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The Kara Bom site: Mousterian to Late Palaeolithic evolution of the lithic industry in the Altai

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Abstract: The present article aims to discuss characteristic and specific features in the development of the lithic industry during the transition from the Mousterian to the Upper Palaeolithic in Gornyi Altai. The proposed evolutionary model of the Middle-Upper Palaeolithic culture is believed to be characteristic not only of this particular region, but of a wider area. Current investigations provide new evidence which elucidates the Late Pleistocene cultural development in the Altai region.

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SITE LOCATION AND GEOLOGY

The Palaeolithic site of Kara Bom is located in the Ongudai region of the Altai Republic, in the south-western part of the Elovskian Depression in Central Altai. The site was discovered by A. P. OKLADNIKOV at the foot of the right slope of a steep valley side near the confluence of the Altai and Semisart Rivers.

The local Quaternary deposits are relatively thin. Flat tops and cones of the surrounding mountains are formed by colluvial sediments, made of "kurums" (products of frost weathering), stone trains and bedrock outcrops. Glacial landforms, such as moraines, drumlins and erratic boulders, up to 5–10 m³ in size can be observed along watersheds and the river valleys. The glacial deposits are composed of packages of sand and gravel of various sizes with inserted large cobbles and blocks. In river beds, the sorted moraine deposits consist of rocky blocks. The height of the end moraines can reach up to 15 m. Glaciofluvial and alluvial sediments are widely distributed in the area. The former build flat sandur fields, sloping slightly in the direction of the water flow. The sandurs and moraines are separated by sandur swells. The glaciofluvial sediments are made of the same materials as the moraines, but the size of clasts is smaller, with sand and pebbles predominating. The cumulative thickness of the glaciofluvial and glacial deposits is not more than 10–20 m. Usually, they relate to the last glaciation. The alluvial deposits at Kara Bom represent the sediments of the first 3–5 m high terrace and the present floodplain. The terrace is gently sloping to the river channel, varying in width from several dozens of metres to 1–1.5 km.

The alluvial deposits consist of pebbles of various sizes, and of sand and gravel. The basal strata expose

glaciofluvial cobbles. The alluvium is cemented by carbonate-rich loam. The first Kaerlyk terrace is likely to be dated to the late Last Glacial and the Early Holocene. The alluvial deposits also include the modern sandy-pebbly floodplain alluvium, stretching laterally for up to one kilometre.

The alluvial-colluvial sediments fill wide valleys of the tributaries of the Kaerlyk River. The sediments are 2–3 m thick and composed of a small-grained pebble alluvium mixed with gravelly colluvium from the slopes. These deposits date to Holocene.

Foothills of the piedmont slopes and deltaic areas of side valleys are filled with fine colluvial gravel and loamy sediments in which the current soil has formed.

The cultural horizons at Kara Bom were exposed within the colluvial deposits of the Upper Pleistocene and Holocene. The relief of the site is characterized by mountains with the maximum height of the surrounding peaks of 2000–2200 m, and a relative elevation in respect to the valley bottom of 400–800 m. The highest peaks (ca. 2600 m a.s.l.) rise to 1200 m over the Kaerlyk valley. The nearest hills represent the alpine relief, characterized by kars, peaked ridges and mountain terraces. Other geomorphological features include:

1. fluvial forms associated with water flows (flood plains and flood plain terraces);
2. glacial forms (moraine ridges, swells, drumlins, rock blocks and pits);
3. glaciofluvial forms (sandurs, solles);
4. forms produced by erosive and gravitational processes (valleys, ravines and watersheds);
5. gravity slope forms (stone trains, kurums);
6. relic forms of denudation processes (flattened surfaces, erosional remnants, bedrock outcrops).

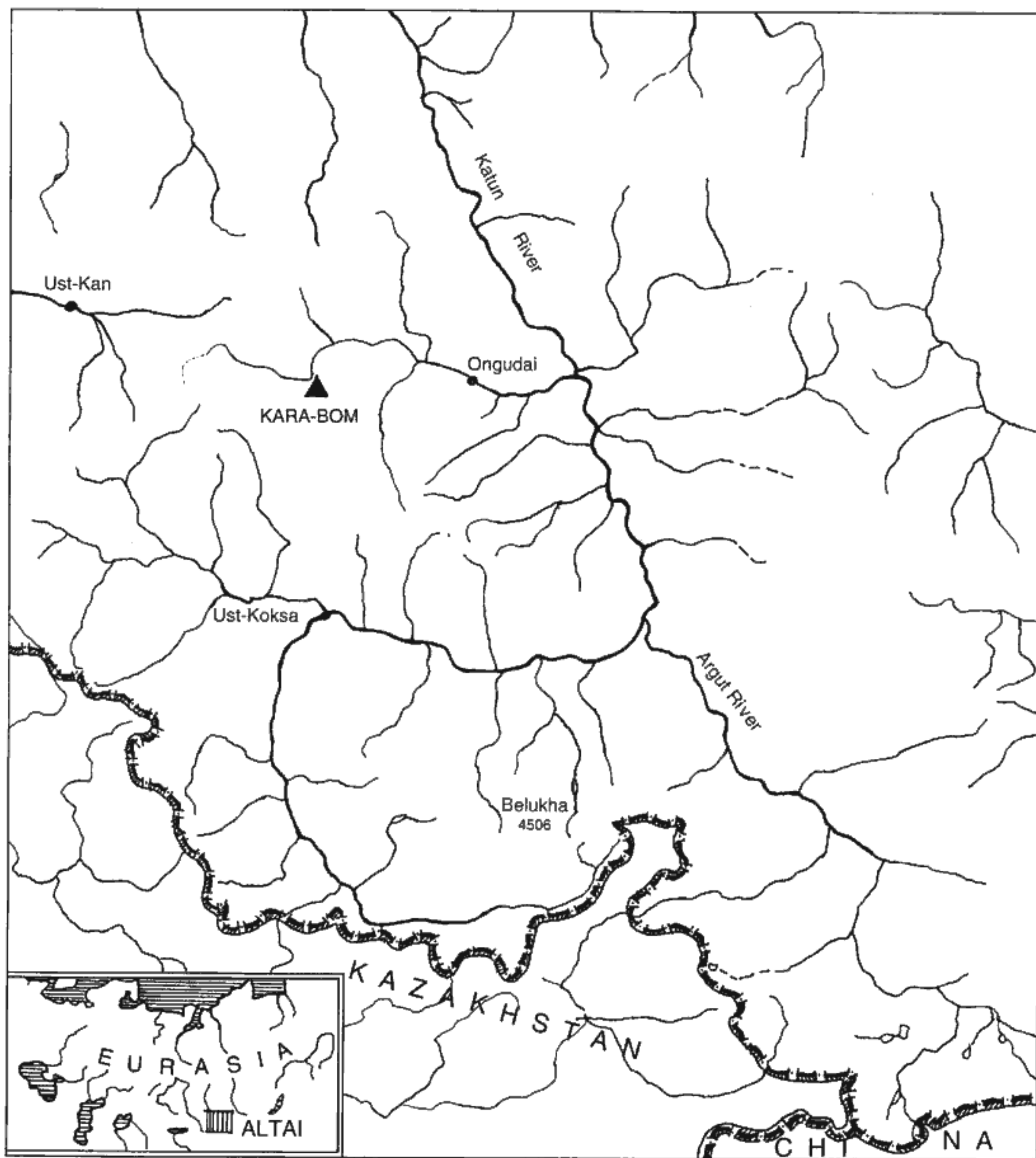


Fig. 1. Location of the Kara-Bom site.

Several radiocarbon and ESR dates were obtained on the samples from the Kara Bom section in the laboratories in the USA and in Russia (Institute of Geology, Geophysics and Mineralogy SB RAS). The dates are shown in the stratigraphical scheme (Fig. 2).

