. If the angle between the platform and working surface is 90 degrees or more, then it is considered obtuse angled flaking.

Historically, many Japanese archaeologists have considered that the obtuse angled flake scars on lithics before the Late Paleolithic were the result of natural fractures, because of the legacy of the Japanese eolith dispute of the 1970s. First, C. Serizawa (1973) introduced A. Barnes' theory (1939), called the "eolith stability criterion" to Japanese archaeologists. This theory states that if we see obtuse angled flake scars on more than 40 percent of the core and flake, it means the core and flake were naturally made. On the other hand, if we see acute angled flake scars on less than 25 percent of the core and flake, it means the core and flake were man made. The Barnes' theory was further developed by P. Bleed (1977), and M. Okamura (1974). Bleed pointed out the low occurrence of obtuse angle flakes from the Sozudai site. His analytical method was based on Barnes' theory and concluded that the majority of flakes from Sozudai were artifacts. In addition, M. Okamura studied the frequency of obtuse/acute angle debitage from several Early and Late Paleolithic sites on the basis of statistical analyses. Thus, previous studies concerning the fracture mechanisms of rocks pointed out the significance of scar angle analysis in distinguishing artifacts from geofacts. I believe that this is the legacy of the Japanese eolith dispute from 1970s to the present.

However, a few Japanese archaeologists have suggested the importance of the irregular flake scars as an intentional lithic technology in the Early and/or Middle Paleolithic in Japan. For example, H. Komura pointed out

the unique perpendicular flake removal techniques from the Kasheizawa site in central Japan (Komura, 1968, 1992). In addition, H. Sato has suggested the presence of irregular secondary retouch based on the careful observation of artifacts as lithic technological features, derived from ancient knappers' styles during the Middle Paleolithic Period (Sato, 2002, 2010). T. Takeoka may also have found that the intention of ancient knapper's was to create nonstandarized flake scars (Takeoka, 2005).

Many Early Paleolithic sites in Japan were lost as a result of the Fujimura Scandals (2000). However, the discovery of new possible Middle Paleolithic sites in the last ten years may provide the opportunity to restart comprehensive studies on variations in chipped stone tool production techniques, or the dynamics of knapping technology. The analytical target of this paper is the reconsideration of obtuse angled flaking. In order to evaluate technological variability in the quartz and quartzite percussion technique, I have incorporated experimental data into the archaeological data.

## MATERIALS AND ANALYSIS

### Takesa-nakahara Site

The Takesa-nakahara site is located in the southern part of Nagano prefecture (at latitude 35'27''56 north and longitude 137'45''40 east). The site was excavated several times between 2000 to 2006 by the Nagano Archaeological Research Center. Most of the Paleolithic assemblages were found mainly in Stratum 4. Over 800 artifacts were unearthed from 4 concentrations, with 62 % made from hornfels in the whole lithic assemblage. In order to estimate the date of this archaeological layer, excavators performed several scientific analyses, such as radiocarbon and IRSL dating, tephrochronological, opal phytoliths analysis, etc. (Tsuruta, Otake, 2010). As a result of these analyses, AT volcanic ash (26–29 ka) was found above the upper part of Stratum 4. The living floor on which the lithic concentrations were located is lower than the AT boundary. Therefore, we know that the lithic assemblage of the Takesa-nakahara site is not younger than 30 ka, and we can deny the possibility that the assemblage would be older than 50 ka (IRSL dating result of Stratum 6 is 53±2 ka). Thus, the estimated date of the lithic assemblage at the Takesa-nakahara site is roughly 30–50 ka (Ibid.; Sato, 2010).

A result of the careful examination of the flake scars from the Takesa-nakahara site, has revealed the dominance of tools with obtuse angled retouch scars. The obtuse angle with irregular flake scars are identified on denticulates, awls, scrapers, cores and retouched flakes. Additionally, quartz refitted materials from the site indicated they were split by direct percussion along the natural joints. On other specimens, white powder-like crush mark concentrations suggest that the heavy crushing marks indicate a perpendicular load by ancient knappers. Flake angles are almost 90 degrees, and crushed bulbs of percussion can be seen on the ventral surface. These characteristics also suggest obtuse angled splitting, that may have resulted from striking

a pebble against an anvil or another pebble (Derevianko, 2008). Interestingly, there are anvil stone in situ at the Takesa-nakahara site. This archaeological evidence is strongly suggestive of obtuse angled flaking by use of anvils at the Takesa-nakahara site.

### The Ishikobara Site and other sites

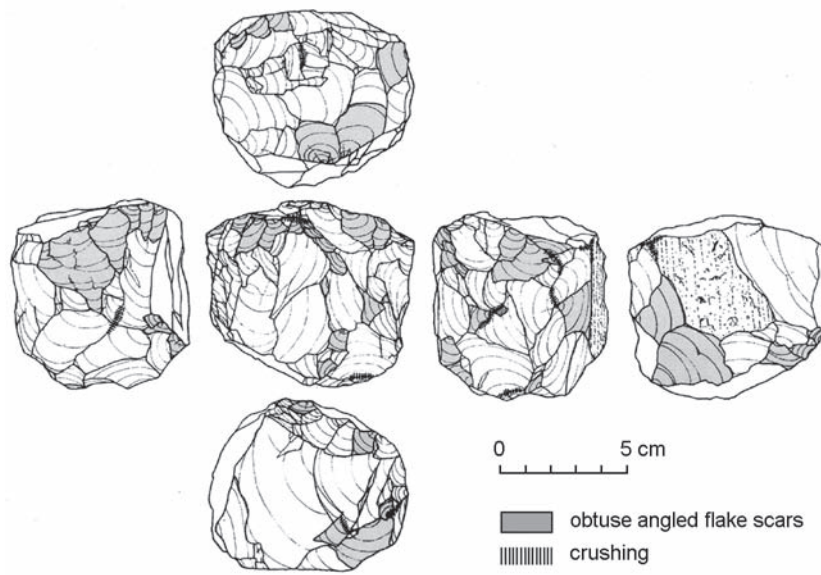
The Ishikobara site is located in Iida city in the Nagano prefecture, almost at the center of the Japanese Archipelago (latitude 35’28’’8 north and longitude 137’45’’31 east), very close to the Takesa-nakahara site (Excavation report..., 1973). As a result of the careful examination of flake scars, the site lithic inventory was found to be dominated by tools with obtuse angled retouch scars. Obtuse angled flake scars are seen around the ridges on the cores and on the retouched flakes. One polyhedral core bearing heavy crushing, incipient cones and obtuse angle flake scars near the ridges, has been identified at the Ishikobara Locality A. This quartz polyhedral core is somewhat similar to the Korean styled polyhedrons from the Korean Peninsula. A *Figure* presents this quartz polyhedron with many obtuse angled flake scars and crush marks from the Ishikobara site, Locality A (Nagai, 2011a). In the figure, the gray areas indicate obtuse angled flake scars and the vertical lines indicate crushing on the ridges. The dominance of obtuse angled flake scars and crushed ridges can be seen on each surface.

In another possible Middle or early Late Paleolithic site (Sato, 2002, 2010), the Kanedori, Nutabura, Ushiromuta site, dated about (>30–40 ka), the dominance of obtuse angled flake scars on tools is also visible (Nagai, 2010, 2011a, b). Obtuse angled flaking scars are evident in the Japanese Middle Paleolithic (MP) lithic industry, on cores and tools, not only on quartz and quartzite, but on other stone types, such as hornfels and shale. One of the important things, generally speaking, is that obtuse angled flaking on cores basically disappeared in the Late Paleolithic period during the Japanese Archipelago.

## DISCUSSION

In order to understand the nature of obtuse angled flaking, I have been conducting experimental polyhedral cores both from examples within and outside of Japan. Since the summer of 2009, I have attempted to make experimental polyhedrons by using Korean quartz and quartzite from the Imjin/Hantan River Basins (IHRB) in South Korea, and conducting comparative investigations regarding the nature of the obtuse angled flaking on artifacts of the possible Middle Paleolithic sites in Japan, including the Takesa-nakahara and Ishikobara sites (Tsuruta, Otake, 2010; Excavation Report..., 1973). As a result of my experimental work, it appears that the obtuse angled flaking of the polyhedral core reduction was signficant. Additionally, my studies suggest that obtuse angled flaking might have been the ancient knappers’ intentional techniques for optimal flake removal (Nagai, 2010, 2011a).

One of the most interesting things I found in my studies was that obtuse angled flaking was actually dominant in the quartz and quartzite lithic industry




Drawing of quartz polyhedron from the Ishikobara Paleolithic site [Nagai, 2011a].

including polyhedral core production from the middle Pleistocene to the early Late Paleolithic period on the Korean Peninsula. Some Korean archaeologists have suggested that obtuse angled flake scars are generally identified on quartz and quartzite lithic artifacts including polyhedral cores and spheroids which has been recognized at sites from the middle Pleistocene to the early Late Paleolithic period: Unjeong, Dangga, Suheol-ri, and Songdu-ri sites, etc. (Lee H J., Rho, Lee H.Y., 2004; Han, Kang, 2009; Lee Y.J., 2006).

The Korean Paleolithic chronological studies in the transitional period from Early to Late Paleolithic are not easy to separate because of cultural complexities; however, recent trials by Korean Archaeologists Seong Chun-taek (2011), Bae Kidong (2010a, b) and others using AMS radiocarbon calibration dating and typological studies may provide the chronological perspective required to understand the technological relevance between the Korean peninsula and the Japanese Archipelago before the early OIS3. In short, the Korean obtuse angled flaking strategy based on the use of quartz and quartzite suggest a strong technological relationships to the Japanese Middle Paleolithic lithics before the early OIS3. The preliminary analytical data comparison between the Ishikobara site and several Korean Paleolithic sites suggest technological relationships among the polyhedron/spheroid technologies.

Although the sample size is small, this pilot study presents an effective approach to the comparative technological study of the Early and Middle Paleolithic in East Asia. Results of this study suggests that the use of optimal flaking techniques to produce obtuse angled flake scars is likely to be a diagnostic tech-

nological trait of Early and Middle Paleolithic knappers, and a high frequency of obtuse angles does not constitute strong evidence of natural fracture. There is a possibility that obtuse angled flaking can be used as a technological marker in comparisons of lithic industries on the Korean Peninsula to that of the Japanese Archipelago before the early OIS3. Detailed examinations of lithic industries in the future may determine if there were interactions between the two regions regarding the use of traditional obtuse angled flaking.

## REFERENCES


**Bae K.D. 2010a**

Origin and patterns of the Upper Paleolithic industries in the Korean Peninsula and movement of modern humans in East Asia. *Quaternary Internat.*, No. 211: 103–112.

**Bae K.D. 2010b**

The transition to Upper Paleolithic industries in the Korean Peninsula. In *The Upper Paleolithic Revolution in Global Perspective: Papers in Honour of Sir Paul Mellars*. Cambridge: McDonald Institute for Archaeological Research, pp. 115–122.

**Barnes A.S. 1939**

The differences between natural and human flaking on Prehistoric flint implements. *American Anthropologist*, No. 41: 99–112.

**Bleed P. 1977**

Early flakes from Sozudai, Japan: Are they man-made? *Science*, vol. 197: 1357–1359.

**Derevianko A.P. 2008**

The Bifacial technique in China. *Archaeology Ethnology and Anthropology of Eurasia*, No. 33 (2): 2–32.

**Excavation Report of Chuo Freeway: Iida Village. 1973**

Part 3: Paleolithic of the Ishikobara Site. Nagano: Board of Education of Nagano Prefecture (in Japanese).

**Han C.G., Kang B.G. 2009**

Suheol-ri Site, Jiksan. Gongju: Chuncheong Reserch Institute of Cultural Heritage.

**Komura H. 1968**

A Study of Lower Paleolithic Industry at Kasheizawa Site, Aichi Prefecture, Japan. Tokyo: Gembunsha (in Japanese with English title and summary).

**Komura H. 1992**

Problems and comparable studies of lithic industry of the Kasheizawa site. In *Archaeology of Musashino: Essays in celebration of 70th birthday of Yoshida Itaru*. Tokyo, pp. 299–315 (in Japanese).

**Lee H.J., Rho S.H., Lee H.Y. 2004**

Report on the Excavation of Dangga Site and Chongokri Site, Naju. Mokpo: Mokpo National Univ. Museum.

**Lee Y.J., Cho T., Kong S., Lee S. 2006**

The Songdu-ri Paleolithic Site: An Excavation Report. Seoul: Jungwon Cultural Properties Institute.

**Nagai K. 2010**

Obtuse-angled flaking in the Early and Middle Palaeolithic in Japan. In *Diversity of the Asian Palaeolithic Culture: Recent Progress and New Trends, The 3rd Asian Paleolithic Association International Symposium*. Gongju: The Korean Palaeolithic Society, pp. 86–87.

**Nagai K. 2011a**

Lithic technology in the “Early/Middle Palaeolithic”, Japan: From the reconsideration of the “Obtuse-Angled Flaking”. *Palaeolithic Research*, No. 7: 93–106 (in Japanese with English title and summary).

**Nagai K. 2011b**

Traits in stone flaking technology at Kanedori, Iwate, Japan. In *The 2nd International Symposium of Bifaces of the Lower and Middle Pleistocene of the World. In celebration for the opening of Jeongok (Chongok) Prehistory Museum*. Gyeonggi: Jeongok (Chongok) Prehistory Museum, pp. 104.

**Okamura M. 1974**

Lower Paleolithic. *Archaeological Journal*, No. 100: 13–17 (in Japanese).

**Sato H. 2002**

Mobility and chronological significances of cultural layer III of the Ushiromuta site. In *Ushiromuta Site: Paleolithic Research in the Ushiromuta Site, Kawaminami, Miyazaki*. Kawaminami: Board of Education of Kawaminami Town, pp. 382–395 (in Japanese).

**Sato H. 2010**

Takesa-nakahara site and lithic industries during the transitional period from Middle to Late Paleolithic in Japanese Archipelago. In *Takesa-nakahara: Paleolithic Site in Nagano Prefecture, Central Japan*. Nagano: Ministry of Land, Infrastructure and Transport Chubu Regional Bureau; Archaeological Research Center of Nagano Prefecture, pp. 365–372 (in Japanese).

**Seong C.T. 2011**

Evaluating radiocarbon dates and Late Paleolithic chronology in Korea. *Arctic Anthropology*, No. 48(1): 93–112.

**Serizawa C. 1973**

Lithic artifacts and natural stones. *The Method of Social Sciences*, No. 6(3): 10–16 (in Japanese).

**Takeoka T. 2005**

Typology of Early Paleolithic. Tokyo: Gakuseisha (in Japanese).

**Tsuruta N., Otake N. 2010**

Takesa-nakahara: A Paleolithic Site in Nagano Prefecture, Central Japan. Nagano: Ministry of Land, Infrastructure and Transport Chubu Regional Bureau; Archaeological Research Center of Nagano Prefecture (in Japanese with English title and summary).

**Whittaker J.C. 1994**

Flintknapping: Making and Understanding Stone Tools. Austin: University of Texas Press.

