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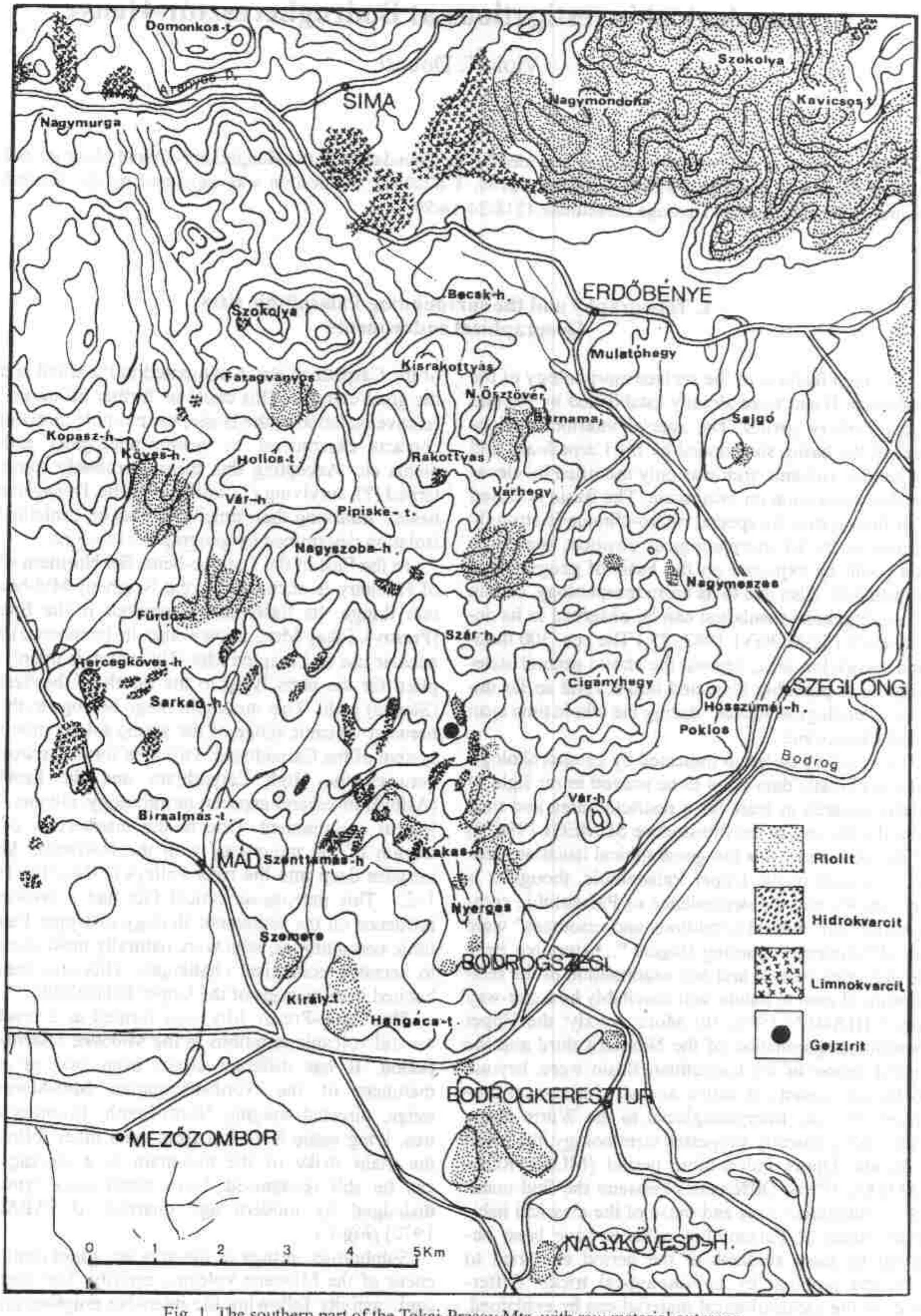


Fig. 1 The southern part of the Tokaj-Presov Mts. with raw material outcrops
(Map by P. Gyarmati)

– last but not least, the stand-alone volcanic cone (Mt. Kopasz at Tokaj) is an eye-catching, spectacular geographical element in itself, a good point of orientation.