PALAEOECOLOGY

At the stratified Kara Bom Complex the following species of large mammals were identified (analysis by S. K. Vasilev): Occupation horizon 2-3 – *Alactaga* sp., *Citellus* sp. and *Arvicola terrestris*;

Occupation horizon 3 – *Citellus* sp. and *Capra sibirica*;

Occupation horizon 4 – *Equus* sp., *Bison* sp., *Allactaga* sp., *Citellus* sp. and *Aves*;

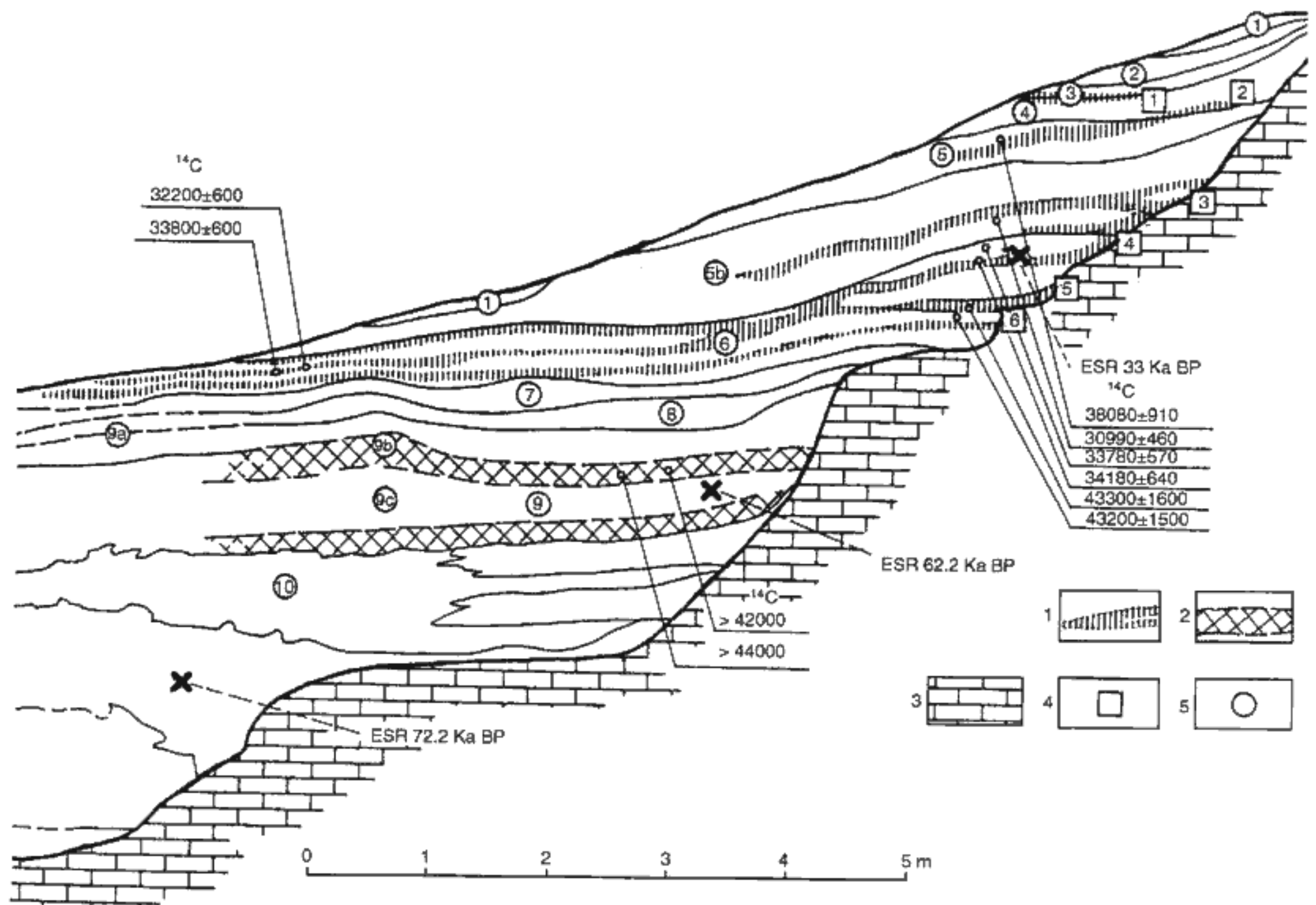


Fig. 2. Kara-Bom, section of the stratified part with the radiocarbon dates. 1 – habitation horizon; 2 – culture-bearing horizon (Moustertian); 3 – bedrock; 4 – figures designating the habitation horizons; 5 – figures of lithological classification.

Occupation horizon 6 – *Citellus* sp., *Marmota baibacina*, *Capra sibirica*, *Equus* cf. *hydruntinus*, *Equus* sp. and *Crocota spelaea*; Horizon “Moustertian 1” – *Marmota baibacina*, *Equus* sp., *Coelodonta antiquitatis*, *Bison* sp., *Capra sibirica*, *Mammuthus primigenius* and *Panthera spelaea*;

Horizon “Moustertian 2” – *Allactaga* sp., *Citellus* sp., *Equus* sp., *Coelodonta* sp., *Capra sibirica*, *Bison* sp. and *Panthera spelaea*.

Among faunal remains with undefined stratigraphical position, the following species were identified: *Citellus* sp., *Allactaga* sp., *Marmota baibacina*, *Canis lupus*, *Equus* sp., *Capra sibirica* and *Antilopinal* gen. indet. In summary, the mammalian assemblage was rather stable throughout the history of Kara Bom. It is represented principally by periglacial steppe and mountain species.

According to the spore-pollen analysis (provided by E. A. Malaieva), four climatic stages in the Kara Bom sequence can be established. The bottom part of the section, up to 3.5 m deep, corresponds to a warm and dry stage, followed by wet stages (from 3.5 to 2.8 m and from 2.8 to 1.3 m) and finally from 1.3 up to the surface by a wet stage with several dry oscillations. In general, the floral assemblage shows the dominance of local bi-

otic taxa. The flora constitutes absinthe-herbal and petrophyte steppe species. The specific feature of Kara Bom is an unusually high percentage of ephedra and chicory pollen. In all cases, the pollen reflect the steppe character of vegetation. Modern types of trees were observed throughout the record, being represented by nut-tree, elm, maple, lime, birch and alder. The thermophilous species (nut-tree) was absent above the basal 3 m. Considerable impoverishment of dendroflora coincided with the time interval prior to the beginning of the first drier stage. Afterwards, the area was transformed into a birch-dominated forest-steppe and a highland steppe. The Kara Bom section revealed no soil horizons, but several trenches in the vicinity of the site contained several brown soil horizons, partly reworked.

The layers at the bottom of the section indicate a cool and relatively wet climate, interrupted by a minor (probably local) warming. During the final stage of the Zyriansk (Last Glacial) stage the climate at Kara Bom was colder and drier than during the preceding periods. In the upper part of the section, the pedogenic features indicate warm and humid fluctuations. All habitation horizons correspond to a favourable and relatively warm environment.

SITE ARCHAEOLOGY

The excavations revealed cultural remains (fire-places, lithics and animal bones) embedded in loamy and fine-gravel sediments that formed an inclined terrace-like surface leaning against a vertical rock exposure. The soft loamy sediments at Kara Bom were formed by physical and chemical weathering of argillaceous schists and to a lesser extent of sandstones and vein quartz. Inclusions of loess are also observed. The deposits are intercalated by colluvial and aeolian sediments.

The lowermost layers of the Kara Bom section, formed by reworking of the chemically weathered blue-grey schists, contain Mousteroid stone artefacts. The overlying strata are composed of rock debris of various sizes, cemented within a fine soil. The cultural remains are revealed in more than a 5 m thick package of sediments, suggesting long-term and/or frequent human occupation of the site. The clearly favourable conditions include the south-facing site exposure, a local source of fresh water all year round and abundance of raw material for tool production in the nearby area. The location of all palaeolithic seasonal and permanent sites near springs documents the importance of water supply for habitation in Kazakhstan and Gornyi Altai and represents a specific feature of Pleistocene sites.

Mousterian (horizon 2)

The lithic assemblage collected in the cultural stratum (649 pcs.) includes 12 blanks; 4 hammerstone; 1 retoucher; 2 anvils; 20 cores and core preforms; 111 tool specimens (that comprise: 9 retouched blades; 7 retouched flakes; 27 notches; 6 notch-denticulates; 3 denticulates; 5 knives; 34 Levallois points; 2 side-scrapers; 6 end-scrapers; 3 burins; 4 pointed tools; 1 graver; 1 biface and 3 combined tools); 502 by-products of primary splitting, including 149 blades; 317 flakes; 21 technical spalls and 15 pieces of débitage.

Mousterian (horizon 1)

The lithic assemblage totals 104 specimens, including 9 blanks; 2 anvils; 3 hammerstones and 41 tools that include 1 point; 2 knives; 1 end-scrapers; 1 burin; 12 notched tools; 1 plate implement; 10 retouched flakes; 8 retouched blades; 1 cleaver; 46 by-products of primary splitting; 3 technical spalls; 19 blades and 24 flakes.