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# OBSIDIAN ACQUISITION IN THE CENTRAL JAPANESE ISLANDS DURING MIS3 AND MIS2

## ABSTRACT

Frameworks of the Japanese Palaeolithic studies have many aspects. Explicit evidence of human occupation that has based both on stratigraphy and morpho-typology of lithic artifacts is possible to trace back to the middle of MIS3 in the Japanese islands. The presentation focuses on obsidian acquisition patterns in the Kozu island, and the Mattobara Upper Palaeolithic site on the mountainous river terrace, with reference to the climatic changes during 50–10 ka from the boring data of the Lake Nojiri, Central North Japan. Generally, lithic assemblages continue from uppermost Palaeolithic Layer down to the Layer X in Kanto area, but a single artifact is available beneath the Layer X. This suggests the first peopling of the Japanese islands connected with this time period, ca. 38 000 cal BP. The earliest evidence of obsidian procurement from Kozu island, was recognized in the Layer VII (Black band) of Ashitaka area dated as ca. 38 000 cal BP. No land bridge was formed between Izu islands and Honshu, and also between Korean peninsula and Japanese islands even in the LGM. This implies a possibility of human migration from Asian mainland to the Japanese islands across the seawater in the middle of MIS3. Obsidian raw material acquisition strategy in the Upper Palaeolithic has been modeled in various ways. First, long distance direct procurement; second, indirect procurement through exchange network systems; and third, the raw material is programmed in the year-round scheduled so-called as an embedded strategy. Even though no single integrated explanatory model may applicable, raw material acquisition strategies are reflecting the different environmental settings of mountainous and isolated islands. The paper has taken up this theme in dichotomy patterns i.e. obsidian procurement along the Shinano river in mountainous region, and the small Kozu island in the Pacific.

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# PLANIGRAPHY OF A DWELLING COMPLEX IN PALEOLITHIC OF WESTERN TRANSBAIKALIA

Theoretical and practical paleolithic research develops major aspects of the lifestyle of ancient communities. Special attention is paid to the study of dwelling complexes and their main component parts – dwellings. Paleolithic dwellings are mostly found in cultural layers in relatively flat-bed perspective and have the form of floor-base. The remains of structural elements and artifact assemblages associated with them localize in surrounding space. It is important that the information contained in the inner space of dwellings offers data on the forms of lifestyle of ancient people which play the most important part in its formation.

The history of the ancient past studies on the territory of Zabaikalsky Krai is closely connected with the problem of identification and analysis of dwelling complexes of late Paleolithic. Promoting ideas concerned with "dwelling" concept in Paleolithic prompted modernization of field research strategies and the introduction of new methods of materials systematization. The integrated approach raised considerably the degree of content richness of data and rendered relevant structural planigraphic analysis.

The remains of ancient settlements of various structures which formed in similar landscape and climatic conditions, are found on multilayered sites of Western Transbaikalia in chronologically successive order (Konstantinov M.V., 1994; Konstantinov A.V., 2001). Relatively short-term habitation period and quick conservation of horizons due to active river-flood dynamics assured archaeological "cleanness" and good preservation of complexes. This became the crucial factor in studying the general organization of settlements and the inner planigraphy of dwellings proper.

The paper presents the results of research of the compound Paleolithic complex in horizon 5 (Studenoe 2 settlement). The settlement is located in Krasniy Chikoi region of Zabaikalsky Krai (50˚03′31″ N, 108˚15′16″ E) and is associated with depositions of II right-bank fluvial terrace of the Chikoi River, in the mouth of the stream Studenoe. The terrace is 9 m high. 817 $m^2$ of the locality have been studied. Stratigraphic profile yielded 15 cultural horizons dating from Paleolithic to Bronze (Fig. 1). Seven horizons of Paleolithic included the remains of various dwelling complexes.

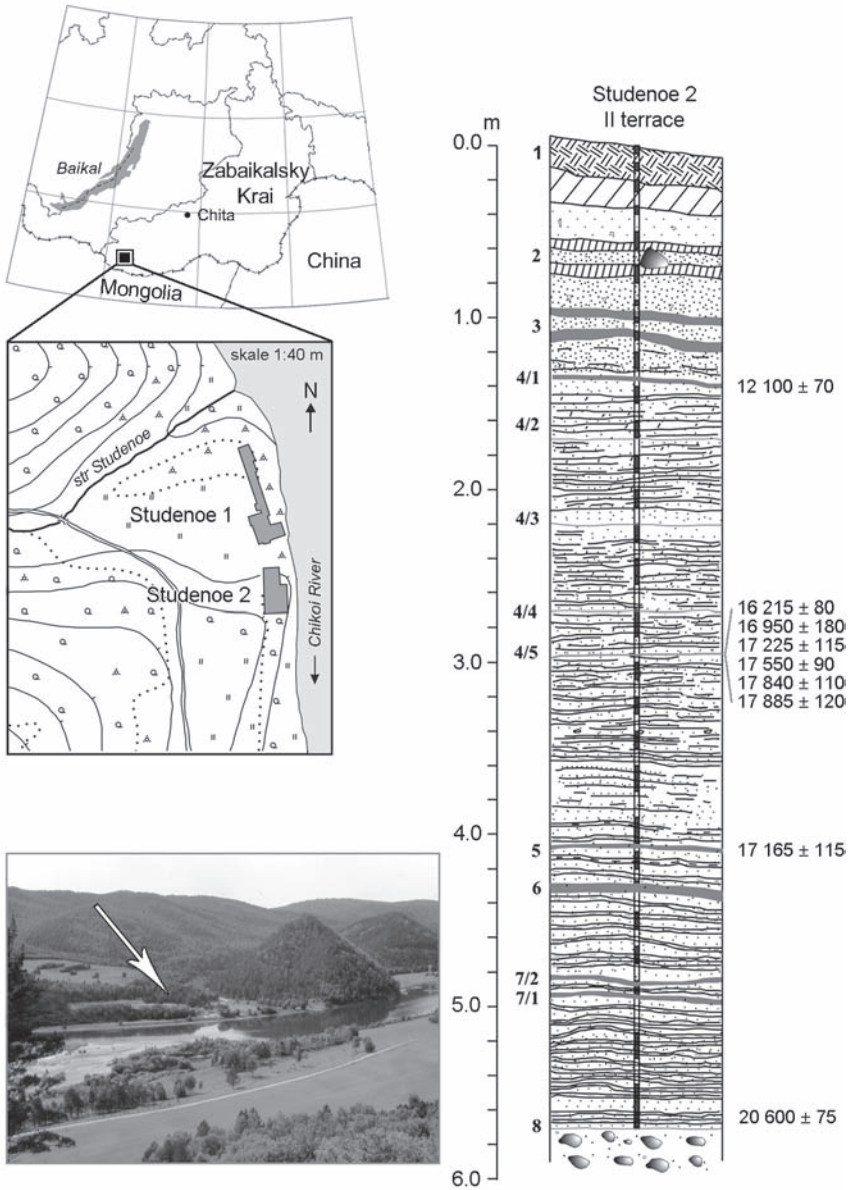


*Fig. 1.* Topologic map and stratigraphic profile of Studenoe settlement, Zabaikalsky Krai.

The cultural horizon 5 is associated with the middle portion of alluvium (lithologic stratum 7) of II fluvial terrace of the Chikoi River. It lay at a depth of 5.25 m below the surface. The depositions presented a layer of multi-grained sand (4–7 cm thick) with no visible textures of microlayers. The lower border of the horizon was outlined by a 3 cm sterile layer of a lighter sand (for full description of the profile see Konstantinov M.V. et al., 2003). The total area of the investigated horizon makes up 287 $m^2$. In the centre of a cape-like section of the terrace, 5 m from its edge there located an oval dwelling complex 11.5 × 7 m in size which determined the localization of artifact assemblages. 90 pebbles and small river boulders are associated with the formation of structural elements of the habitation space. They range in size from 75 × 10 to 305 × × 65 cm (Fig. 2).

The complex had a complex structure. It stretches along the ancient ledge of the terrace by longitudinal axis directed from the North to the South. The structure of the settlement included hearths, charcoal stains, stones of inner and outer lining, lithic artifacts and faunal remains. To the outer borders of the complex refer 52 stones. They lay in groups or in scattered chains along the perimeter thus marking the outer border of habitation area. Along the south border of the complex in 29/30-K squares there lay a group of four stones: three massive basalt boulders lay together and one was some distance away from them. It is possible that certain structural elements of the former land-based construction were fastened together with their help. Bone fragments of big Bovidae and one jaw fragment of a cloven-hoof animal were uncovered next to the complex.

A more complex picture may be seen on the northern side of the complex. Here the lines of stones have formed two arcs. The inner arc which stretches along the contour of the charcoal stain is marked by 12 small boulders. They lie loose with 20–30 cm between them. The contour of the outer arc of 2 m in diameter is marked by a line of 13 stones. In the first case the edge of the arc is 2.4 m away from hearth № 3, in the second – 4.5 m away. Few artifacts of bone and single lithic tools are associated with the outer arc. The total area of the complex amounts to around 37 $km^2$.

The stones used in lining were notable for their massiveness. Ancient inhabitants preferred to use basalt and granite cobbles. Stones of similar quality, but of a smaller size were used in lining of the hearths which occupied the central part of the complex and stretched along its longitudinal axis in the southward direction.

Excavations of the southern part of the complex identified the charcoal stain with associated stones. In the course of field work the structure was interpreted as hearth № 1 (square 27h–i). It had an elongated oval shape stretching from the east to the west (1.25 × 1.6 m). To the hearth lining belonged ten stones. Charcoal filling which was 2 cm thick yielded small fragments of burnt bone and single flakes. Coal analysis yielded the following data – 17 165 ± 115 (AA–23657) (Goebel et al., 2000).

In the central part of the complex, 1.2 m to the north from the hearth № 1 there were the remains of two more hearths (№ 2 and № 3). They were 60 cm apart from each other. Hearth № 2 had a roundish cup-like shape and was

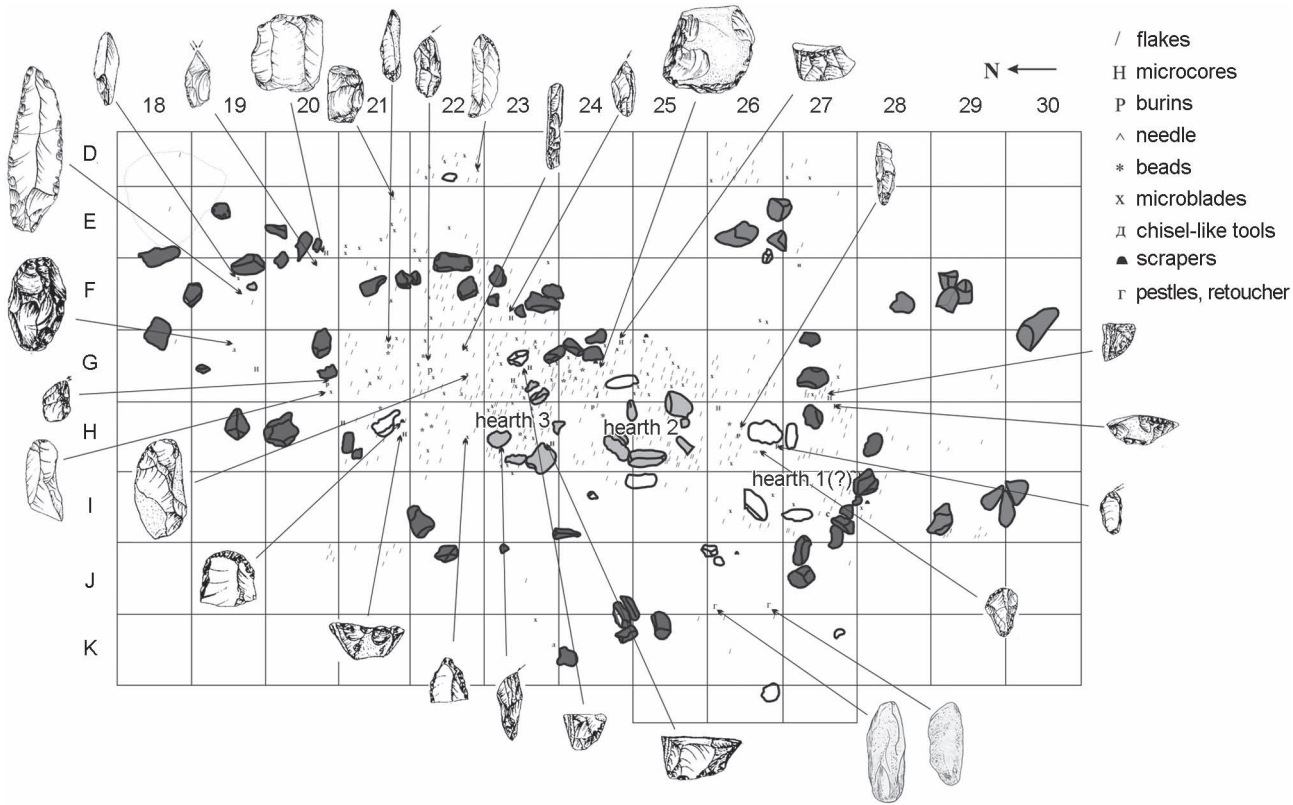


*Fig. 2.* Studenoe 2. Plan of the dwelling complex in horizon 5.

15 × 1.2 m in size. The sabulous filling with charcoal inclusions was about 3 cm thick. There were five big and two medium stones in the hearth lining. Two big cobbles were placed there at the early stage of the hearth construction as there were no charcoal layer under them. The other stones were brought later when the hearth was already in use. The hearth filling yielded small scales, fragments of microblades and burnt bone fragments.

Hearth № 3 (15 × 1.3 m) with a roundish cup-like shape had an arched lining which parted on the northern side. The filling (about 3 cm thick) included flakes, scales, fragments of mircoblades, one bead made of ostrich egg-shell and burnt bones. The perimeter of the hearth was lined by 6 stones. A large flat boulder on the southern side stood out among the rest with its size (465 × 405 × 15 cm). It had been brought on the "clean" layer and hadn't been moved since. Next to the hearth in the eastern section there were found a series of artifacts, assemblages of debitage fragments and beads of tuffite and of ostrich egg-shell.

In the southern part of the dwelling complex few artifacts were uncovered between the outer groups of stones and the presumed lining of hearth № 1. In the centre of the complex there lay two large flattened boulders in parallel with each other. They were 60 cm apart and lay between hearth № 1 and hearth № 2. There was a coaly layer under them which was about 1–2.5 cm thick and yielded scales, microblades and small fragments of burnt bones. The stones were brought here during constructions. They might have been used as seats. Next to them some implements were uncovered: one scraper, one central incisor, one retouched blade and two retouched flakes.

In the northern part of the complex the surface between the lining of hearth № 3 and the stones of the first line of the outer lining was covered with thin ashy coating. The assemblage of microdebitage and round beads made of different material were found here.

Next to the hearths there was a charcoal stain 1.5–2 cm thick on the surface of the "floor" which reduced to a very thin coating the farther it was from the hearth. Another charcoal stain was in the northern part of the complex and adjoined two last stones lying next to the northern (second arc) line of the outer lining.

The greater part of the artifacts belonged to the hearths and charcoal stains of the central part of the dwelling. Along the eastern line of the outer lining there was free space with few artifacts.

Spatial analysis of the dwelling complex included the analysis of the assemblages of lithic tools. Lithic materials, application of tools and microdebitage were of similar nature along the whole surface of the complex. It evidenced the simultaneous formation of structures belonging to this horizon.

The absolute majority of artifacts in the horizon are lithic artifacts (83 %), the faunal remains comprise 17 % of the artifacts. Stone artifacts associated with the dwelling complex included 789 items: tools – 42 items (5,3 %), cores and their fragments – 12 items (1,5 %), flakes – 138 items (17,6 %), scales – 332 items (42,1 %), microblades and their fragments – 235 items (29,8 %), blades – 12 items (1,5 %), spalls – 6 items (0,6 %), beads – 12 items (1,5 %).