Density of finds (in situ or off-site) proved that most of these attractions were valid in those days as well, even supposing that the present environment of the site is more or less different from the conditions during the Interpleniglacial. Partly, the hills were necessarily lower because the great loess-producing periods were just to come. The Southern Zemplén was still an undislodged block. In course of the study of the hydrology and the surface formation of the Alföld region, S. Somogyi came to the conclusion that the immediate surroundings of Bodrogkeresztúr-Henye and its immediate surroundings were different from a geomorphological point of view in the last third of the Würm period, same as the larger region, North-Eastern Hungary.

The hill and its environs was not an elevated shelter in the marshes at the meeting point of the rivers Tisza and Bodrog, but simply the last member of the volcanic series bordering the right bank of the river Bodrog. Bodrog used to have a longer course in the last phase of the Ice Age. It reached the river Tisza at a larger distance, at the margin of the Nyírség and Hortobágy, the active bed of which was probably in the line of the streams Ér and Berettyó today. The current conditions were formed by the end of the Ice Age and the Early Holocene, with the elevation of the Nyírség area and the depression of the Bodrogköz region. The river Tisza was turning to North and "captured" several rivers running North-South, including Bodrog (SOMOGYI 1982, 79.).

The Late Pleistocene endowments of the micro-region were, however, influenced only in small extent by the different hydrogeological setting. Surface morphological forms and dimensions remained constant in the two periods *(Fig.2.)*

The vicinity of raw material sources, loess plateaux ideal for settlement, the meeting point of several different biotopes (proved by fauna elements with different ecological demands), i.e., ideal settlement conditions were present here, irrespective of the fact that the Bodrog must have reached the Paleo Tisza (Östisza) not here but further to the South in the line of today's Ér-Berettyó rivers.

Palaeolithic finds were collected from all hill-tops around the Henye hill in a circle of some hundred meters *(Fig. 3.)*. These hill-tops were all inaccessible for excavations with the exception of the Henye itself. By our last field survey in 1988., new vineyards, old but cultivated plantations and the village water plant station were in function on them.

This group of sites fit well into the chain of Upper Palaeolithic sites which:

– follow the southern margin of the Northern Mid-Mountain range, rich in raw materials

– occupied the lowland-foothill surfaces intruding deep into river valleys from the Danube-bend till Beregovo and Korolevo, in other words the gate of the Tisza entering the Alföld (Great Hungarian Plain).

This area had been studied relatively well from an archaeological point of view. Due to the excellent grapes propagating optimally on the volcanic weathering products, highly developed viniculture, intensive working of the soil became permanent, drawing early attention to the archaeological sites. The environs of the site have been subject to several (archaeological, geological, geographical) studies as a collecting spot "in the way" to any North-East Hungarian study trips. Therefore the find material had to be collected from unusually varied sources.[1] There were several field surveys during the excavations and independent of them, by professionals as well as private collectors. Location of the latter collecting activity could not always be identified exactly. The find material is inventoried in the Herman Ottó Museum of Miskolc (HOM) and the Hungarian National Museum (HNM), respectively.

Significant quantity of finds is known from the following collecting spots:

Kavicsos or Kavicsbánya dűlő – from the hilltop, NE and SE slopes of the hill (probably spread by ploughing): Pb 64/482–494, Pb 83/224–233.

Type distribution:

end-scraper on flake, 1 piece
double end-scraper on flake, 1 piece
lateral burin, 1 piece
retouched flake, 2 pieces
blade, blade-like flake, 8 pieces
flake, worked fragment: 60 pieces (2 hydro-opalite, 3 radiolarite, 1 erratic flint 37 hydroquartzite and 17 obsidian)
core, core fragment 8 pieces (2 obsidian and 6 hydroquartzite)

Kastélytábla (mentioned as Csengős hill in the field survey report by Lajos Tóth engineer), deep ploughing for vineyard plantation probably disturbed the cultural layer here: Pb 83/234–238

Type distribution:

2 end-scraper on flake made of obsidian
1 blade (Szeletian felsitic porphyry)