The lithic industry analysis is discussed together for both Mousterian assemblages (M1 and M2), comprising a total of 753 specimens.

Cores and preforms – 23 items (3 %)

Practically all the cores are of a Levallois type. Most numerous are forms with parallel flake removals, characterized by rather small flake scars. The next numerous

are the Levallois flake cores, which, however, are not the classical "tortoise" nuclei; the remaining are the Levallois point cores (3 pcs.), almost completely used. The limited number of specialized cores contradicts the notion that the Levallois points and large Levallois blades are the most abundant in the assemblage, whereas the Levallois flakes are quite few. This can be explained by a recurrent use of cores. After a number of blanks had been removed, the core was subjected to "reforming" with each stage of re-use corresponding to different blanks. At the first stage of utilization the large elongated blades were removed. Judging from the position of the edges of the spalls, one cycle of stone splitting can provide 3–4 blade-shaped blanks. All cores were of the plain type, with the exception of one core from the M2 horizon. A technological sequence of core reduction can be observed from the recurrent unipolar linear mode of removals of blades and blade-shaped spalls to the unipolar recurrent convergent one for removals of points and vice versa.

By-products of primary splitting – 548 items (72.7 %)

The indices for the Mousterian horizon 2 were calculated from all the spalls and tools available: $I_{lam} = 33$; $IF_{large} = 53$ (total); $IF_{strict} = 29$.

Noteworthy is the dominance of the index of faceted blades over the flakes: IF_{strict} (on blades) = 34; IF_{large} (on blades) = 58;

IF_{strict} (on flakes) = 38; IF_{large} (on flakes) = 15.

The metric analysis of blades shows a high index of fragmentation of spalls and a relatively low percentage of elongated blades.

The Levallois index equals 15.3; thus, the industry is not affiliated to the Levallois tradition. Nevertheless, it is necessary to note that, of the total of 111 tools, 57 implements were made of the Levallois spalls. The general technical indices are similar for both Mousterian horizons, but the index laminar is increasing from M2 to M1, whereas the Levallois index is decreasing.

Mousterian horizon 2

The tools were made on flakes ($n = 29$; 26.1 %), on spalls with the sharp ends ($n = 39$; 30.6 %); on technical spalls ($n = 9$; 8.1 %) and on blades ($n = 38$; 34.2 %). In the group of blades, 11 pieces are complete, 18 pieces are represented only by proximal parts, 5 pieces by middle segments of blades and 4 pieces by distal ends of blades.

The indices of the length of tools (in cm) are the following:

L < 1	L > 1	L 1.5	L > 2	L > 2.5	L > 3	L > 5
12	25	31	25	15	2	1

The retouch was made on the dorsal face – 52 %; on the ventral face – 16.3 %; in the alternate form – 22.9 % and the opposite form – 8.1 %.

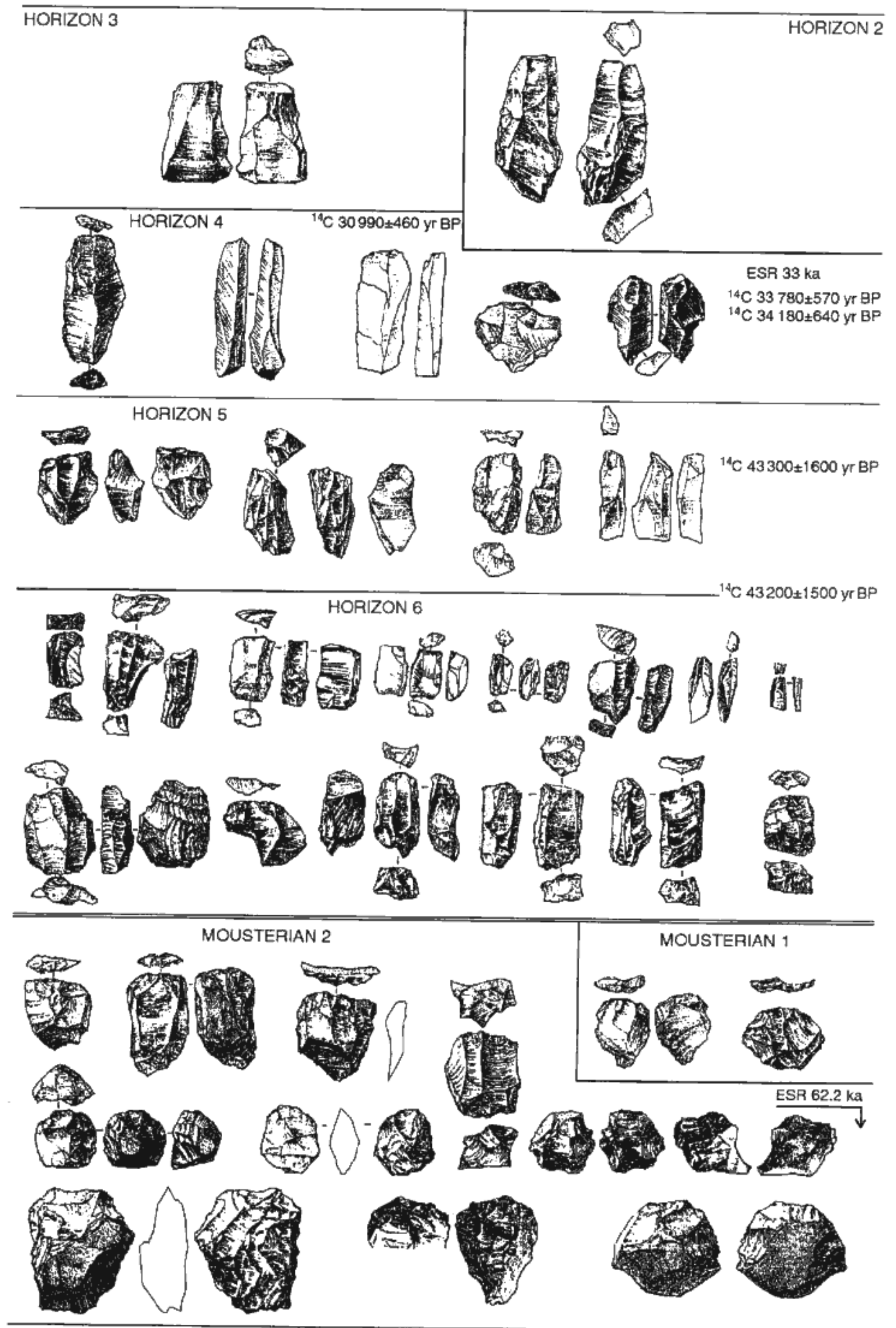
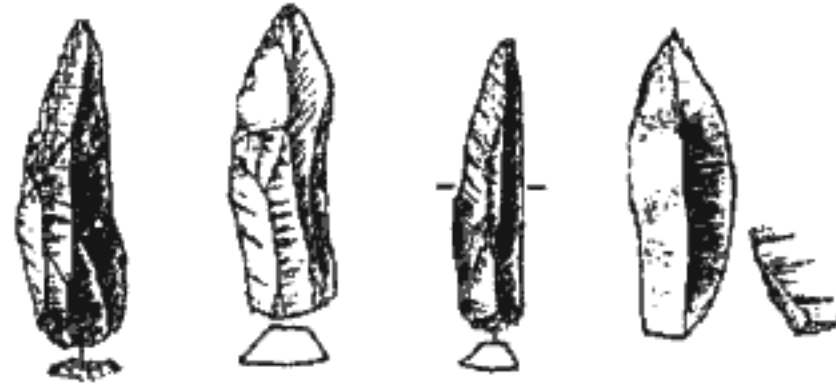


Fig. 3. Evolutionary development of cores.