Reduction strategy is represented by one bifacial flattened prismatic core and a series of expressive wedge-shaped micro-cores and their fragments. (Fig. 3, *19, 20, 22–24*). All were made of jasper of different colours. According to the trace analyst E.Y. Ghirya (Saint-Petersburg, IIMK) wedge-shaped micro-cores were reduced with pressure technique. All cores had a light grinding along the dorsal surface. But only one specimen was used as a tool after reduction, presumably as a borer (Fig. 3, *22*). Microblades constituted stable series.

Almost all relatively large blades (up to 5 cm long) were reduced from the prismatic core of dark cherry-coloured jasper. It had been reduced to 4,5 × 5 cm and was used as a wood-cutting tool (Fig. 3, *33*).

The collection of lithic and bone artifacts constitutes 48 specimens. There are 3 scrapers (6 %), 4 chisel-like tools (8 %), 6 burins and one carver (12 %), 3 retouched microblades (6 %), 9 retouched blades (20 %), 12 retouched flakes (26 %), 2 tools on cores (4 %), 2 chopping tools (4 %), 2 pestles (4 %), 1 retoucher (2 %), 4 needle and awl fragments (8 %). Trace analysis made by E.Y. Ghirya (Saint-Petersburg, IIMK) allowed to identify tools with traces of bone and antler treatment (burins), with traces of scraping and cutting hide (scrapers, one drawing-knife), knives for meat and wet hide, knives for cutting wood. Most of the tools were fixed in antler or wooden handles and possibly had a padding of soft material (a piece of hide) in between. The tools were in use for a long time and were often rejuvenated (Kimura, 2012: 175–187). Bone tools are represented by one fragment of dented cortical bone (retoucher), needle and awl fragments, one bone fragment with a pointed end (possibly a borer).

It is noteworthy that the inhabitants of the settlement most often used only ready tools and the minimum of brought high-quality jasper materials. The cycle of primary reduction is absent. The percentage of implements from the total number of lithic artifacts constitutes 5 % and 21 % without taking into account microblades and scales (60 % of debitage products were up to 0.5 cm in size). Trace analysis showed that all lithic artifacts more than 1.5 cm in size (except microblades) were in use.

To the art objects belongs the “pierced baton” uncovered in the complex. It was made on the antler of a reindeer (Fig. 3, *36*). The artifact was broken in antiquity. The remaining part (2.05 × 4.75 × 10 cm) has a round drilled hole. The surface of the artifact is richly decorated and has traces of polishing and ochre (Mecherin, Razgildeeva, 2002). Items of adornments are represented by 12 round beads and their fragments made of talc shale, tuffite and ostrich egg-shells. Beads are 0.3–0.6 cm in diameter, biconical holes are 0.2–0.3 cm in diameter, thickness is 0.15–0.2 cm (Fig. 3, *37*). The beads were made of small pieces of material which was most often polished on one side. To art objects may also refer the left heel bone of argali (Ovis ammon) (Fig. 3, *38*). It didn’t have any special decorations, but its natural shape looks like the head of a deer (Konstantinov M.V. et al., 2007). Trace analysis showed that the surface of the bone was polished. Ancient dwellers actively used mineral paint – ocher, which was ground by pebble-pestles.

The faunal collection is very scarce. Bones of red deer (*Cervus elaphus*), small cloven-hoofed animal (*Ovis*), large Bovidae and one phalanx of a rhi-


*Fig. 3.* Studenoe 2. The collection of lithic and bone artifacts in cultural horizon 5.

*1–6* – microblades; *7–11, 21* – burins; *12–14* – tool fragments; *15, 16* – scrapers; *19, 20, 22–24, 32, 33* – microcblade cores; *21* – tools on flakes; *25–30, 34* – tools on blades; *31* – chisel tool; *35* – chopping tool; *36* – "pierced baton"; *37* – beads; *38* – "head of an elk" – the heel bone of argali.

noceros were recovered (*Coelodonta sp*). Large and medium bone fragments are very few in number. Preserved small burnt bone fragments point to a high degree of utilization.

Expressiveness of material in cultural horizon 5 allowed to conduct a thorough spatial analysis of the settlement. When conducting spatial analysis the method of building circular models was applied along with the traditional method (Razgildeeva, 2008). This allowed to define the structure of the studied complex more precisely.

The centre of the complex was occupied by an elongated two-hearth dwelling. Its total area was 26.5 $m^2$. The main entrance into the dwelling was on the eastern side opposite the hearth № 2 and faced the river. On the same side of the dwelling next to the hearths there were artifact assemblages and rarefield discard area. Entrance curtains might have been absent here at all as the stones which lined the entrance were quite far.

The inside of the structure was the centre of household activity of ancient people. Next to the hearths there were uncovered knives for cutting meat, scrapes for hide and skin, burins for antler-bone, flakes with utilitarian retouch. The surface of the floor around hearth № 1 and of the southern part of the complex was covered by a thin charcoal layer up to 2 cm thick, which indicated close connection of household activity in this part of the dwelling with the hearth. There also were two small boulders – “seats” here. Each had a stone beside them used as a stand. This sector of the dwelling must have been associated with preparing food.

As noted above, the inhabitants of the dwelling used mineral paint. Along the border of the western sector opposite hearth № 2 and next to the outer stone lining there were found two small pebbles – pestles for grinding ochre which judging by their location had been hidden under the entrance curtains.

Diverse activities were carried out next to the hearth № 3 where the second household zone is indicated. Spatial analysis indicated the presence of bone needles, awls and round beads. There were no signs of the production of beads in the complex. It makes possible the assumption that the area in the eastern sector next to the hearth № 3 was used for clothes manufacture. The beads might have been an adornment and were lost when clothes was repaired.

According to trace analysts V.E. Shelinsky and E.Y. Ghirya (Saint-Petersburg, IIMK) a unique tool made on the blade was recovered which was used for meticulous cutting. The tool served for thin cutting of well-stretched hide or for skin-painting. The blade was fixed in the bone handle with a soft padding made of hide (Fig. 3, *34*).

In the north-eastern sector, next to the hearth № 3 three assemblages of microblades and scales were indicated. This area was used for core reduction and for rejuvenation of tool edges. Four meat-cutters and burins for antler-bone were found next to the hearth. On the floor there were uncovered small bone fragments associated with kitchen remains.

In the eastern sectors of the dwelling away from the hearths there were artifact-free spaces occupying a little more than 1 $m^2$ which might have served

as sleeping zones. A narrow rarefield discard area of small artifacts indicated the presence of the small extra passage here.

As mentioned earlier, a working area with outer enclosure adjoined the dwelling on the northern side. Of interest is the location of tools for wood in the periphery zones of the complex. Combination of tools in the outer northern perimeter indicates a separate working area: one chisel-like tool, one burin for antler-bone, one fragment of an implement for hide and one blade-penknife for cutting wood (Fig. 3, *27*). It is possible to assume that combined works associated with the production of hunting weapons made of different materials were carried out here. In the southern perimeter of the dwelling there are places of occasional activity associated with separate groups of stones.

The chart of the level of the "floor" surface in the dwelling complex indicated a complex bulging and concave relief of the area. The complex occupies level space, though the area has abrupt lowerings of the layer along the ancient edge of the terrace towards the Chikoi River (along the lines of A, B squares). At the same time the central part of the dwelling has two zones with rises in microrelief where hearths № 2 and № 3 are located. Around them there are circular zones of micro-lowerings (up to 5 cm) and even "lower" zones (up to 10 cm) around hearth № 1 and in the south-western sector of hearth № 2. These microstratigraphic changes in the relief formed under the influence of anthropogenic factor with human activity of different intensity.

The conducted spatial analysis allows to reconstruct the oval two-hearth dwelling 8 m long. Two hearths (№ 2 and № 3) were located in the centre, but hearth № 1 wasn't. It represented the zone of active near-hearth activity. The line of stones, which was earlier associated with the southern side of the hearth lining, was part of the outer lining of the dwelling which occupied the central place in the complex. The main entrance was on the eastern side. Another entrance was on the opposite side from the hearths. It was small and could be covered by entrance curtains. The construction could be two conical single-hearth structures. They faced each other and were connected with a ridged pole in the middle (up to 1.5 m long). Sleeping areas were behind the hearths along the western wall. Food was prepared in the southern part of the dwelling. Household works were done in the northern sector. Behind the dwelling there might have stood a small structure like a kaltami (semi-choom) where hunting weaponry was produced and repaired.

There is no exact data on the seasonal occupation of the settlement. Palinological horizon spectra reconstruct the vegetation of Sartan. There is a combination of wet waterlogged sedge-grass and steppe associations and goosefoot and ephedra in cold climatic condition with low precipitation and high soil moistening. In the river valley there existed landscapes of willow, moss and grass communities. On slopes there were light forests of larch. Profile palinological analysis of terrace II on Studenoe-2 allowed to identify periods of short-term warming withing Sartan age. Cultural horizon 5 is associated with the earliest time of one of these periods (Razgildeeva, Reshetova, 2011).

## REFERENCES

**Goebel T., Waters M.R., Buvit I., Konstantinov M.V., Konstantinov A.V. 2000**

Studenoe 2 and the origins of microblade technologies in the Transbaikal, Siberia. *Antiquity*, vol. 74: 567–575.

**Kimura H. 2012**

The Decipherment of "Shirataki Code". The Archeological study on Obsidian Mine Site. In *Excavation of Paleolithic Culture on Toma locality of Horokazawa site, Hokkaido, Japan.* Rokuichi Shobo.

**Konstantinov A.V. 2001**

Ancient dwellings of Zabaikalye: Paleolith, Mezolite. Novosibirsk: Nauka.

**Konstantinov M.V. 1994**

Stone age of the East Transbaikal. Ulan-Ude, Chita.

**Konstantinov M.V., Konstantinov A.V., Vasiliev S.G., Yekimova L.V., Razgildeeva I.I. 2003**

Pod pokrovitelstvom Bolshogo Shamana: archaeological journey in Zabaikalye. Guide of the field excursion of the international symposium "Ancient cultures of Asia and America". Chita: Express tipographiya.

**Konstantinov M.V., Konstantinov A.V., Yekimova L.V., Razgildeeva I.I. 2007**

The results of investigations on Studenoe complex (Zabaikalye). In *Northern Eurasia in anthropogenic: man, paleostrategies, geoecology, ethnography and anthropology. All-Russian international conference devoted to 100-year anniversary of M.M. Gerasimov's birth*, vol. 1. Irkutsk: Ottisk, pp. 302–307.

**Mesherin M.N., Razgildeeva I.I. 2002**

About small-size art finds on Paleolithic settlement Studenoe 2. In *The history and culture of Eastern Asia. Materials of international scientific conference*, vol. 1. Novosibirsk: Izd. IAE SO RAN, pp. 116–120.

**Razgildeeva I.I. 2008**

Planigraphy of dwelling complexes: method of building circular models. In *Trudy of II (XVIII) All-Russian Archaeological Conference in Suzdal*, vol. III. Moscow: IA RAN, pp. 170–174.

**Razgildeeva I.I., Reshetova S.A. 2011**

Paleoclimate and planigraphy of ancient dwellings. In *Trudy of III (XIX) All-Russian Archaeological Conference*, vol. 1. St.-Petersburg, Moscow, Nizhnii Novgorod, pp. 81–83.

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# INTRASITE VARIABILITY OF OSHOROKKO MICROBLADE INDUSTRY IN YOSHIIZAWA SITE IN HOKKAIDO, NORTHERN JAPAN

## INTRODUCTION

Late Pleistocene Yoshiizawa site is located on the Kitami Mountains along the seaside of Okhotsk in eastern Hokkaido. Many kinds of microblade industries flourished during the Late Upper Paleolithic (LUP, 21–11 ka BP) in Hokkaido. Yoshiizawa site belongs to the Oshorokko microblade industry that was the last stage of LUP (Sato and Tautaumi, 2007). First excavation of this site was carried out in 1966 (Preliminary Report..., 1966) and the report was published (Oba et al., 1983). According to this research result, Yoshiizawa site is thought to be one of representative sites with the Oshorokko microblade industry in Hokkaido.

The department of Archaeology in the University of Tokyo had started the excavation of Yoshiizawa site in 2006 and has continued until today. Total excavated area is 104.5 square meters. In this report we will discuss about the intrasite variability between lithic concentrations on Yoshiizawa site. Since the excavation is not finished, the result of these analyses is interim (Sato et al., 2009).

## GEOGRAPHICAL SETTING AND THE STRATIGRAPHY OF YOSHIIZAWA SITE

Tokoro River having 145 km length, which originates from the backbone range of the central Hokkaido, flows inside the Kitami Mountains and hills around and pours into the sea of Okhotsk. It is well known that many prehistoric sites including Paleolithic are located in the Tokoro River basin. Small Yoshiizawa Creek surrounds by the mountain slopes on the south bank of Muka River where is the tributary of the Tokoro River. Along the Yoshiizawa Creek, 4 river terraces and a wet floodplain are formed. Yoshiizawa site is located on the top terrace having around 170 m height above sea level and the relative elevation between the site and the Muka River bed is about 10 m.

The stratigraphy of Yoshiizawa site is as follows from the top to the bottom: Stratum I comprises black humus (0.1 m) and Stratum II dark brown soil (0.1–0.15 m), and Stratum III loamy brown soil (0.4–0.5 m). Under these strata, sediments become fluvial deposition gradually. As archaeological materials are recovered from the lower Stratum II and the upper Stratum III (0.2–0.3 m), it is likely that the site was inhabited relatively quickly when the terrace emerged. But, we would like to propose the accurate process in details, after the working of geoarchaeological analyses such as sedimentological, soil scientific and topographical will be finished. The content of lithics and their yielded stratigraphical condition suggest that the archaeological layer is single.

## ARCHAEOLOGICAL REMAINS

To date archaeological remains from Yoshiizawa site are only lithics and the total number of lithics is 13,694 (*Table*). No pottery and features such as fireplaces or dwellings are there. 97 % of Lithic raw materials is obsidian and a few shale and andesite are there. According to the EPMA source analysis, 70 % of obsidian lithics is from Oketo source and each 15 % from Shirataki and Rubeshibe, by the preliminary analysis for some flakes and chips. 21 archaeological obsidian sources are confirmed presently and major utilized obsidian sources in the prehistoric Hokkaido are 4 ones such as Shirataki, Oketo, Tokachi (eastern Hokkaido), and Akaigawa (western Hokkaido) (Izuho and Sato, 2007). Obsidian from these 4 sources was widely utilized in the Paleolithic Hokkaido and Shirataki obsidian used to the north as the northern Sakhalin (Kuzmin et al., 2002). Since the distance from Yoshiizawa site to Oketo source is 15 km, and to Rubeshibe is 30 km, and to Shirataki is 40 km, obsidian from each source is not supposed to exotic.

95 % of the lithics from Yoshiizawa site is unearthed from 3 lithic concentrations (Block). Its breakdown exhibits in *Table*, in which the number in the bracket indicates the excavated positions unrecorded including the number in the total. As 11,207 chips (93 %) to12,003 ones counted 88 % of the total number of lithics are recorded in their excavated three dimensional positions, we believe to hold the high resolution of accuracy for the analysis about the lithic production and its usage behavior in the lithic concentrations.