HORIZON 3



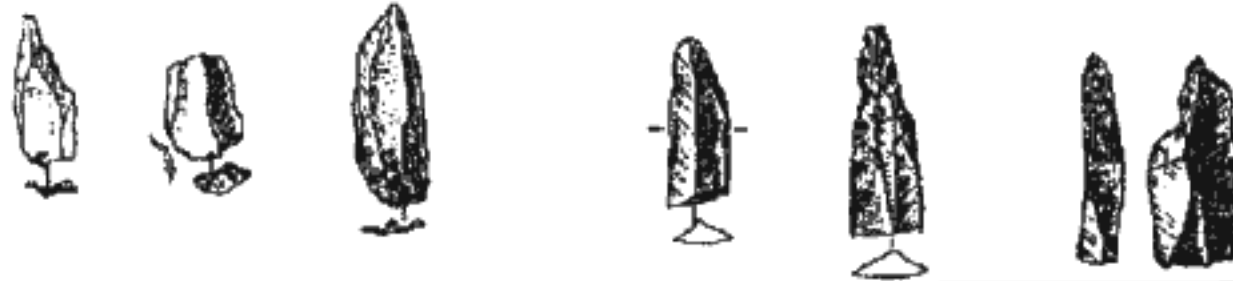
HORIZON 4



^{14}C 30 990±460 yr BP
 ^{14}C 33 780±570 yr BP
 ^{14}C 34 180±640 yr BP

ESR 33 ka

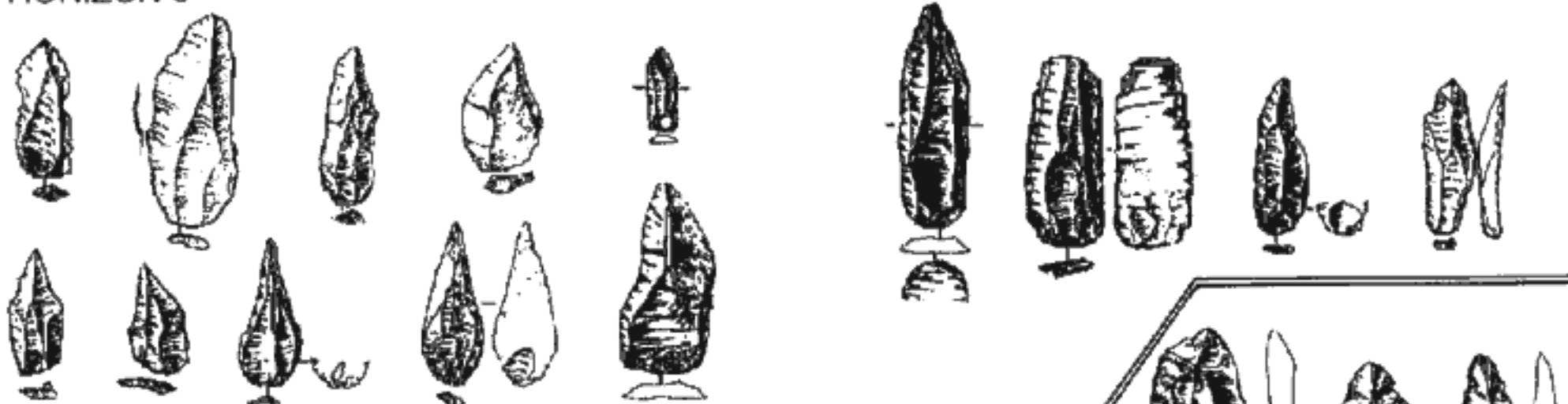
HORIZON 5



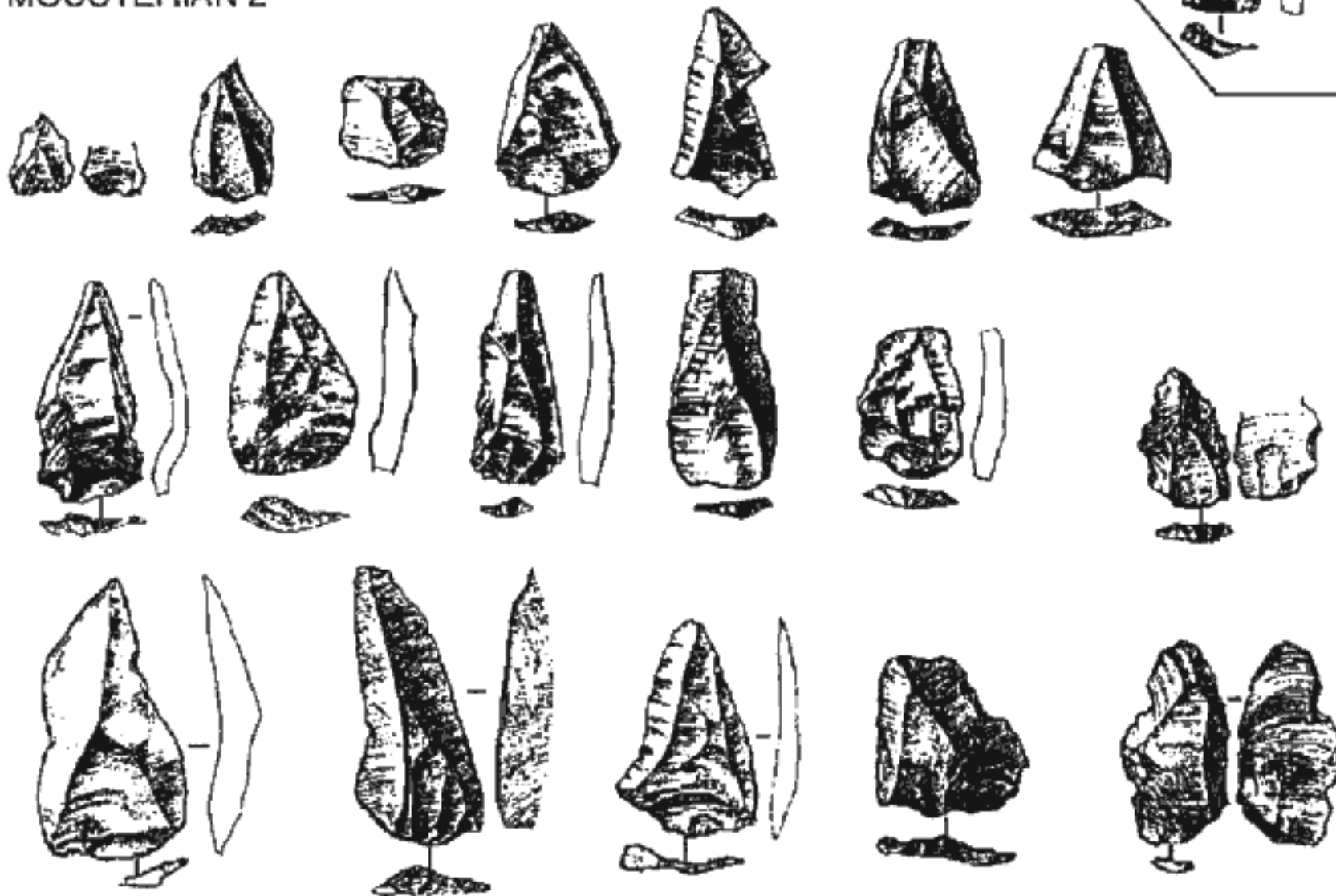
^{14}C 43 300±1600 yr BP

^{14}C 43 200±1500 yr BP

HORIZON 6



MOUSTERIAN 2



ESR 62.2 ka

Fig. 4. Evolutionary development of points.

Tools include 152 specimens or 22.2 % of the assemblage (spalls with irregular retouch were excluded)

Tool type	M2	M1	total
Levallois points	34	4	38
unretouched	2	4	24
retouched	14		14
Elongated symmetrical point retouched along both sides		1	1
Side-scrapers of high form, retouched over the margins	2		2
Knives	5	2	7
with natural pebble haft	2		2
with longitudinally edged haft	3	1	4
with the haft produced by the transverse spall and retouch	1		1
Scrapers	6	1	7
on the terminal spall retouched over 3/4 of the perimeter		1	1
of high form, retouched over 1/2 of perimeter	1		1
End-scraper on flake	1		1
on fragmented spalls with high working edge	4		4
Burins	3	1	4
in the middle portion of blank	1		1
side-burin		1	1
angular	2		2
Piercers	4		4
Graver	1		1
Notches	27	12	39
Denticulates	3		3
Notches-denticulates	6		6
Blades with regular retouch	9		9
Flakes with regular retouch	7		7
Tabular tool		1	1

Mousterian horizon 1

The tools were made on flakes ($n = 15$; 36.6 %); on blades ($n = 17$; 41.5 %), including the pieces produced on proximal ends – 10 pieces, on the middle blade segments – 7 specimens; on spalls with sharp ends – 4 specimens (9.8 %); on technical spalls – 3 pieces (7.3 %); on tabular rocks and pebbles – 1 specimen on each (2.4 %). The indices of the tool length are:

$L < 1$ $L > 1$ $1 > 1.5$ $L > 2$ $L > 2.5$
 3 14 11 9 1

The retouch was made on the dorsal face of tools –

57 %; on the ventral face – 17 %; and in the alternate forms – 25 %.

The following major groups of tools can be distinguished within the assemblage: 1 – end-scrapers; 2 – side-scrapers; 3 – burins; 4 – Levallois points; 5 – notched-denticulated tools; 6 – knives; 7 – tools with the elements of a piercer.

CONCLUSIONS

The primary flaking technique is characterized by the Levallois flake and point removals from prepared cores by a parallel patterned flaking.

The analysis of cores and spalls suggests a “recurrent” strategy of reduction that means that, during a single cycle of reduction, a series of blanks was removed with the former blank determining parameters of the following one (in the form of a blade, a point or a flake). All cores except one are plain.

In general the industry is non-Levallois and non-faceted.

M2	M1
IL = 15.3	IL = 10.7
$I_{\text{strict}} = 29$	$I_{\text{strict}} = 27$
$I_{\text{lam}} = 33$	$I_{\text{lam}} = 46$

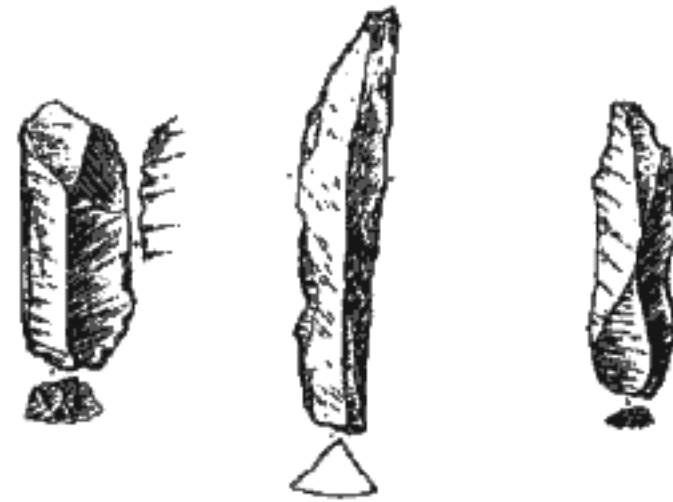
The majority of the tools, however, were made on the Levallois spalls; and the index of faceting is only slightly less than the values of I_f , typical for the faceted industries.

There are three groups of tools that can be classified within the assemblage. Group 1 comprises the Mousterian-Levallois tools (M2 = 32 %; M1 = 21 %). Group 2 includes the Upper Palaeolithic tools (M2 = 16 %; M1 = 21 %). Group 3 consists of the notches and denticulates (M2 = 32 %; M1 = 52 %). In view of the above characteristics the industry can be attributed to the Mousterian (Levallois) tradition with a strong notch-denticulate component and with the Late Palaeolithic elements. Although the industry belongs to the Mousterian-Levallois tradition, it is difficult to affiliate it to some definite Mousterian variants in Bordes' classification. The authors believe that the prehistoric people tried to use the implements in all possible ways, which led to a polyfunctional utilization of tools. The poor typological kit might be considered as a result of such usage.

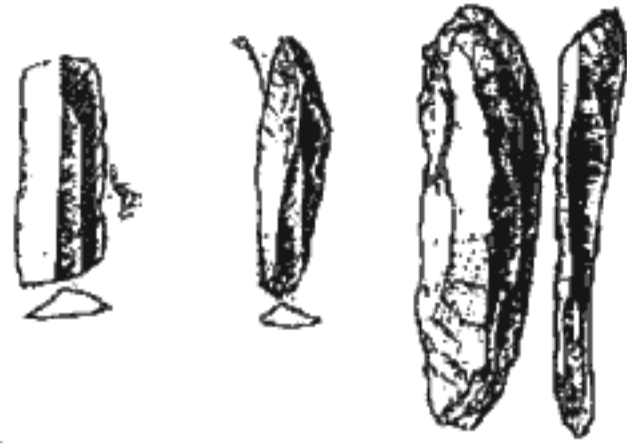
The Upper Palaeolithic tools are characterized by the absence of definite, patterned forms, often being amorphous and poorly developed.

The poor typological variety is indemnified for the rich variety in the secondary treatment that was observed in various combinations on one and the same blank.