Stone tools from this site are mainly composed of end scrapers, burins, side scrapers, drills, axes, pebble tools, stemmed point, bifaces, and microblades. Besides the debitage such as blades, blade cores, microblade cores, flakes, flake cores, and chips (maximum length less than 2 cm), burin spalls, microblade core spalls, pigment, and anvil are unearthed. The total number of lithics from the block 1, which is the largest, is counted to 8,819 and from the block 2 is 1,623 and from the block 3 is 2,589. During these blocks, 92 % from the block 1, 68 % from the block 2 and 89 % from the block 3 are chips.

Although AMS radiocarbon dating had been measured to the carbides from the cultural layer, data were discrete and not secure. Considering some measurements from other sites, it can be estimated that the date of the Oshorokko microblade industry is around 12–11 ka BP.

**Lithic assamblage in Yoshiizawa Site from 2006 to 2011 seasons**

| | Block 1 | | | | Block 2 | | | Block 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | obsidian | shale | andesite | others | obsidian | shale | others | obsidian | shale | andesite | others |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| End scraper | 101 (8) | 1 | – | – | 11 (1) | – | – | 21 (3) | – | – | – |
| Burin | 6 (2) | 6 (1) | – | – | 2 | – | – | 9 (1) | 2 | – | – |
| Side Scraper | 35 (2) | – | – | – | 3 | – | – | 2 | – | – | – |
| Drill | – | 1 | – | – | 2 | – | – | 2 | – | – | – |
| Axe | – | – | – | – | – | – | 1 | – | – | – | – |
| Pebble Tool | – | – | – | 1 | – | – | – | – | – | – | – |
| Stemmed Point | – | – | – | – | 1 | – | – | – | – | – | – |
| Biface | 5 (1) | – | – | – | 1 | – | – | 1 | – | – | – |
| Total Fragment | 12 | – | – | – | – | – | – | 10 (5) | – | – | – |
| Microblade | 44 (1) | – | – | – | 9 (1) | 1 | – | 55 (7) | – | – | – |
| Blade | 96 (3) | 4 | – | – | 26 (2) | 17 | – | 25 (1) | 4 (2) | – | – |
| Microblade Core | 1 | – | – | – | – | – | – | 7 | – | – | – |
| Blade Core | 1 | – | – | – | – | 1 | – | – | – | – | – |
| Flake Core | 1 | – | – | – | – | 1 | – | – | – | – | – |
| Burin Spall | 26 | 6 | – | – | 7 | 2 | – | 35 (4) | 10 | – | – |
| Microblade Core Spall | – | – | – | – | – | – | – | 3 | – | – | – |
| Flake | 344 (31) | 13 (2) | 18 (3) | 3 (2) | 342 (14) | 87 | 2 | 74 (14) | 15 (2) | 1 (1) | 10 (2) |
| Chip | 8.030 (348) | 42 | 4 | 5 | 1,053 (38) | 52 | 1 | 2,286 (205) | 16 (2) | – | – |
| Pigment | – | – | – | – | – | – | 1 | – | – | – | – |
| Anvil | – | – | 1 | – | – | – | – | – | – | – | – |
| Pebble, Pebble Fragment | – | – | 1 | 12 (4) | – | – | – | – | – | – | 1 (1) |
| *Total* | 8,701 (396) | 73 (3) | 24 (3) | 21 (6) | 1,457 (56) | 161 | 5 | 2,530 (240) | 47 (6) | 1 (1) | 11 (3) |

*Continuation of Table*

| | Others | | | | Total | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | obsidian | shale | andesite | others | obsidian | shale | andesite | others | |
| 1 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| End scraper | 2 (2) | – | – | – | 135 (14) | – | – | – | 136 (14) |
| Burin | 1 | – | – | – | 18 (3) | 8 (1) | – | – | 26 (4) |
| Side Scraper | 1 | – | – | – | 41 (2) | – | – | – | 41 (2) |
| Drill | – | 1 | – | – | 4 | 2 | – | – | 6 |
| Axe | – | – | 1 | – | – | – | 1 | 1 | 2 |
| Pebble Tool | – | – | 1 | – | – | – | 1 | 1 | 2 |
| Stemmed Point | – | – | – | – | 1 | – | – | – | 1 |
| Biface | – | – | – | – | 7 (1) | – | – | – | 7 (1) |
| Total Fragment | 2 (2) | – | – | – | 24 (7) | – | – | – | 24 (7) |
| Microblade | 2 (1) | 1 (1) | – | – | 110 (1) | 2 (1) | – | – | 112 (1) |
| Blade | 15 (4) | 2 | – | – | 162 (1) | 27 (2) | – | – | 189 (12) |
| Microblade Core | – | – | – | – | 8 | – | – | – | 8 |
| Blade Core | – | – | – | – | – | 1 | – | – | – |
| Flake Core | – | – | – | – | 1 | 1 | – | – | 2 |
| Burin Spall | 3 | 3 (1) | – | – | 71 (4) | 21 (1) | – | – | 92 (5) |
| Microblade Core Spall | 1 (1) | – | – | – | 4 (1) | – | – | – | 4 (1) |
| Flake | 69 (34) | 13 (1) | 4 (1) | 1(1) | 829 (93) | 128 (5) | 23 (5) | 16 (5) | 996 (108) |
| Chip | 505 (200) | 8 (3) | – | 1 | 11,874 (791) | 118 (5) | 4 | 7 | 12,003 (796) |
| Pigment | – | – | – | – | – | – | – | 1 | 1 |
| Anvil | – | – | – | – | – | – | 1 | – | 1 |
| Pebble, Pebble Fragment | – | – | – | 26 (23) | – | – | 1 | 39 (28) | 40 (28) |
| *Total* | 601 (244) | 28 (8) | 6 (1) | 28 (24) | 13,289 (936) | 309 (15) | 31 (5) | 65 (33) | 13,694 (989) |

## VARIABILITY BETWEEN THE LITHIC CONCENTRATIONS (BLOCKS)

Lithic assemblages from each block exhibit high variability. 136 end scrapers are detected from each block, but 75 % of these is from the block 1. Although 26 burins and 92 burin spalls are detected from each block, these concentrate on the block 1, 46 % of burins and 35 % of burin spalls, and the block 3, 42 % of burins and 49 % of burin spalls. Almost side scrapers are detected from the block 1, 35 (85 %) out of 41. 33 % of drills is detected from the block 2 and 3, 71 % of bifaces is from the block 1, and 88 % of Oshorokko microblade cores and 49 % of microblades are from the block 3. The amount of blades from each block can be supposed to deviate in numbers. In this way, the distributional deviation of every tool and lithic between each block is so remarkable. Most part of chips detected with a high percentage (89–92 %) from the block 1 and the block 3 has the characteristic derived from the process of secondary tool preparation. As the result mentioned above, the function and human activities of each block can be estimated at the present stage as follows.

The block 1: some sort of working activities using end scrapers, side scrapers, and burins, and the maintenance behavior of these.

The block 2: some sort of working activities using drills, axe, stemmed point, and pigment, and shale blade production.

The block 3: some sort of working activities using burins, and microblade production, and the maintenance behavior of these.

Since microblades having the characteristic derived from the Oshorokko microblade cores are detected from each block, it is thought that each block were formed contemporarily, in spite of the deference with the number of microblades and microblade cores each block. In the stage of the Late Microblade Industry including the Oshorokko Microblade Industry and the Hirosato Microblade Industry (Sato, 2004), it is believed that the movement area by the prehistoric hunter-gatherers is more reduced and the intersite and intrasite variability more increased than the previous stage as the late Early Microblade Industry including the Sakkotsu Microblade Industry and the Shirataki Microblade Industry with Yubetsu Method, and the Tougeshita Microblade Industry (Yamada, 2006; Sato and Tsutsumi, 2007). Also, Yoshiizawa site in the Late Microblade Industry have the same tendency. Hypothetically, it is suggested that people inhabited along the creek bank and carried out the some kinds of deferent behaviors for each concentration. That variability maintained between the blocks may be due to use of each place as a working space that had been strongly controlled for any reason socially and ecologically, or the duration of occupation is a very short time.

## REFERENCE

**Izuho M., Sato H. 2007**

Archaeological obsidian studies in Hokkaido, Japan: retrospect and prospects. *Bulletin of the Indo-Pacific Prehistory Association*, vol. 27: 114–121.

**Kuzmin Y.V., Glascock M.D., Sato H. 2002**

Sources of archaeological obsidian on Sakhalin island (Russian Far East). *Journal of Archaeological Science*, vol. 29: 741–749.

**Oba T., Kondo Y., Kubo K., Miya H. 1983**

Report on the Excavation of Yoshiizawa site. *Bulletin of the Kitami Regional Museum*, vol. 13: 1–37 (in Japanese).

**Preliminary Report on the Excavation of Yoshiizawa site, Aino-nai, Kitami-city. 1966**

Kitami Regional Research Association (ed.). Kitami: Kitami Regional Research Association (in Japanese).

**Sato H. 2004**

Lithic procurement and reduction strategy of Hirosato Industry in the Japan Sea Rim area. *Seonsa wa Kodae*, vol. 20: 205–221.

**Sato H., Izuho M., Yamada S. 2009**

Interim report on the excavation of the Yoshii-zawa site in Hokkaido, northern Japan. In *International Symposium on Paleoanthropology in Commemoration of the 80th Anniversary of the Discovery of the First Skull of Peking Man and the First Conference on Quaternary Research of Asia.* Beijin: IVPP.

**Sato H., Tsutsumi T. 2007**

The Japanese microblade industries: technology, raw material procurement and adaptation. In *Origin and Spread of Microblade Technology in Northern Asia and North America.* Burnaby: Archaeology Press, Simon Fraser Univ., pp. 53–78.

**Yamada S. 2006**

A Study of Microblade Assemblages in Hokkaido, Japan. Tokyo: Rokuichi-Shobo. (in Japanese).

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# PALAEOLITHIC LAYERS OF THE MULTILAYER SITE BIRYUSA, MIDDLE YENISEY

Although only preliminary and general characteristics on the palaeolithic assemblages of the Biryusa (Middle Yenisey basin) multilayer site (Fig. 1) are known, its cultural attribution and relative chronology had been distinguished (Auerbakh, Gromov, 1935; Khlobystin, 1972; Abramova, 1979; Tseitlin, 1979). New evidence from natural-scientific analysis provides information for more detailed examination both for cultural layers and its chronological position.

During the field investigation at 1926–1927 and 1961–1962 several palaeolithic layers was identified there: four (C1, C2, C3, C4) in the northern part of the site by N.K. Auerbakh and V.I. Gromov (Auerbakh, Gromov, 1935) and five (I, II, III, IIIA, IV) by L.P. Khlobystin (1962) in its southern part. Owing to the few number of artifacts from distinct layers N.K. Auerbakh and V.I. Gromov considered all palaeolithic assemblages together. As mentioned from the entire collection of 136 artifacts. There were 101 stone tools and 14 bone tools from layer C3 and only 21 artifacts from layers C1 and C2. V.I. Gromov, who prepared the publication after N.K. Auerbakh's death, didn't seen collection of cultural layer C4 from the excavation of 1926–1927.

Palaeolithic layers were associated with the sequence of 4–5 humus horizons and moreover the localization of cultural deposits coincided with distribution of humuses.

Materials of all 5 layers of the Biryusasite are homogeneous. The difference between assemblages of these horizons is connected with different quantitative characteristics of collections. The typological composition of collections is determined by 4 principal categories of tools: end-scrapers, scrapers, splintered pieces and pebble-tools. Burins and borers are presented in all layers by single tools. According to technico-typological features these materials were identified with Afontovskaya culture (Abramova, 1979).

The quantitative materials obtained during all years of excavation are determined the following way:

It seems to be possible on the base of quantitative composition of tools types to make a conclusion that during the period of accumulation of the Palaeolithic layers I and II the south part of the settlement was characterised by

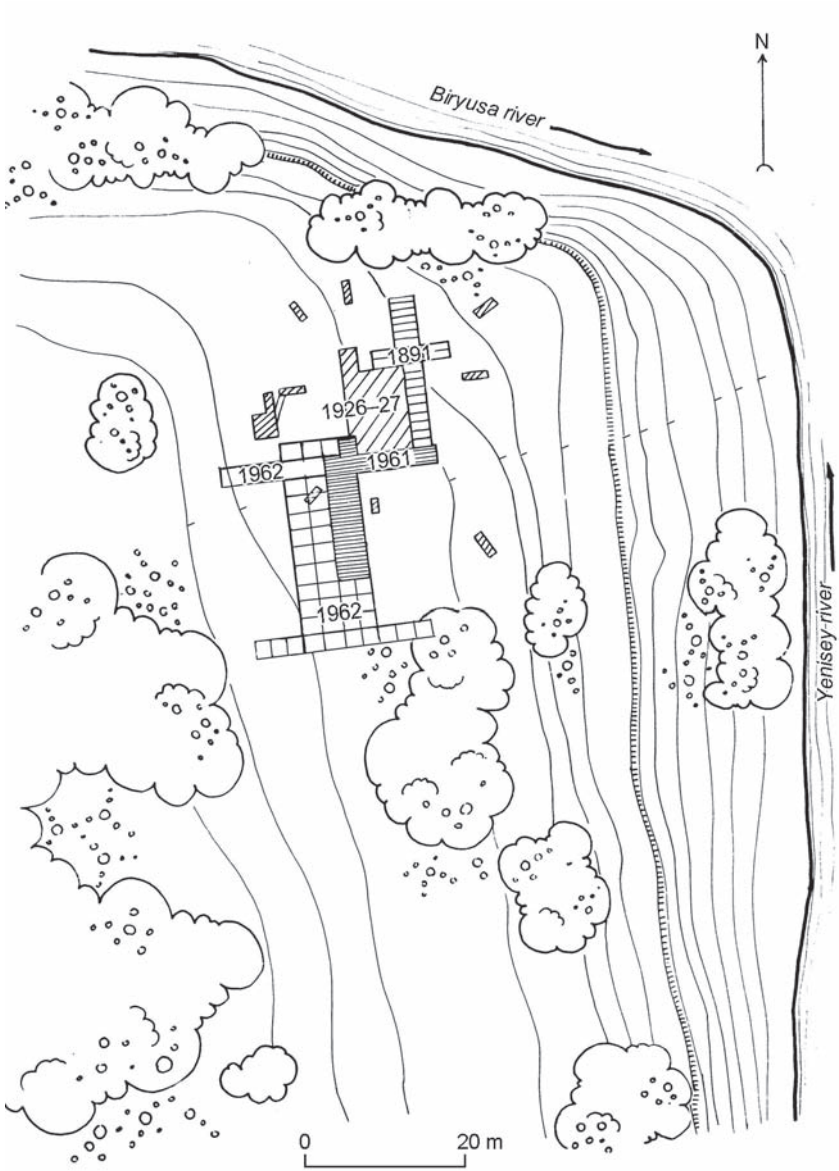


*Fig. 1.* Excavation's area at Biryusa site (after Gurina, 1964).

association of different kinds of human activities. In contrast the most part of such activities was localised on the northern part of the site during the period of the occupation of III cultural level. The cultural layer IIIA was not identified on the northern part, but cultural layer IV was represented everywhere by concentrations of materials of very high density.

The problem of correlation of cultural deposits in southern and northern parts of the site cannot be realised in a directly strict manner because documentation does not give a possibility to link-to longitudinal sections. Nevertheless, theirs stratigraphic unites appears to be the most probable. Concentrations of cultural remains were associated with humus-charcoal layers of local distribution. Outside of these concentrations only isolated remains were obtained.

Seven concentrations of cultural remains were distinguished on the 385 $m^2$ of the excavated surface of the palaeolithic layer I. 736 artefacts were obtained from these concentrations, 99 pieces or 13.5 % of them had secondary modifications. Two from these concentrations were represented by flint-knapping areas; the others five were connected with hearths. It is important to note that the largest concentrations of all layers were located in the same areas.