HORIZON 3



HORIZON 4



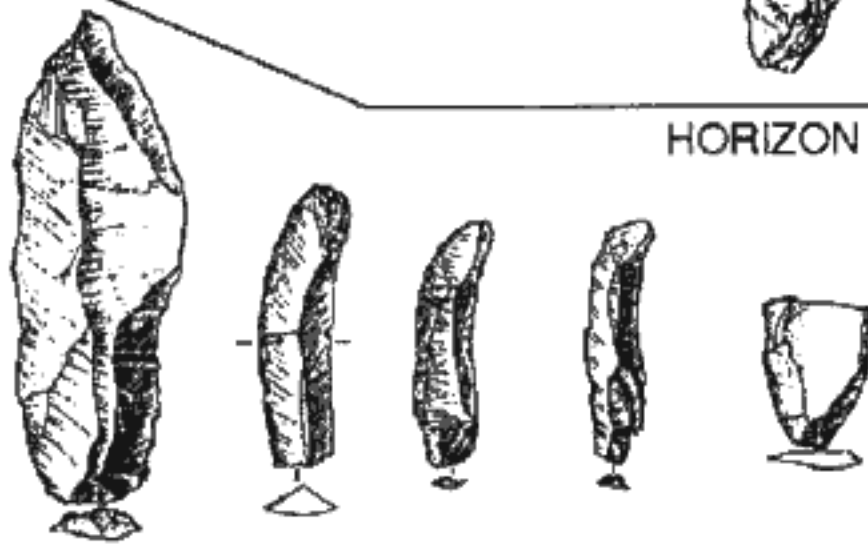
^{14}C 30 990 \pm 460 yr BP

^{14}C 33 780 \pm 570 yr BP

^{14}C 34 180 \pm 640 yr BP

ESR 33 ka

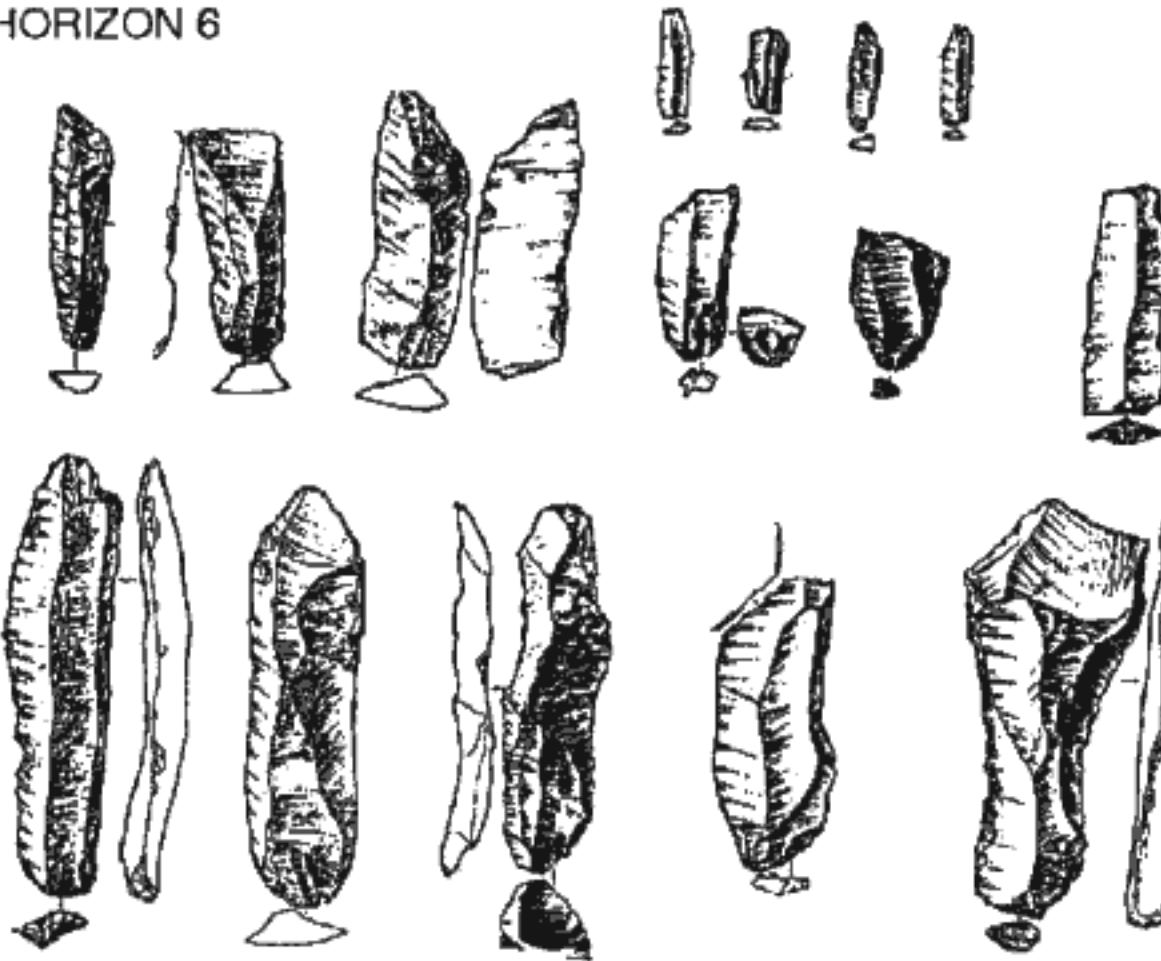
HORIZON 5



^{14}C 43 300 \pm 1600 yr BP

^{14}C 43 200 \pm 1500 yr BP

HORIZON 6



MOUSTERIAN 2



ESR 62.2 ka

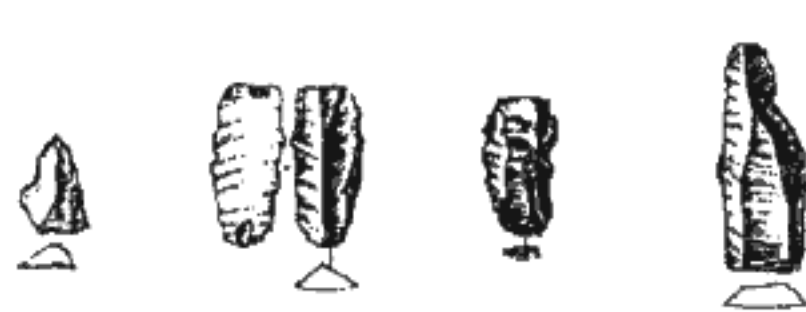


Fig. 5. Evolutionary development of retouched and unretouched blades.

HORIZON 3



HORIZON 4



^{14}C 30 990±460 yr BP
 ^{14}C 33 780±570 yr BP
 ^{14}C 34 180±640 yr BP

ESR 33 ka

HORIZON 5



^{14}C 43 300±1600 yr BP

^{14}C 43 200±1500 yr BP

HORIZON 6



MOUSTERIAN 2

MOUSTERIAN 1



ESR 62.2 ka

Fig. 6. Evolutionary development of notch-denticulates.

Occupation Horizon 6

The assemblage of the overlying cultural horizon comprises 878 specimens, 17 blanks, 2 implements of primary flaking, and 16 cores. Tools are represented by 143 specimens, including 10 Levallois points, 6 ordinary points, 3 pieces on blades with bevelled distal ends, 1 side-scraper, 9 knives, 16 end-scrapers, 10 burins, 25 notches, 3 denticulates, 6 notch-denticulates, 6 re-

touched flakes, 6 blades with regular retouch, 29 blades with irregular retouch, 8 tools on the blade-knives, 3 tools with spurs, 1 piercer and 1 combined tool. There are 700 by-products of the primary reduction, including 49 technical spalls, 541 blades, 290 flakes, 8 tubular flakes and 2 pieces débitage.

The artefacts of primary stone-flaking include one anvil made on a sandstone pebble of a subrectangular form 9 cm long and 5 cm wide, and a pebble with traces

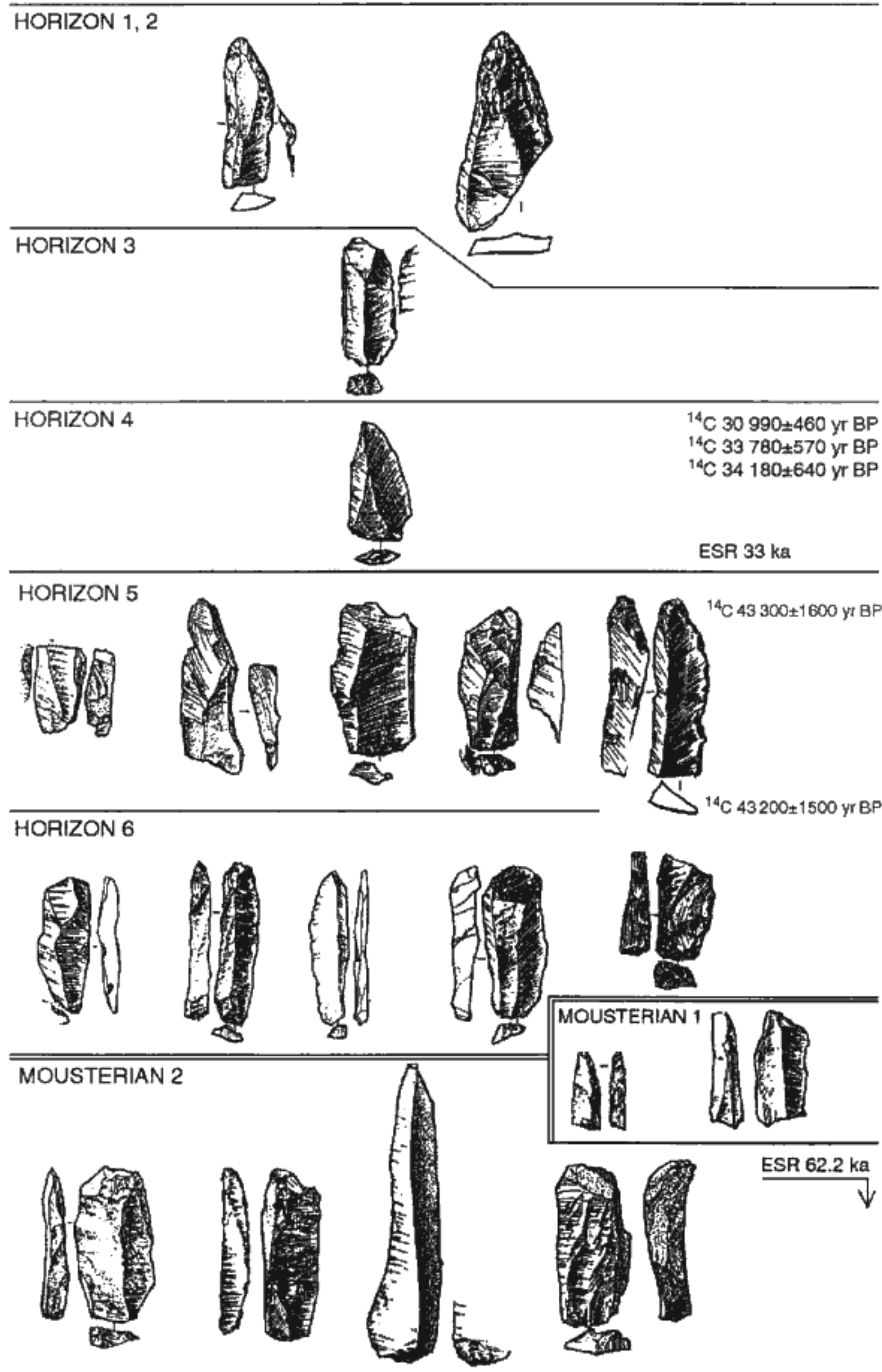


Fig. 7. Evolutionary development of knives.

of utilization. The wide surface of the anvil exhibits numerous indentation marks. Among the unmodified stones, there were 9 burned and fire-broken pebbles.

Occupation Horizon 5

The assemblage of the following horizon comprises 594 lithic objects, that include 5 blanks, 3 anvils, 1 retoucher, 7 cores and preforms, 3 Levallois points, 2 small side-scrapers, 8 end-scrapers, 7 knives, 3 points, 1 burin, 13 notches, 4 denticulates, 9 regularly retouched blades, 1 blade-knife, 14 tools with random retouch, 3

tools on curved blades, 1 peculiar object, 3 technical spalls, 181 flakes, 273 blades and 9 tabular flakes.

Because of the uniform technique of primary reduction, the similarity in general technical and typological features of the lithic industry, suggesting one cultural tradition, both horizons 5 and 6 were analysed together.

Cores and preforms – 23 pieces (1.5 %) include forms with a parallel flaking pattern, bifacial cores, central, double-platformed cores and some other types. A technique of a lateral flaking is specific for the industry. With removals of flakes from the lateral sides, the edge was kept sharp and the flaking surface concave. The de-

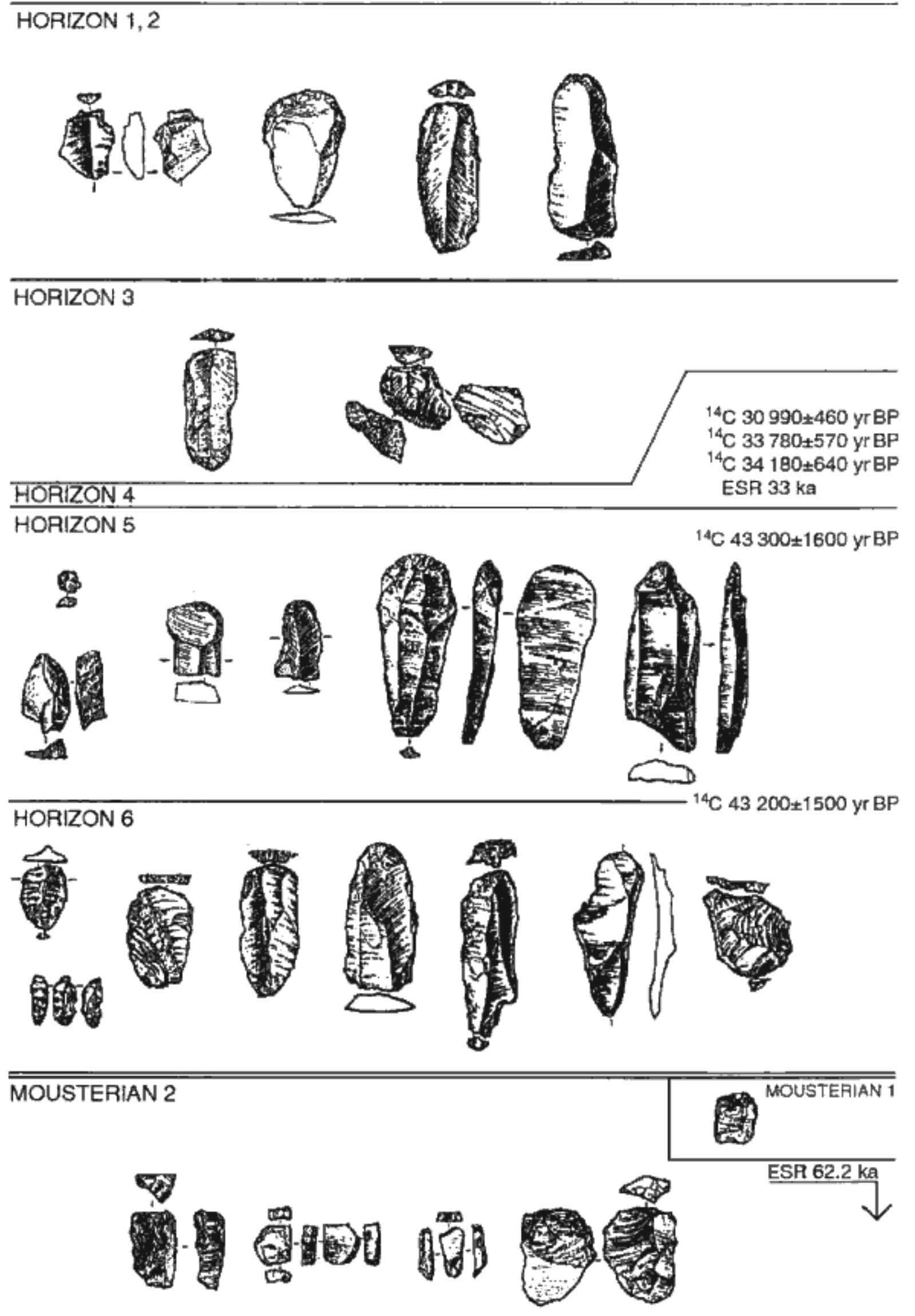
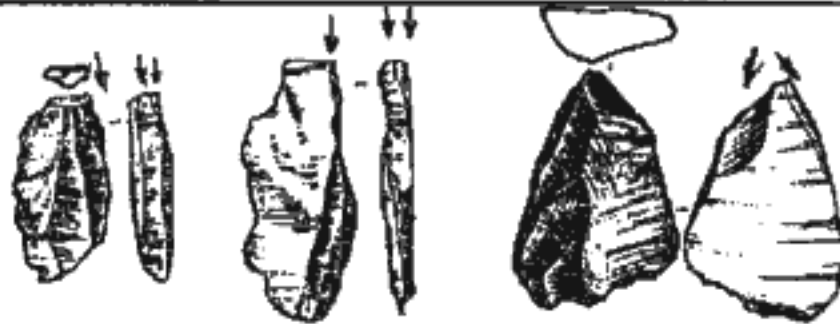


Fig. 8. Evolutionary development of scrapers.

HORIZON 2



HORIZON 3



HORIZON 4



^{14}C 30 990 \pm 460 yr BP
 ^{14}C 33 780 \pm 570 yr BP
 ^{14}C 34 180 \pm 640 yr BP
 ESR 33 ka

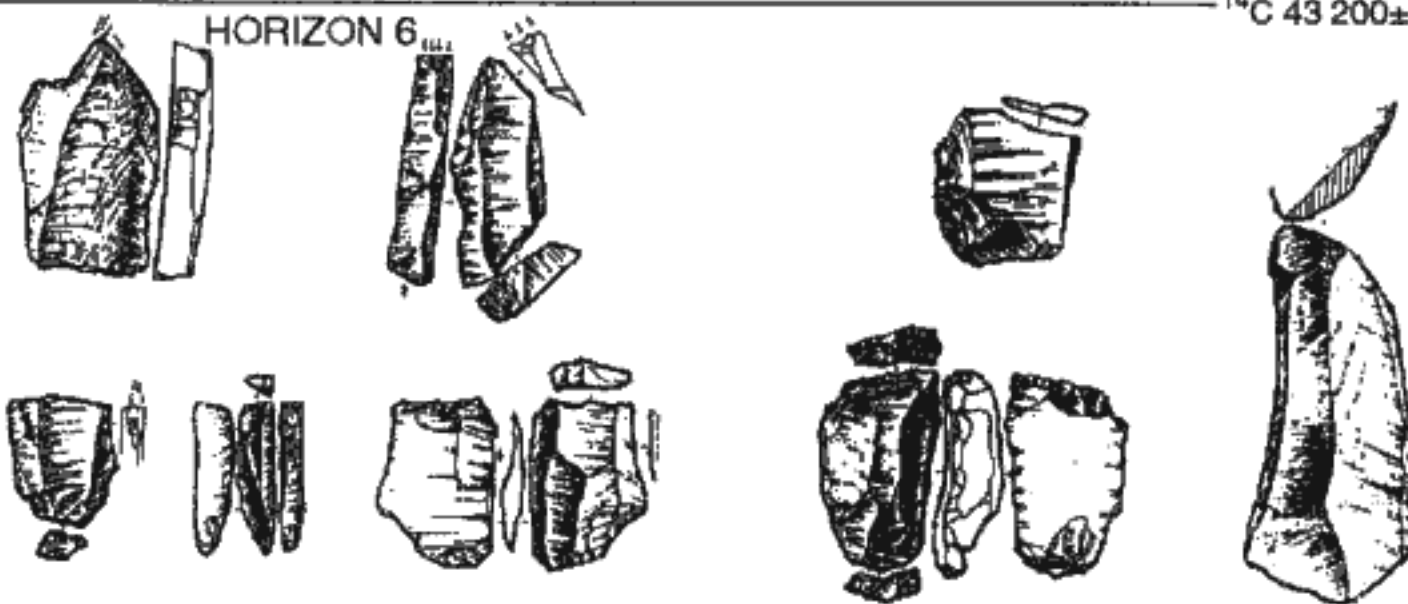
HORIZON 5

^{14}C 43 300 \pm 1600 yr BP



^{14}C 43 200 \pm 1500 yr BP

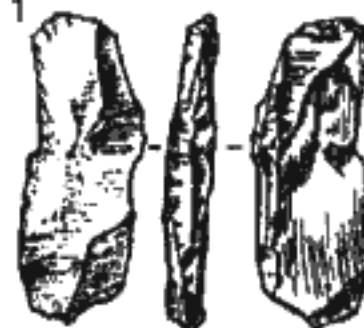
HORIZON 6



MOUSTERIAN 2



MOUSTERIAN 1



← ESR 62.2 ka

Fig. 9. Evolutionary development of burins.

tached flakes were worked into knives, burins and other hafted tools that are numerous in the assemblage. In the final stage of core extraction, the lateral sides were trimmed in longitudinal and latitudinal directions. When a further core reduction became impossible from the available platform, a new striking front was formed by a

dorsal flake/blade removal, the débitage of which are numerous in the group of technical spalls. When the core became completely used it looked like a multi-faceted burin. These often non-diagnostic "burin-core" forms are believed to represent the final stage of the core reduction.