Palaeolithic layer II also was a relatively rich by material remains (Table 1). Cores were represented by two typical varieties for Afontovskaya culture: so-called pebble-cores (3 items) and micro-cores (5 items). Refitting of three pebble-cores gives a possibility to distinguish real technological sequences of core reduction. Large flake-blade (10 × 4.3 cm) was removed from the oval-long pebble (Fig. 2, *2*). Side – scraper was made later on this blank by means of ventral scaled retouch (Fig. 2, *1*). The lower, opposite to striking platform, end of the pebble was shaped by dihedral removals, where one negative used as a striking platform for the other. The same dihedral method was used for producing blanks from the other core (Fig. 2, *6*), which had a similar with chopping-tools morphology. The third core of bipolar removals was reshaped at three times according to available crested blades (Fig. 2, *5*). 17 from 111 flake-blades of the layer were refitted to this core.

Micro-cores were represented by two varieties of wedge-like type (Fig. 2, *3*, *4*).

The most numerous group of tools of the cultural layer II was a small end-scrapers (25 items) made on flakes (Fig. 3, *2–10*, *14*). Middle-size end-scrapers were less numerous (Fig. 3, *11*, *12*). 16 side-scrapers of convex working edge were shaped usually by abrupt and semi-abrupt scaled retouch (Fig. 3, *13*, *15*, *16*).

There are two varieties of splintered pieces: first of small size with wedge-like section and second with the working edge made on large flakes. Burins on a transverse break and borers are represented by single tools only.

In general such composition of the assemblage is typical for all the palaeolithic layers of the site.

The industry of cultural layer C-3 and III is characterised by variable side-scrapers, more often with continuous retouch over the whole outline of the blank; by varieties of end-scrapers with the dominance of small-size one. The most probable splintered pieces and individual tools such as borers were used in the handle. Important for the interpretation seems the association of this lithic assemblages with the dominance till to 86 % of hare's bones in osteological remains of these cultural layers.

*Table 1*. **Biriysa. The composition of the Palaeolithic assemblages from 1926–1927, 1961–1962 excavations**

| Tools | Layers | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $C_1$ | $C_2$ | $C_3$ | C | I | II | III | I–III | III–A | III–IV | IV | Total |
| **Stone tools** | | | | | | | | | | | | |
| Side-scrapers | 4 | – | 2 | 1 | 10 | 18 | 2 | 7 | 5 | 1 | 11 | 61 |
| Fragments of side-scrapers | – | – | 2 | – | 8 | 10 | 1 | 8 | 1 | – | 9 | 39 |
| End-scrapers | 2 | 2 | 6 | 1 | 9 | 10 | – | – | 4 | 2 | 9 | 45 |
| Micro end-scrapers | – | – | 4 | 1 | 3 | 25 | 5 | – | 2 | 3 | 4 | 47 |
| Splintered pieces | – | – | – | – | 6 | 9 | 4 | 5 | 7 | 5 | 23 | 59 |
| Borers | – | – | 1 | – | 2 | 2 | – | – | – | 1 | 1 | 7 |
| Burins/burins spalls | – | – | 1 | /1 | – | 2 | – | – | – | 4 | 4/2 | 12/3 |
| Retouched blades | – | – | 3 | – | – | – | 1 | – | – | – | 1 | 5 |
| Retouched flakes | – | – | 4 | – | 12 | 26 | 2 | 4 | 3 | 6 | 9 | 66 |
| Points | – | – | 3 | – | – | – | – | – | – | – | 6 | 9 |
| Pebble-tools | 1 | – | – | – | 13 | 18 | 6 | – | 2 | 1 | 34 | 75 |
| Divers | – | – | – | 1 | 1 | 2 | – | – | 1 | – | 3 | 8 |
| Hammerstones | – | – | 2 | – | 3 | – | – | – | – | – | 1 | 6 |
| Grindstones | – | – | – | – | 1 | 1 | – | 1 | 1 | – | 2 | 6 |
| Utilized blanks | – | – | – | – | 4 | 15 | 1 | 4 | 1 | 1 | 8 | 34 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fragments of tools | – | – | 1 | – | 15 | 21 | 3 | – | 8 | 2 | 12 | 62 |
| *Total* | 7 | 2 | 29 | 5 | 87 | 163 | 25 | 29 | 35 | 26 | 139 | 547 |
| **Blanks** | | | | | | | | | | | | |
| Microblades | – | – | – | – | 9 | 31 | 2 | 2 | – | – | 8 | 54 |
| Blades | 6 | – | 26 | 3 | 7 | 32 | 3 | 7 | 2 | 13 | 25 | 124 |
| Flakes | 4 | 1 | 2 | 22 | 532 | 1379 | 155 | 470 | 146 | 125 | 711 | 3547 |
| *Total* | 10 | 1 | 28 | 25 | 548 | 1442 | 160 | 479 | 148 | 140 | 744 | 3725 |
| Debris | – | – | 3 | 2 | 37 | 126 | 7 | 41 | 32 | 32 | 203 | 472 |
| **Bone tools** | | | | | | | | | | | | |
| Needles | – | – | 3 | 1 | – | – | – | – | – | – | 3 | 7 |
| Points | – | 1 | 4 | 2 | – | – | – | 2 | – | – | 9 | 18 |
| Pendants | – | – | 3 | – | – | – | – | – | – | – | – | 3 |
| Worked bones | – | – | – | – | – | – | – | – | – | – | 11 | 11 |
| *Total* | – | 1 | 10 | 3 | – | – | – | 2 | – | – | 23 | 39 |

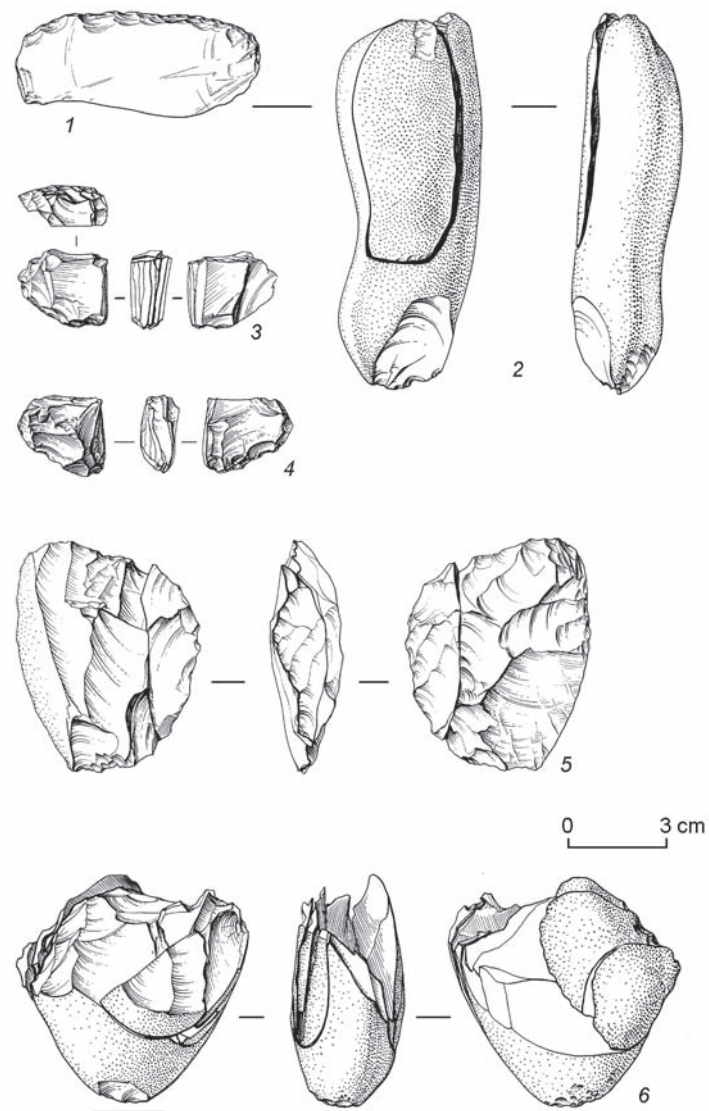


*Fig. 2.* Biryusa. Lithic assemblage of the cultural layer II.

Cultural layer IIIA was identified only in the southern part of the excavated area of the site. Typological composition of its lithic assemblage (216 pieces) does not distinguished from uppermost layers: end-scrapers, side-scrapers, splintered pieces. One radiocarbon date of 14 480 ± 400 (LE-3777) was obtained by Yu.S. Svezhentsev on bison's bone from this layer.

Cultural remains of Palaeolithic layer IV is distinguished by its quantity. 133 pieces from 1 106 knapped stones have a secondary modifications. Cul-

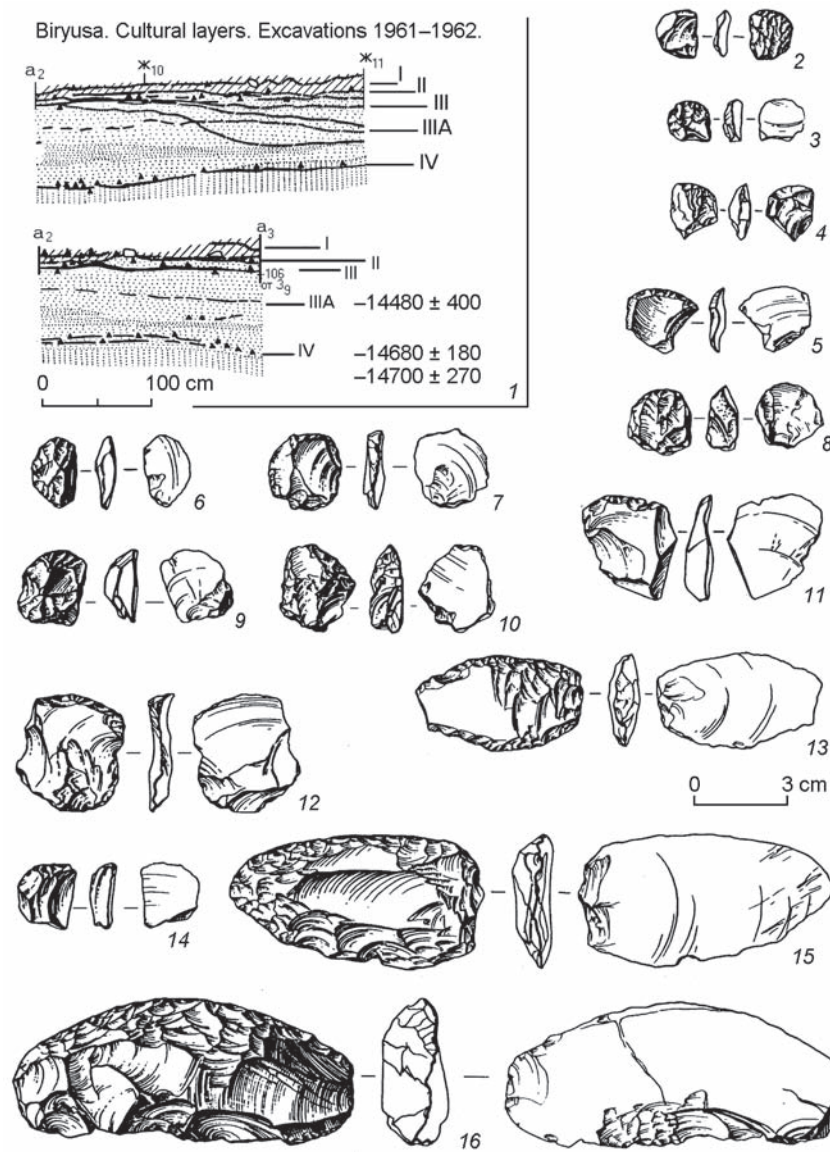


*Fig. 3.* Biryusa. Position of cultural layers in section. Radiocarbon dates. Lithic assemblage of the cultural layer II.

tural layer are characterised also by high degree of the concentration of broken and fragmented bones. Two radiocarbon dates of 14 680 ± 180 (LE-4910) and 14 700 ± 270 (LE-4912) were obtained on bone samples of this cultural layer. The most part of remains were located around some hearths in southern part of the excavated area.

Up to now the age of site occupation was defined on the background of comparing typology of lithic assemblages at 12 000 BP about (Tseitlyn, 1979: 129). Owing to radiometric dates and palaeozoological studies the age of site existence appears to be older at 3 thousands years as minimum.

## FAUNA

The composition of mammal's osteological remains from Palaeolithic layers of the site Biryusa included the following species: *Lepus tanaiticus, Vulpes vulpes, Equus* sp., *Equus hemionus, Rangifer tarandus, Capreolus capreolus, Bison priscus, Saiga tatarica*.

All these animals appear to be an objects of hunting. The composition was not a constant during the period of cultural layers formation. There are a lot of similarities between IV and IIIA cultural layers. The main objects of hunting at that time were rangifer tarandus and bison. Bones of them composed accordingly 73 % and 22 % in IV layer, and 45 % and 37.5 % in the layer IIIA. Remains of equus hemionus and saiga tatarica are the most important for environmental reconstruction as a diagnostic species of continental and dry climatic conditions. Lepus sp. was represented by 2.5–3 % of bones.

The quantity of rangifer tarandus and bison were reduced but number of bones of *Lepus sp.* sharply increased in three uppermost layers. Moreover the quantity of the latter gradually reduced from III to I layer (Table 2). Relative

*Table 2.* **Biryusa. The composition of faunal species from 1961–1962 excavations**

| Species | Layers | | | | |
|---|---|---|---|---|---|
| | IV | III-A | III | II | I |
| *Lepus* cf. *tanaiticus* | 17/2* 3 % | 1/1 2.5 % | 88/3 86 % | 209/9 80.7 % | 132/4 75 % |
| *Vulpes vulpes* | – | – | – | – | 6/2 3.4 % |
| *Equus* sp. | – | – | – | 1/1 0.4 % | 4/1 2.3 % |
| *Equus hemionus* | 11/1 2 % | 5/1 12.5 % | – | – | – |
| *Rangifer tarandus* | 404/5 73 % | 18/2 45 % | 11/1 11 % | 37/2 14.3 % | 20/1 11.4 % |
| *Capreolus capreolus* | – | – | – | – | 1 1 0.6 % |
| *Bison priscus* | 120/1 22 % | 15/1 37.5 % | 3/1 3 % | 12/1 46 % | 13/1 7.4 % |
| *Saiga tatarica* | – | 1/1 2.5 % | – | – | – |
| Total | 552/9 100 % | 40/6 100 % | 102/5 100 % | 259/13 100 % | 176/10 100 % |

* Bones/individ.

number of rangifer tarandus remained immutable in the framework of 11–14 %. On the contrary, the quantity of bison bones increased from 3 % in III layer to 7.4 % in the uppermost one. Remains of vulpes vulpes and copreolus capreolus were found in I cultural layer only and began to be a vigorous argument for increasing degree of forestation of the territory at that time.

### *Lepus* cf. *tanaiticus*

Measuring of a relatively few number of bones of *Lepus* cf. *tanaiticus* of good preservation show that there were no principal modifications in the size of this animal during the period of accumulation of five cultural layer of the site Biryusa (Table 3).

Comparative analysis with bones of upper Pleistocene lepus tanaiticus from Medvezhia peschera (Bear's cave) of Northern Ural show that this species from Biryusa is the most similar with the smallest hares of Northern Ural (Kuz'mina, 1971). The same comparison with the size of hares from Palaeolithic loesses of Kostenki area (Voronezh region, middle Don basin) shows that lepus tanaiticus from Biryusa is more similar with the most small variety of this species from upper palaeolithic sites of Kostenki (Averianov, Kuz'mina, 1993).

### *Rangifer tarandus*

Although all five cultural layers of site provided a number of remains of reindeer, only bones from layers IV and IIIA were suitable for measuring and comparative analysis (Table 4).

The dimensions of the lower epiphyses of humerus, metacorpes and astragalus show that few increasing in size of bones and so increasing a body dimensions took place during the period from IV to IIIA layers accumulation.

The size of reindeer from the cultural layer IV of Biryusa in nearly the same that the minimal size of this species from Late Pleistocene sediments of Northern Ural. The same range of similarity it has with the size of reindeer bones from Kostenki. The latter was distinguished as subspecies Rangifer tarandus guettardi (Sablin, Kuz'mina, 1992). Materials under discussion show that the same subspecies inhabited middle Yenisey basin at 15 thousand years BP about. On the base of a number of bones and antlers of young animals and long bones with unattached epiphyses one may be possible to define the season of theirs death in the period of late autumn – early winter.

### *Bison*

The number of bones of this animal suitable for measuring was the less than reindeer's ones (Table 5).

The size of bison bones from IV, IIIA and III layers of Biryusa was a bit less than the size of bones of the same species from Northern and Middle Ural (Kuz'mina, 1975).

In general morphometrical study give a background for conclusion about the more rigorous climatic conditions during the period of accumulation of cultural

*Table 3.* **Comparative analysis of the size of bones of *Lepus tanaiticus***

| Bones, measuring (mm) | Biryusa, layer IV | Biryusa, layer III | Biryusa, layer II | Biryusa, layer I | Nothern Ural, after Kuz'mina, 1971 | Kostenki loess, after Aver'janov, Kuz'mina, 1993 |
|---|---|---|---|---|---|---|
| **Mandibula** | | | | | | |
| Row P3–M3 | – | – | 19.5; 22.6 | 19.3 | 20.0–22.2 | 20.0–23.5 |
| Height front P3 | – | – | | – | – | – |
| Height | – | – | 16.0; 17.0 | 16.5 | 16.8–20.5 | 14.2–20.0 |
| Behind M3 | – | – | 16.0–18.6 / 17.7 | – | – | – |
| **Humerus** | | | | | | |
| Width of lower epiphysis | 12.0 | – | 12.0 | 11.6–13.0 / 12.2 | 11.9–14.0 | 11.8–14.4 |
| Diameter of lower epiphysis | 10.0 | – | 9.0 | 8.5–9.9 / 9.1 | – | – |
| **Radius** | | | | | | |
| Length | – | – | | 107.0 | 110.7–118.0 | 119.1–125.0 |
| Width of upper epiphysis | – | – | 9.0–9.1 | 9.0–9.2 / 9.05 | 9.2–10.3 | 8.7–11.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Diametr of upper epiphysis | – | – | 6.0; 6.5 | 5.8–6.3<br>6.07 | – | – |
| Diametr of lower epiphysis | – | – | – | 10.2 | 11.0–11.8 | 10.6–13.0 |
| **Tibia** | | | | | | |
| Width of upper epiphysis | – | 20.5 | – | – | 19.0–19.6 | 19.2–24.5 |
| Diametr of upper epiphysis | – | 20.5 | – | – | – | – |
| Diametr of lower epiphysis | 16.0 | 14.2–16.0<br>15.6 | – | – | 14.3–17.2 | 13.7–17.2 |
| **Calcaneus** | | | | | | |
| Length | – | 33.0; 33.2 | – | 31; 31; 32 | 31.8–36.8 | 33.1–39.3 |
| Width of joint part | – | 12.0; 12.1 | – | 12;11.5; 12.3 | – | – |
| **Astragalus** | | | | | | |
| Length | – | 16.5 | – | 15.8–16.5<br>16.0 | 15.5–18.6 | 16.3–20.0 |

*Table 4.* **Biryusa. Comparative analysis of the size of bones of *Rangifer tarandus***

| Bones, measuring (mm) | Biryusa, IV layer | Biryusa, III A layer | Nothern Ural, after Kuz'mina, 1971 | Kostenki, after Sablin, Kuz'mina, 1992 |
|---|---|---|---|---|
| **Mandibula** | | | | |
| Length tooth row P3 – M3 | 101.0 | – | length tooth row P2–M3: 97.5–105. 0 | – |
| **Humerus** | | | | |
| Width of lower epiphysis | 41.0; 43.0 | 47.5 | 41.0–51.2 | 41.8–51 (51.2) |
| Diametr of lower epiphysis | 35.5; 46.5 | 48.2 | – | – |
| **Radius** | | | | |
| Width of upper epiphysis | 41.0; 46.0 | – | 44.0–48.7 | 42.2–51.2 |
| Diametr of upper epiphysis | 24.0; 24.5 | – | 39.0–47.0 | – |
| Width of lower epiphysis | 9.5–42.2<br>40.9 | – | – | 40.2–47.0 |
| **Metacarpale** | | | | |
| Width of lower epiphysis | 40.0; 44. 0 | 39.5 | 37.5–44.0 | 38.2–50.0 |
| Tibia | | | | |
| Width of lower epiphysis | 38.0 | – | 36.0–47.0 | 34.0–46.4 |
| **Astragalus** | | | | |
| Length of bone | 42.5 | 42.0; 45.0 | 40.8–52.8 | 43.4–47.8 |
| Width of lower epiphysis | 27.5 | 28.0; 30.0 | – | – |

*Table 5.* **Biryusa. Comparstive analysis of the size of bones of *Bison priscus***

| Bones, measuring (mm) | Biryusa, IV layer | Biryusa, III A layer | Biryusa, III layer | Northern and Middle Ural, after Kuz'mina, 1971, 1975 |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| **Scapula** | | | | |
| Width from scapules hillock | 110.0 | – | – | – |
| Diametr of joint part | 74.5 | – | – | – |
| **Humerus** | | | | |
| Width of lower epiphysis | – | – | 114.0 | – |

*Continuation of Table 5*

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| **Metacarpale** | | | | |
| Width of lower epiphysis | 79.0 | – | – | 80.0; 95.0 |
| Diametr of lower epiphysis | 48.0 | – | – | – |
| **Metatarsale** | | | | |
| Width of lower epiphysis | – | 75.0 | – | 71.0 |
| Diametr of lower epiphysis | – | 46.0 | – | – |

layers IV and IIIA of Biryusa in the middle Yenisey basin than the conditions of Northern Ural and middle Don areas during the period of loessic loam's accumulation.

Osteological analysis proved a view point of N.M. Ermolova (Ermolova, 1978) about the relative simultaneously or coexistence of such sites as Biryusa, Druzhinikha, Kamenny log, Zabochka on Yenisey and Fediaevo and Krasny Yar (uppermost layers) on Angara.

Stratigraphic sequence of five cultural layers of the site Biryusa shows the successive existence at the same place of temporary settlements belonged to the population with the same techno-typological traditions of material culture.

Existence of 5 distinct sites here is proved by refitting of flakes to cores from each cultural layer separately; by the sequence of radiocarbon dates and by evidences of osteological analysis. The existence of concentrations of material remains and hearth the one over the other does not contradict them. There are some examples of such position even for dwelling constructions belonged undoubtedly to different cultural horizons the site Studenoe I, horizons 18, 19 (Konstantinov, 1994). There is nothing unusual in this disposition according to seasonal or intermittent occupation of the place by the same population.

## CHRONOLOGICAL PROBLEMS

Up to now the appreciation of the age of cultural layers of Biryusa was based on indirect evidences, the estimation of which was not homogeneous. V.I. Gromov believed that the site is located on the first terrace of the river (Auerbakh, Gromov, 1935). S.M. Tseitlin (Tseitlin, 1979) was defined it as a second, which sediments were simultaneous to the deposit of the site Kokorevo III with the date of 12 690 ± 140 B.P. (LE-629). On the base of analysis of fauna remains from the excavations of 1926–1927 V.I. Gromov defined climatic conditions of the period of site existence as a relatively temperate with afforested landscape. He supposed the existence in these conditions a saiga, although that time there was no bones of this animal in available collection. Now there are bones of saiga tatarica and equus hemionus from IIIA cultural layer, that in any measure prove the view point of V.I. Gromov. Both coexistence of bones of reindeer and bison in IV and IIIA layers of Biryusa and radiocarbon

dates gives a background for its comparison with the cultural layer V of the site Kurtak (Svezhentsev, Lisitsyn, Vasil'ev, 1992). So the age of 15 000 BP for IV and IIIA layers of Biryusa seems to be distinguished convincingly enough.

Three uppermost layers without radiocarbon dates may be dated in wide framework of cold period of end of last glaciation.

Although comparative analysis of archaeological materials from five cultural layers of Biryusa does not brought to light any evolution, it seems to be important for understanding a real ways of subsistence of Palaeolithic population of middle Yenisey. Sequences of short-time seasonal sites are vigorous arguments for the reconstruction of local migrations of peoples during the period from 15$^{th}$ to 12$^{th}$ years BP.

## REFERENCES


**Abramova Z.A. 1979**

The Paleolithic of Yenisey. Afontovskaya culture. Novosibirsk: Science (in Russian).

**Averianov A.O., Kuz'mina I.E. 1993**

Don's hares *Lepus tanaiticus* Gureev from upper Paleolithic sites of Kostenki. *Proceedings of the Zoological Institute, Russian Academy of Sciences*, vol. 249: 66–92 (in Russian).

**Auerbakh N.K., Gromov V.I. 1935**

Materials for study of Biriysa sites near Krasnoyarsk. *Paleolithic of USSR. Proceedings of the State academy of the History of material culture*, vol. 118: 219–245 (in Russian).

**Gurina N.N. 1964**

Excavation of Neolithic group of Krasnoyarsk expedition. *KSIA*, vol. 97: 88–97 (in Russian).

**Ermolova N.M. 1978**

Teriofauna of Angara basin in the late Anthropogene. Novosibirsk: Science (in Russian).

**Khlobystin L.P. 1972**

Bone and antler artefacts from palaeolithic layers of the site Biriysa. *Materials and studies for the archaeology of USSR*, vol. 185: 150–156 (in Russian).

**Konstantinov M.V. 1994**

Stone age of the eastern part of Baikal Asia. Ulan-Ude; Chita (in Russian).

**Kuz'mina I.E. 1971**

Formation of teriofauna of Northern Ural in the late Anthropogene. *Proceedings of the Zoological Institute, Russian Academy of Sciences*, vol. 49: 44–122 (in Russian).

**Kuz'mina I.E. 1975**

Some datas of mammals of Middle Ural in the late Pleistocene. *Bulletin of Comission for study of the Quaternary*, vol. 43: 63–77 (in Russian).

**Sablin M.V., Kuz'mina I.E. 1992**

Late pleistocene reindeer *(Rangifer tarandus)* from the Upper Don. *Proceedings of the Zoological Institute, Russian Academy of Sciences*, vol. 246: 72–80 (in Russian).

**Svezhentsev Yu.S., Lisitsyn N.F., Vasil'ev S.A. 1992**

Radiocarbon chronology of Yenisey palaeolithic. In *Chronostratigraphy of Palaeolithic of Northern, Central, Eastern Asia and America (International symposium).* Novosibirsk: Science, pp. 57–64 (in Russian).

**Tseitlin S.M. 1979**

Geology of Paleolithic of the Northern Asia. Moscow: Science (in Russian).

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# PALEOANTHROPOLOGY OF ABORIGINAL TASMANIANS FROM THE PROBLEM OF THEIR ORIGIN PERSPECTIVE

This paper considers the results of the Aboriginal Tasmanians craniological study in view of their origin. We studied 15 skulls, 9 of them belonged to men and 6 to women. The skulls were measured according to the standard craniology program and to the author's craniotrigonometric program. The aim of the study was to obtain the detailed description of the craniology type of Aboriginal Tasmanians and to compare them with the Paleolithic finds.

The average characteristics of male and female skulls are given in Tables 1 and 2.

The male skull of the Aboriginal Tasmanians can be described as a little elongated and not wide, mesocranial with a tendency to the dolichocrania. In most of the cases the shape of the vault is ovoid. The skull is not high, orthocranial (Height-Length Index). At the same time absolute Cranial Height is medium, it is confirmed by the moderate Height-Breadth Index (metriocrania). In general, the absolute sizes of the skull mostly fall into the category of large and moderate-sizes. For example, Cranial Length and Byzygomatic Diameters are large, so male skull of Aboriginal Tasmanians are characterized by the elongation of the length sizes of the braincase and wide face.

The face is prognathic, wide and very low. Upper Facial Index shows euryene (very low-faced). The upper angle of the horizontal profile is moderate, so the face is slightly flattened. Zigo-maxillary angle is categorized as very low, indicating a considerable alveolar prognathism. The orbits are low and wide (chamaeoconch). In absolute size of the nose is not tall and very wide (hyperplatyrrhine). The angle of protrusion of the nose is not big. The lower edge of the pyriform aperture is sulcus praenasalis, so the lateral edge of the pyriform aperture are continuing down for a considerable length, the lower edge is smoothed and prenasalis pits merge into one big depression. Canine fossa are well-developed. The lower jaw has a widely deployed condyles and angles, the moderate height and slightly massive body.