Tools total 224 specimens (15.2 % of the assemblage). They can be subdivided into four groups: 1 – spalls (43 pieces; 19.2 %); 2 – notched and denticulated tools (51 pcs.; 28 %); 3 – knives (16 pcs.; 8.8 %); 4 – scrapers (24 pcs.; 13.2 %).

Types of tools	5 occ. horizon	6 occ. horizon	tot
Levallois points	3	10	13
retouched	1	7	8
unretouched	2	3	5
Points	3	6	9
elongated symmetrical, both edges retouched	1	2	3
elongated symmetrical with one edge retouched	1		1
beveled	1		1
stemmed		1	1
on blades, elongated, unretouched		2	2
retouched on blades		1	1
Side-scrapers	2	1	3
longitudinal, convex, on the dorsal face		1	1
longitudinal, dihedral, convex, on the dorsal face	1		1
Small side-scrapers	2		2
Knives	7	9	16
with a stem formed with transverse flakes and retouch	4	5	9
with a stem formed with longitudinal flakes	2		2
with a natural back	1	3	4
Scrapers	8	16	24
end-scrapers on blades	3	9	12
lateral, of high form	1	1	2
double lateral on blades	1	2	3
on lateral side of a blade		1	1
double on lateral side, on flake		2	2
angular on blade	1	1	2
"nosed" scrapers	1	1	2
micro-scraper	1		1
Burins	10	10	20
angular	6	4	10
angular multifaceted		2	2
angular in the middle	3	2	5
in the middle of the blank		1	1
angular, in the middle part, doubled		1	1
on the lateral side, doubled	1		1
Piercer		1	1
Notch	3	25	38
Denticulate	4	3	7
Notch-Denticulate		6	6
Blades with regular retouch	9	6	15
Tools on blades-knives	1	8	9

The assemblage of the occupation horizon 5 includes 1 particular Levallois point-core, which suggests the transition from the Levallois technique of point removals to the blade technique. The Levallois technique of point removal was known in the Upper Palaeolithic, as indicated by the presence of 13 points from occupation horizons 5 and 6, whereas only a single core of this type is recorded.

The butt cores and preforms include 8 specimens. The working face exhibits the rectangular or a triangular convex form; the striking platforms are rather long and bevelled to the direction of the wedge-shaped part of the core. Apparently this form is reminiscent of the wedge-shaped cores, which became widely spread all over Northern Asia in the Late Palaeolithic. The specimens from the site are less standard in their forms, possibly because of the early date of the assemblage. These implements, being rather numerous, are considered as the proto-wedge-shaped cores.

The produced series of primary splitting comprises 1197 specimens (81.3 % of the assemblage).

The technical indices provided below are calculated for both assemblages, including the tools and spalls. For the occupation horizon 5, $IF_{large} = 35.7$; $IF_{strict} = 17.4$; that means that the industry does not belong to the faceted type; $I_{lam} = 61.9$ for the total assemblage, including the spalls with the parallel edges; $I_{lam} = 39$, with the exclusion of the spalls with parallel edges, for them $I_{lam} < 2$. For the occupation horizon 6, $I_{lam} = 55.5$ (total); $I_{lam} = 31.6$; $IF_{large} = 41.7$; $IF_{strict} = 29.2$, indicating that the industry is of the faceted facies (with the coefficient 0.8). The laminar index is lower in comparison with horizon 5, which would corroborate the earlier date of the horizon 6.

As the present assemblage corresponds chronologically to a later stage of cultural development, there are some more progressive tool types. The principal tool groups include:

1. End-scrapers; 2. Side-scrapers; 3. Burins; 4. Levallois points; 5. Notch-denticulated tools; 6. Knives; 7. Tools with an element of a piecer; 8. Points; 9. Tools on curved blades; 10. Aurignacian retouched blades; 11. Spurs.

Several patterns of primary lithic industry flaking were observed: a – the Levallois technique, manifested by the Levallois point cores; b – a transitional technique with cores characterized by a parallel pattern of flaking; the cores themselves are plain, unifacial, two-platformed, or bifacially conjugated; c – the Upper Palaeolithic technique, corresponding to the butt and proto-wedge-shaped cores. Overall, a great similarity in morphological features of flakes was observed between the single horizons. The major difference is in the increase of the index of faceting in horizon 6, thus attributing this horizon to faceted facies, and the overlying Horizon 5 to the unfaceted facies.

Group 1 of the Mousterian-Levallois tools forms 9.8 % of the total lithic industry assemblage.

Group 2 of the Upper-Palaeolithic tools is represented by 38.9 % of the assemblage.

Group 3 of the notch-denticulated tools corresponds to 28 %.

In summary, the archaeological record from the occupation horizons 5 and 6 represent a rather developed Upper Palaeolithic industry with the notch-denticulated component and certain reminiscences of the Levallois technique.

FUNCTIONAL ANALYSIS OF THE PALAEOLITHIC INDUSTRY

In respect of the composition of the lithic assemblage (15.2 % tools, 81.3 % débitage and 1.5 % cores) both occupation horizons 5 and 6 might be considered as site-workshops. The main possible functions of tools were likely for butchering and hide-processing as suggested by knives/end-scrapers, side-scrapers, notches and combination tools. The assemblages originate from a stratigraphic sequence that corresponds to the chronological interval of about 20 000 years. Undoubtedly the studied complexes belong to one and the same cultural tradition. Both the primary core reduction strategy and the tool flaking technique reflect the evolutionary development of technology. The most progressive changes are observed in the technology of the primary stone flaking. The Mousterian assemblages are characterized by tabular Levallois cores, from which blades, points and flakes were removed. The so-called "recurrent" system of core splitting was identified.

An entirely different picture is observed in the Upper Palaeolithic occupation horizons, mainly in the mode of core reduction. The tabular Levallois cores represent

only one stage in the "cascade" cycle of raw material working. The strategy of stone splitting experienced a major change - the flaking front was moved to the butt end of the core resulting in the production of blanks with characteristic features showing removals of previous flakes. The origin of the wedge-shaped core seems to be associated with this process. The ratio of blades increases in a similar manner to the index of IF_{strict} . As for the tool collections, which are not rich in typologically variable forms, the principal tool types are likely associated with some specialized activities. The high combination potential of the industry can be regarded as a specific feature of this assemblage. Nearly all the tools exhibit more than one functional element. Some definite evolutionary traits are observed. The Mousterian horizon displays the dominance of the Mousterian-Levallois tools, particularly the points and the scarcity of the Upper Palaeolithic tools. The overlying horizons, with typically developed Upper Palaeolithic industry, differ from the Mousterian ones by numerous and very impressive series of progressive tool types, such as end-scrapers, burins, points and blade-knives. Characteristic of the entire assemblage is the notch-denticulated component dominating throughout the sequence. As for the nature of the Kara Bom locality in general, the Mousterian horizons can be interpreted as occupation sites, the Upper Palaeolithic occupation horizons (6-5) as workshop sites and the uppermost horizons (4-1) as again occupation sites.

The proposed evolutionary model of the Middle-Upper Palaeolithic cultures is believed to be typical not only of this particular region, but of a wider area as well.

Recommended for print by M. Oliva