The female skull of the Aboriginal Tasmanians can be described as somewhat elongated and narrow, dolichocranial. The shape of the vault is ovoid. The skull is not high (Height-Length Index – orthocrania). At the same time,

*Table 1.* **Average craniometric characteristics of the male Aboriginal Tasmanians**

| № | Traits | N | X | S |
|---|---|---|---|---|
| 1 | Cranial Length | 9 | 185,9 | 5,6 |
| 8 | Cranial Breadth | 9 | 139,6 | 6,1 |
| 17 | Basion-bregma Height | 9 | 134,2 | 3,5 |
| 5 | Cranial Base Length | 9 | 100,4 | 3,8 |
| 9 | Minimum Frontal Breadth | 9 | 97,4 | 5,3 |
| 10 | Maximun Frontal Breadth | 9 | 118,6 | 4,3 |
| 11 | Cranial Base Width | 9 | 125,9 | 5,7 |
| 12 | Nape Width | 9 | 109,8 | 6,2 |
| 29 | Frontal Chord | 9 | 111,2 | 6,1 |
| 30 | Parietal Chord | 9 | 117,2 | 5,3 |
| 31 | Occipital Chord | 9 | 95,4 | 3,9 |
| 26 | Frontal Arch | 9 | 126,6 | 8,0 |
| 27 | Parietal Arch | 9 | 129,8 | 7,2 |
| 28 | Occipital Arch | 9 | 114,6 | 5,4 |
| 45 | Bizygomatic Diameter | 9 | 139,2 | 7,4 |
| 40 | Facial Base Length | 9 | 106,8 | 5,7 |
| 48 | Upper Facial Height | 9 | 63,6 | 3,5 |
| 47 | Total Facial Height | 7 | 109,3 | 4,7 |
| 43 | Upper Facial Breadth | 9 | 112,3 | 4,4 |
| 46 | Middle Facial Breadth | 9 | 99,3 | 4,0 |
| 55 | Nasal Height | 9 | 48,6 | 2,8 |
| 54 | Nasal Breadth | 9 | 29,0 | 2,7 |
| 51 | Orbital Breadth (mf) | 9 | 41,6 | 1,9 |
| 52 | Orbital Height | 9 | 32,4 | 2,5 |
| 77 | Naso-malar angle | 9 | 142,8 | 3,3 |
| <zm | Zygo-maxillary angle | 9 | 121,7 | 5,3 |
| 71a | Min Ramus Breadth | 7 | 35,7 | 5,2 |
| 65 | Bicondylar Breadth | 6 | 119,7 | 7,9 |
| 66 | Bigonial Width | 6 | 97,8 | 6,0 |
| 67 | Anterior Width | 7 | 48,7 | 1,9 |
| 69 | Chin Height | 7 | 32,4 | 3,6 |
| 69(1) | Height of the Mandibular Body | 7 | 30,9 | 2,1 |
| 69(3) | Breadth of the Mandibular Body | 7 | 13,1 | 1,3 |
| 8/1 | Cranial Index | 9 | 75,2 | 4,2 |
| 17/1 | Height-Length Index | 9 | 72,2 | 1,2 |
| 17/8 | Height-Breadth Index | 9 | 96,4 | 5,9 |
| 48/45 | Upper Facial Index | 9 | 45,7 | 2,3 |
| 54/55 | Nasal Index | 9 | 60,7 | 5,2 |
| 52/51 | Orbital Index | 9 | 77,5 | 4,8 |
| 75(1) | Nasal Protrusion Angle | 5 | 22,0 | 11,3 |
| | Canine fossa depth | 4 | 5,3 | 1,0 |

*Table 2.* **Average craniometric characteristics of the female Aboriginal Tasmanians**

| № | Traits | N | X | S |
|---|---|---|---|---|
| 1 | Cranial Length | 6 | 176,2 | 5,2 |
| 8 | Cranial Breadth | 6 | 131,3 | 5,6 |
| 17 | Basion-bregma Height | 6 | 125,5 | 3,3 |
| 5 | Cranial Base Length | 6 | 95,0 | 1,9 |
| 9 | Minimum Frontal Breadth | 6 | 92,3 | 2,9 |
| 10 | Maximun Frontal Breadth | 6 | 108,8 | 2,6 |
| 11 | Cranial Base Width | 6 | 116,8 | 1,5 |
| 12 | Nape Width | 6 | 105,8 | 2,3 |
| 29 | Frontal Chord | 6 | 105,5 | 5,2 |
| 30 | Parietal Chord | 6 | 111,3 | 2,0 |
| 31 | Occipital Chord | 6 | 91,5 | 7,3 |
| 26 | Frontal Arch | 6 | 120,3 | 8,7 |
| 27 | Parietal Arch | 6 | 124,3 | 3,9 |
| 28 | Occipital Arch | 6 | 108,5 | 9,2 |
| 45 | Bizygomatic Diameter | 6 | 123,8 | 1,6 |
| 40 | Facial Base Length | 6 | 101,2 | 4,2 |
| 48 | Upper Facial Height | 6 | 61,8 | 4,2 |
| 47 | Total Facial Height | 5 | 103,6 | 7,0 |
| 43 | Upper Facial Breadth | 6 | 103,7 | 3,5 |
| 46 | Middle Facial Breadth | 6 | 92,5 | 5,2 |
| 55 | Nasal Height | 6 | 47,0 | 1,7 |
| 54 | Nasal Breadth | 6 | 27,0 | 1,3 |
| 51 | Orbital Breadth (mf) | 6 | 40,5 | 2,6 |
| 52 | Orbital Height | 6 | 31,0 | 1,5 |
| 77 | Naso-malar angle | 6 | 140,7 | 4,2 |
| <zm | Zygo-maxillary angle | 6 | 122,7 | 5,2 |
| 71a | Min Ramus Breadth | 6 | 34,0 | 3,7 |
| 65 | Bicondylar Breadth | 6 | 112,2 | 4,4 |
| 66 | Bigonial Width | 6 | 93,0 | 3,9 |
| 67 | Anterior Width | 6 | 46,0 | 3,7 |
| 69 | Chin Height | 6 | 28,5 | 3,0 |
| 69(1) | Height of the Mandibular Body | 6 | 28,5 | 2,7 |
| 69(3) | Breadth of the Mandibular Body | 6 | 11,5 | 0,8 |
| 8/1 | Cranial Index | 6 | 74,6 | 2,8 |
| 17/1 | Height-Length Index | 6 | 71,3 | 2,6 |
| 17/8 | Height-Breadth Index | 6 | 95,8 | 6,7 |
| 48/45 | Upper Facial Index | 6 | 50,0 | 3,5 |
| 54/55 | Nasal Index | 6 | 57,6 | 4,6 |
| 52/51 | Orbital Index | 6 | 77,5 | 2,9 |
| 75(1) | Nasal Protrusion Angle | 4 | 15,0 | 4,1 |
| | Canine fossa depth | 4 | 5,3 | 1,0 |

it is small in absolute Height, as evidenced by moderate Height-Breadth Index (merriocranial). In general, the absolute sizes of the skull mostly fall into the category of small and moderate-sizes. For example, with a Cranial Length goes moderate-wide Byzygomatic dimeter, so female skull is characterized elongation in the length sizes of the cranium and moderate-wide face.

The face is prognathic, moderate-wide and very low. Upper Facial Index shows euryene. The upper angle of the horizontal profile is moderate, so the face is slightly flattened. Zigo-maxillary angle is categorized as very low, indicating a considerable alveolar prognathism. The orbits are of the moderate height and width (mesoconch). In absolute size nose is low and wide (platyrrhine). Nasal Protrusion Angle is small. The lower edge of the pyriform aperture – sulcus praenasalis, so lateral edge of the pyriform aperture are continuing down for a considerable lenght, the lower edge is smoothed and prenasal pits merge into one big depression. Canine fossa are well-developed. The lower jaw has little corners and deployed condyles, moderate height and slightly massive body.

## COMPARATIVE ANALYSIS

Back in the late XIX century many researchers compared the Aboriginal Tasmanians with Neanderthals and almost said that they were the direct descendants of Homo neanderthalensis. So in the book, where was an inventory of the finds at the Museum of Natural History in New York, Dr. Bergell (1879) described two skulls with the word “neandertaloid”. In order to identify certain trends in the parameters of the skull formation of the Aboriginal Tasmanians, we conducted two Multivariate analyses using Principal Component Analysis. We used the angular sizes of the cranium and facial skeleton, the parameters that poor depend on the absolute size and reflect the shape of the skull. In the first analysis, along with male skulls of Tasmanians we took Paleolithic specimens (Southwest Asia forms – Amud 1, Shanidar 1 and Skhul V, the East Asian erectoid (Hexian and Dali) and the Upper Paleolithic sapiens from China Liujiang (Fig. 1).

The first three components describe 80 % of the variance. 7 angles, reflected the shape of the cranium, was used in analysis. For the PC I the angle *ast-n-ast*, reflected the relative width of the occiput and the lenght of the braincase, has maximal loadings. The graph shows that erectoid Hexian has the shortest braincase and a wide occiput, and the Tasmanians and the Upper sapiens from China have less wide occiput.

The PC II shows an increase in the angle of *n-b-l* and a simultaneous decrease in the angle of *b-au-l*. That means with general flattening of the arch of the cranium relative extension of the braincase happens. Dali specimen has the most flattened and relatively broad cranium. Tasmanians located at the opposite on the graph.

The PC III indicates an increase of the angle of *ast-l-b*, which descrbes the increase in the curvature of the back of the braincase. Here we can also see that erectoid forms and Tasmanians are situated on opposite sides. As a result of the analysis we can conclude that Tasmanians are sapiens forms (according

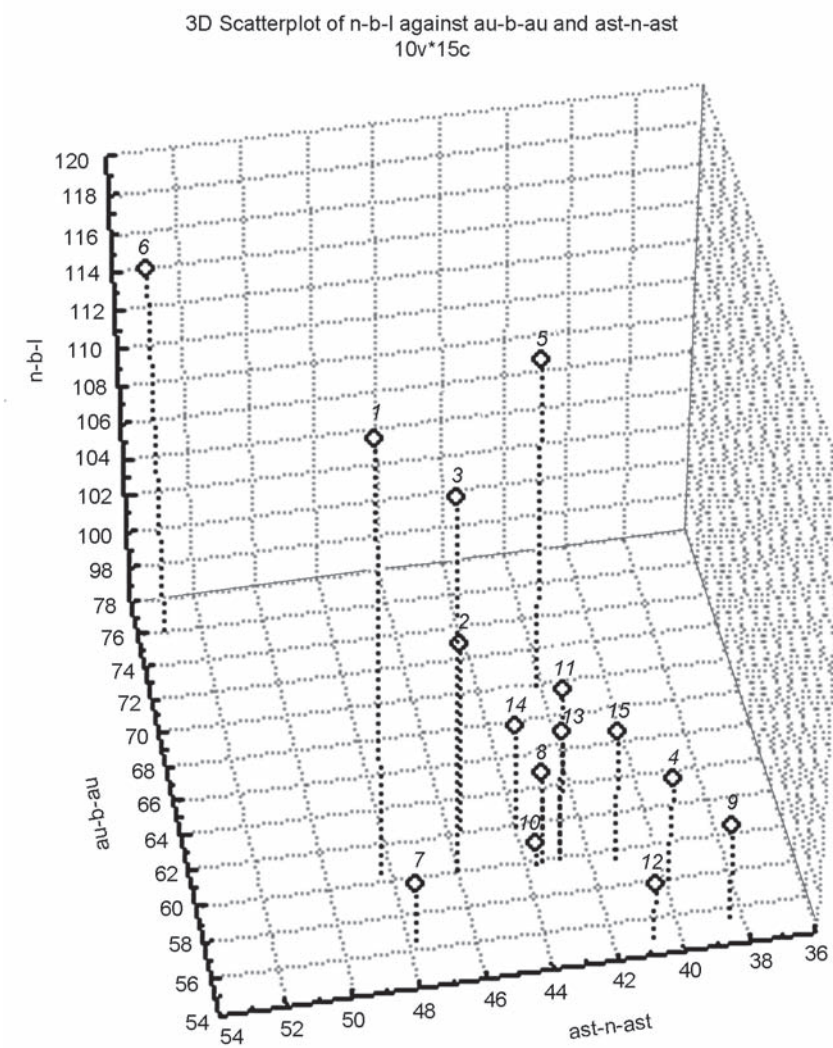


*Fig.* 1. Principal component analysis of the angular sizes of the cranium.
*1* – Amud 1; *2* – Skhul V; *3* – Shanidar I; *4* – Liujiang; *5* – Dali; *6* – Hexian; *7–15* – Aboriginal Tasmanians.

to cranium formation parameters), and they differs morphologically from East erectoid and Southwest neanderthal specimen.

The second analysis was carried out with the angular parameters of the facial skeleton (Fig. 2). In addition to the Tasmanians, the erectoid specimen Sangiran 17 and Broken Hill, neanderthaloid Amud 1, Shanidar 1, Gibraltar 1, La Chapelle-aux-Saints, La Ferrassi and Upper Paleolithic sapiens (Liujiang, Cro Magnon, Vadyak, Talgay and Fish Hoek) took part in the analysis.

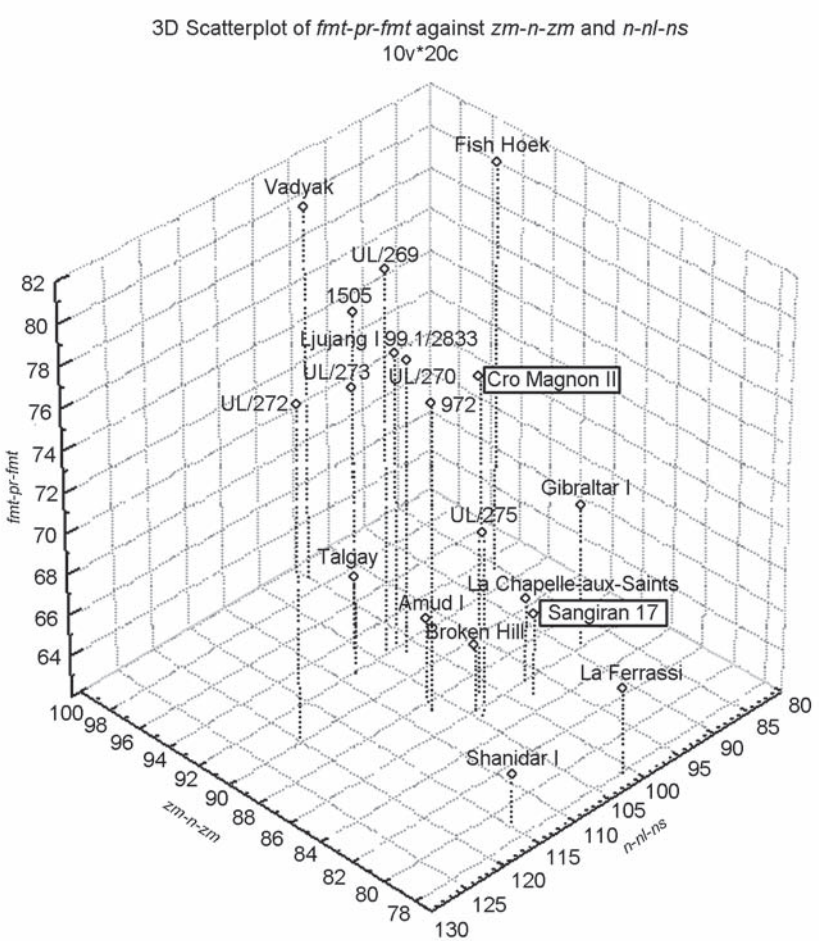


*Fig.* 2. Principal component analysis of the angular sizes of the facial skeleton.

The first three components describe 70 % of the variance. 8 angels of the facial skeleton were used in the analysis. The PC I reflects the increase in the angles of *fmt-pr-fmt* and *zm-n-zm*, so it points to the relative expansion of the facial skeleton at the upper and middle levels. Tasmanians and Vadyak with Fish Hoek found to be the widest-faced. On this background neanderthaloid specimen found to be relatively narrow-faced. The PC II indicates a decrease of such angles as the *n-nl-ns* and *pr-zm-infor*, or relative wide-nosiness and the decrease of the relative height of the upper jaw. Fish Hoek specimen found to have the widest nose. Tasmanians took an intermediate position between the Upper Paleolithic sapiens forms and neanderthaloids. The PC III reflects the increase of the *pr-n-fmt* angle. Tasmanians and Vadyak with Fish Hook specimen have the smallest angles. Neandretaloids are situ-

ated at the opposite end of the graph. The analysis showed that Tasmanians are close to sapiens forms and in fact Tasmanians have no overlap with neanderthal forms.

Thus, as a result of the study we can conclude the following:

• Aboriginal Tasmanians have a specific craniocomplex, characterized by very low and wide face, wide and not long nose, well-marked alveolar prognathism, deep Canine fossa, the vault is dolichocranial with a relatively low height (Fig. 3).

• As a whole Aboriginal Tasmanians female skull has the same craniocomplex, but relatively less wide (Fig. 4).

• By formation parameters of the crania Aboriginal Tasmanians are the closest to the Upper Paleolithic Liujiang.

• The resemblance of Aboriginal Tasmanians with the Upper Paleolithic sapiens from different continents (Fish Hoek, Wadyak and Cro-Magnon) is found in the angular parameters of the facial skeleton.

• According to Multivariate Analysis Aboriginal Tasmanians are quite different from the Neanderthals and are unlikely to have kinship.

*Fig. 3.* Facial reconstruction of the skull UL 273 (Author R.M. Galeev).

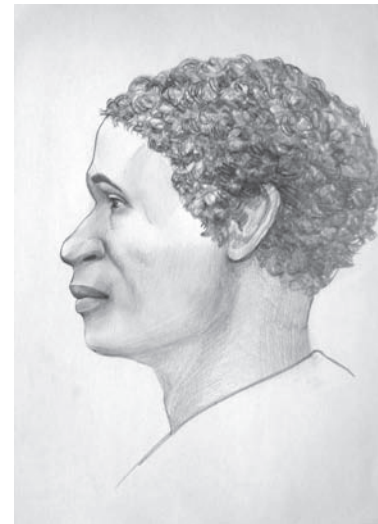

*Fig. 4.* Facial reconstruction of the skull UL 274 (Author R.M. Galeev).

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# ARCHAEOLOGICAL SITES IN THE MUD VOLCANISM ZONES*

In February, 2006, E.V. Sokol and I.S. Novikov presented a paper** at the meeting of the Stone Age Department of the Institute of Archaeology and Ethnography SB RAS in Novosibirsk. The authors hypothesized on interrelationships between the mud volcanism and possible routes of early human migrations and settling in Eurasia. This hypothesis was based on the stone tools that were collected from the combusted rock surfaces in the Hatrurim Basin in Negev Desert, Israel (see Sokol, Koh, 2010). The mud volcanism zone attracted ancient human populations due to the availability of fresh water resources, erupted rocks suitable for tool production and repeated combustion of methane. For instance, every sixth eruption was accompanied by gas flaming (Shniukov et al., 2009). The duration of gas ignition during mud eruption does not usually exceed few hours. However, there are cases when gas has been flamed over one hundred years in the Apsheron Peninsula (Sokol et al., 2007, 2008; Shniukov et al., 2009).

This hypothesis was well supported and led to subsequent search for the traces of early human habitation in the mud volcanism zones not only in Israel, where the human habitation could have been accidental, but also in other regions. Geological research in the Trans-Jordan Plateau (Daba-Siwaqa complex, Husain-Matruk locus in Jordan) has yielded numerous stone tools in association with the ancient mud volcano (Sokol, Koh, 2010). The stone tools have been attributed to the Upper Paleolithic n the basis on the noted morphological features. V.S. Slavinsky from the Institute of Archaeology and Ethnography has identified notch-denticulate tools on flakes and blades, narrow-face cores, from which small blades were detached, technical spalls, blades and flakes within this collection.

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** The Origins, Spatial Distribution, Geological Features of the Areas with Durable Gas Flaming and their Role in Formation of Micro-climatic Anomalies and their Possible Impact on the Early Human Migration Routes (On the Examples of the Eastern Mediterranean and the Pontic and Caspian Regions).

The bad state of preservation of ancient mud volcano constructions represents an objective difficulty in their studies. The relict volcanoes are usually detected due to the occurrence of burnt rocks in craters that were affected by continuous combustion of methane currents. Presently, the mud volcanoes are situated in the tectonically active zones generating hydrocarbon gases and petroleum. The majority of these zones have been located within the Alpine-Himalayan and Pacific shifting belts (Sokol, Koh, 2010). Mud volcanoes have been recorded in eastern and northern Africa, Pakistan, India, Span, Italy, Turkey, and in the Balkans (Korf, 2002). Another zone of mud volcanism is located in the Northern Pontic area (Taman) and the Caspian Sea coast (Apsheron and Cheleken). Recently, volcanic formations have been located and studied in eastern Kazakhstan (Altyn-Emel) (Fishman et al., 2012) and in the Gobi-Altai in Mongolia (RukavičNRYi + DQåO

Correlations of the mud volcano locations with those of the Early Paleolithic sites have shown that the reconstructed routes of the earliest human migrations in Eurasia (Derevianko, 2009) run through the mud volcanism zones. For instance, the Early Paleolithic sites of Bogatyri/Sinaya Balka and Rodniki on the Taman Peninsula show the early human usage of rocks (dolomite with quartz admixture) erupted from the ancient mud volcanoes as the raw materials for stone tool manufacture (Schelinsky, Kulakov, 2009; Schelinsky et al., 2010a, b). Some stone tools recovered from the Ilsky site in the Kuban River basin have also been made of these raw materials (E. Giria, personal communication). S.A. Kovalevsky (1940: 75) reported an end-scraper of the "Paleolithic" shape from the mud volcano Akhtarma-Pashaminsky in Azerbaijan. This information provides the grounds for a possible discovery of Paleolithic sites in the mud volcanism zone in Azerbaijan and other Caspian mud volcanism zones, like Dagestan and Turkmenistan.

In 2010, another mud volcanism province has been discovered in the Altyn-Emel National Park in Kazakhstan (Fishman et al., 2012). The collection of flint artifacts, likely representing the Terminal Paleolithic – Mesolithic, have been assembled from the mud volcanism area with numerous residue cones (resulting from gas flaming). The collection includes blade cores, a small blade, a small side-scraper and an end-scraper fashioned on flakes and a blade retouched along the margin on the ventral surface. No artifacts have been noted beyond the volcanic formations.

Dr. E. Vapnik invited the present author and Dr. A.A. Anoikin to visit the University in Beer-Sheva, Israel, in October 2010. We visited many mud volcanism areas belonging to the Hatrurim Formation in Negev, where geologists had found lithic artifacts. In the course of our excursion we also have found some isolated flint artifacts demonstrating various states of surfaces preservation. Four areas with circular and cone-shaped formations of melt rocks revealed clusters of lithic artifacts*. The areas of Gurim 1 and 2 have yielded flint ar-

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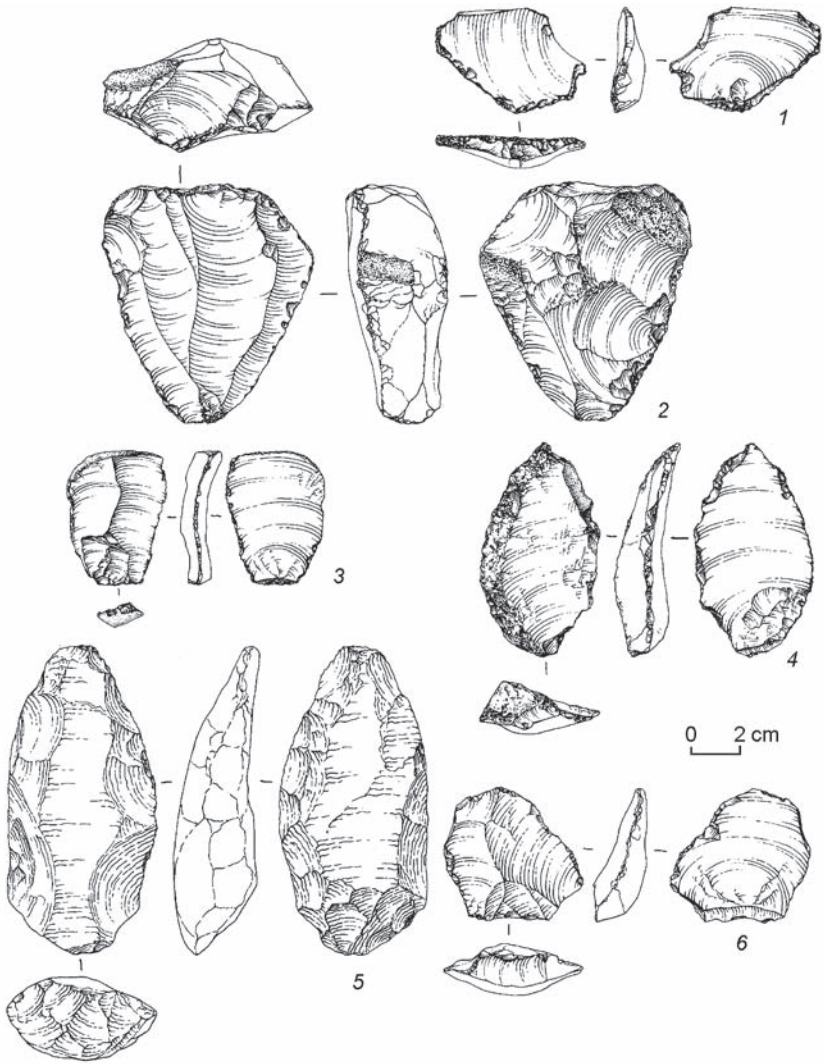
* Arbitrary assemblages of lithic artifacts collected from Parsa-1 (n = 9), Parsa-2 (n = 8) and Gurim-2 (n = 8) have been deposited in the Hebrew University in Jerusalem.

tifacts with mostly light aeolian abrasion of the surfaces, while Parsa 1 and 2 have yielded mostly artifacts of metamorphic larnite with the hardness index 6 of Moose's scale with moderate aeolian abrasion of the surfaces. Judging by the terrigenous rock outcrops, larnite eruptions preceded eruptions of flint.

The noted state surface preservation and morphological features of the artifacts from Gurim-1 and 2 suggest their attribution to the Terminal (?) Middle Paleolithic. The industries clearly show the impacts of the Levallois reduction techniques (see *Figure, 1–4*). The larnite artifacts from Parsa 1 and 2




Lithic artifacts from the Hatrurim Formation in Negev, Israel: Gurim 1 (*2*); Gurim 2 (*1, 3, 4*), Parsa 1 (*6*) and Parsa 2 (*5*).

are different from the flint tools; the Parsa artifacts are large and robust, possibly because of the petrophysical features of the rocks. The noted artifacts show various degrees of surface abrasion including those with non-abraded surfaces.

The category of lithic artifacts with the heavily abraded surfaces (see *Figure, 5–6*) includes mostly thick and short spalls with the beveled, plain striking platforms and large percussion bulbs and various artifacts bearing traces of bifacial working, which feature suggests attribution of these artifacts to the Acheulian period. The category of spalls includes a considerable number of implements with the radial pattern of dorsal face working and "Kombewa" flakes. Symmetrical bifaces are few, the majority of bifaces being asymmetrical in the cross-section. These bifaces were prepared on elongated spalls with the convex ventral surface. Few tools resemble axes-adzes. Abundant non-finished and broken in antiquity artifacts from Parsa 1 and 2 suggest their identification as the workshops where bifacially worked tools were prepared.

The category of lightly weathered implements mostly includes thin and wide flakes with the narrow striking platforms. We have seen a flat block of conglomerate, about 0.6–0.7 m in diameter, consisting of spalls and chips of larinite with lightly weathered surfaces. Chemical analyses of cementing substance from this conglomerate through RFA (Innov-X 5000) have shown the proportion of carbonates up to 25 %. The tiny particles of charcoal (?) in the cementing substance make it possible to estimate the age of cementation (6258 ± 65 BP (AA-96345)). It is noteworthy that no ceramic artifacts, polished tools, typical blades and blade cores have been noted. The flat surfaces of some heavily weathered rocks show artificial carved motifs (https://plus.google.com/photos/). The Israeli researchers (Vardi, Cohen-Sasson, 2012) attribute the Har-Parsa technocomplexes to the Neolithic-Charcolithic periods. Additional studies at Har-Parsa will provide new insight into the issues of the chronological classification of the lithic industries and new information concerning the features of the mud volcanism areas that were beneficial for ancient humans and large ungulate populations.

## REFERENCES

**Derevianko A.P. 2009**

Drevneishie migratsii cheloveka v Evrazii v rannem paleolite. Novosibirsk: Izd. IAE SO RAN.

**Fishman I.L., Kazakova Y.I., Sokol E.V., Kokh S.N., Polyansky O.P., Vapnik Y., White Y., Bajadilov K.O. 2012**

Mud Volcanism and Gas Combustion in the Yli Depression, Southeastern Kazakhstan. In *Coal and peat fires: a global perspective*, vol. 2, G.B. Stracher, A. Prakash, E.V. Sokol (eds.). Amsterdam: Elsevier, pp. 215–228.

**https://plus.google.com/photos**/105136813099313279473/albums/553004163669201515 3?authkey=CLiNr6CqiqHoSQ&banner=pwa&gpsrc=pwrd1#photos/105136813099313279473/albums/553004163669201515 3?authkey=CLiNr6CqiqHoSQ&banner=pwa&gpsrc=pwrd1

**Korf A.J. 2002**

Significance of mud volcanism. *Reviews of Geophysics*, vol. 40 (2): 1005–1012.

**Kovalevskii S.A. 1940**

Griazevye vulkany Yuzhnogo Prikaspia (Azerbaidjana i Turkmenii). Baku: Azgostoptehizdat.

**Rukavičková L., Hanħl P. 2008**

Mud volcanoes in the Khar Argalantyn Nuruu, NW Gobi Altay, Mongolia as manifestation of recent seismic activity. *Journal of Geosciences*, vol. 53: 181–191.

**Shchelinsky V.E., Dodonov A.E., Baigusheva V.S., Kulakov S.A., Simakova A.N., Tesakov A.S., Titov V.V. 2010a**

Early Palaeolithic sites on the Taman Peninsula (Southern Azov Sea region, Russia): Bogatyri/Sinyaya Balka and Rodniki. *Quaternary Internat.*, vol. 223–224: 28–35.

**Schelinsky V.E., Dodonov A.E., Baigusheva V.S., Kulakov S.A., Simakova A.N., Tesakov A.S., Titov V.V. 2010b**

Rannepaleoliticheskie pamiatniki Tamanskogo poluostrova (Yuzhnoe Priazovie). In *Drevneishie obitateli Kavkaza i rasselenie predkov cheloveka v Evrazii*. St. Petersburg: Peterburg. vostokovedenie, pp. 11–46.

**Schelinsky V.E., Kulakov S.A. 2009**

Kamennye industrii eopleistocenovyh rannepaleoliticheskih stoianok Bogatyri (Sinaia balka) i Rodniki na Tamanskom poluostrove (Yuzhnoe Priazove, Rossia). In *Drevneishie migratsii cheloveka v Evrazii: materialy mezhdunarodnogo simpoziuma.* Novosibirsk: Izd. IAE SO RAN, pp. 188–206.

**Shniukov E.F., Sokol E.V., Nigmatulina E.N., Korzhova S.A., Gusakov I.N. 2009**

«Ognennoe izverzhenie» griazevogo vulkana Karabetova gora, 2000 g.: stsenarii sobytia, produkty izverzhenia, mineralogia i petrografia plavlenyh porod. *Geologija i poleznye iskopaemye mirovogo okeana*, No 4: 77–94.

**Sokol E.V., Koh S.N. 2010**

V otbleskah «vechnyh ognei». *Nauka iz pervyh ruk*, No. 5 (35): 52–71.

**Sokol E.V., Novikov I.S., Vapnik E., Sharygin V.V. 2007**

Gorenie gazov griazevyh vulkanov kak prichina vozniknovenia vysokotemperaturnyh pirometamorficheskikh porod formatsii Hatrurim (raion Mertvogo Moria). *Doklady Academii Nauk*, vol. 413, No. 6: 803–809.

**Sokol E.V., Novikov I.S., Zateeva S.N., Sharygin V.V., Vapnik E. 2008**

Pirometamorficheskie porody spurrit-mervinitovoi fatsii kak indikatory zon razgruzki zalezhei uglevodorodov (na primere formatsii Hatrurim, Izrail). *Doklady Academii Nauk*, vol. 420, No. 1: 104–110.

**Vardi J., Cohen-Sasson E. 2012**

Har-Parsa: a large-scale larnite quarry and bifacial tool production site in the Judean Desert, Israel. *Antiquity*, vol. 86, No. 332. URL: http://www.antiquity.ac.uk.

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