[1] A box of strayfinds from the site, found in the heritage of the Gábori-couple got into the Hungarian National Museum in 1998, which could not be taken into consideration because of the closing of the manuscript

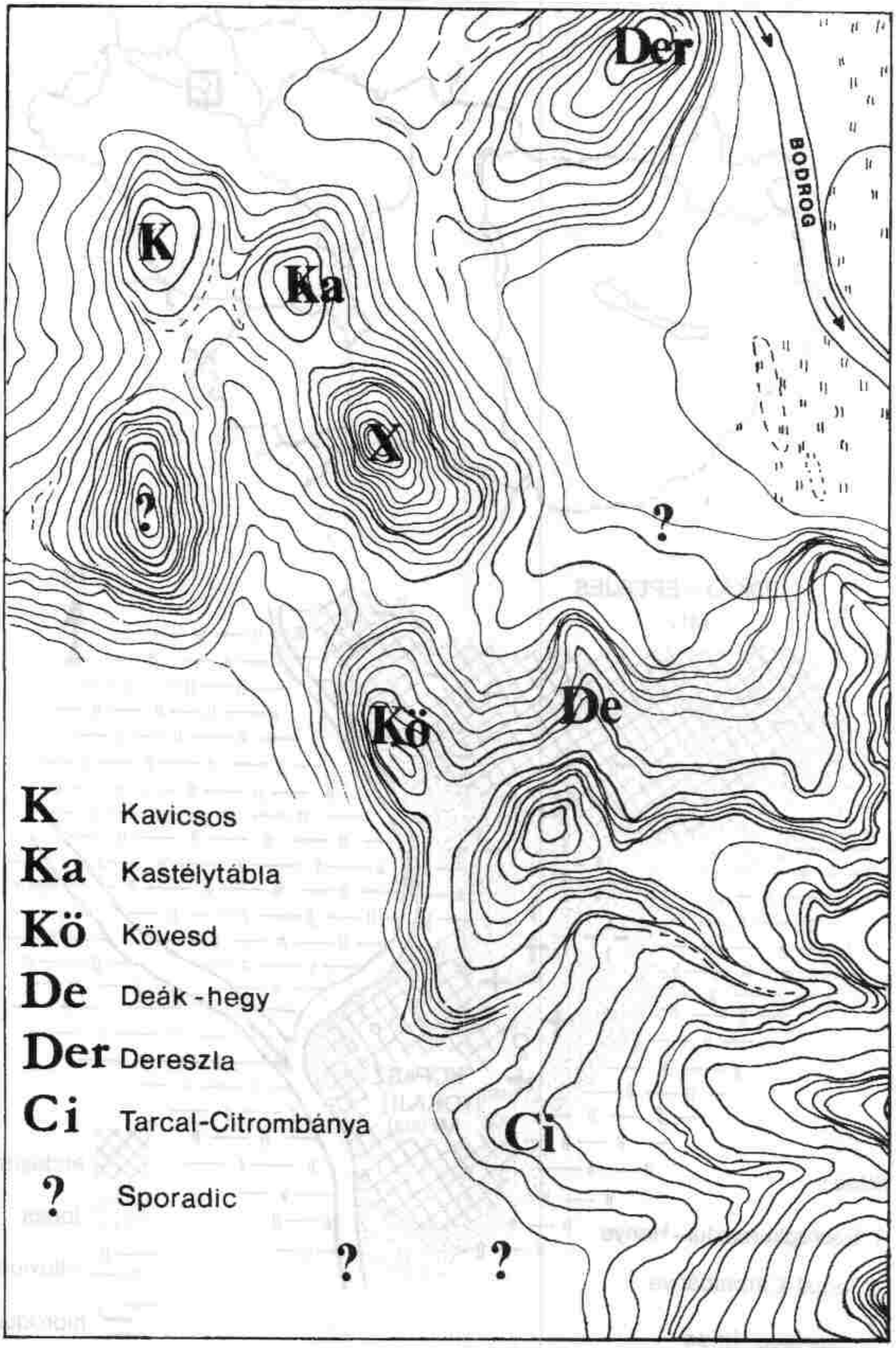


Fig. 3 Sites and collecting spots around Henye hill

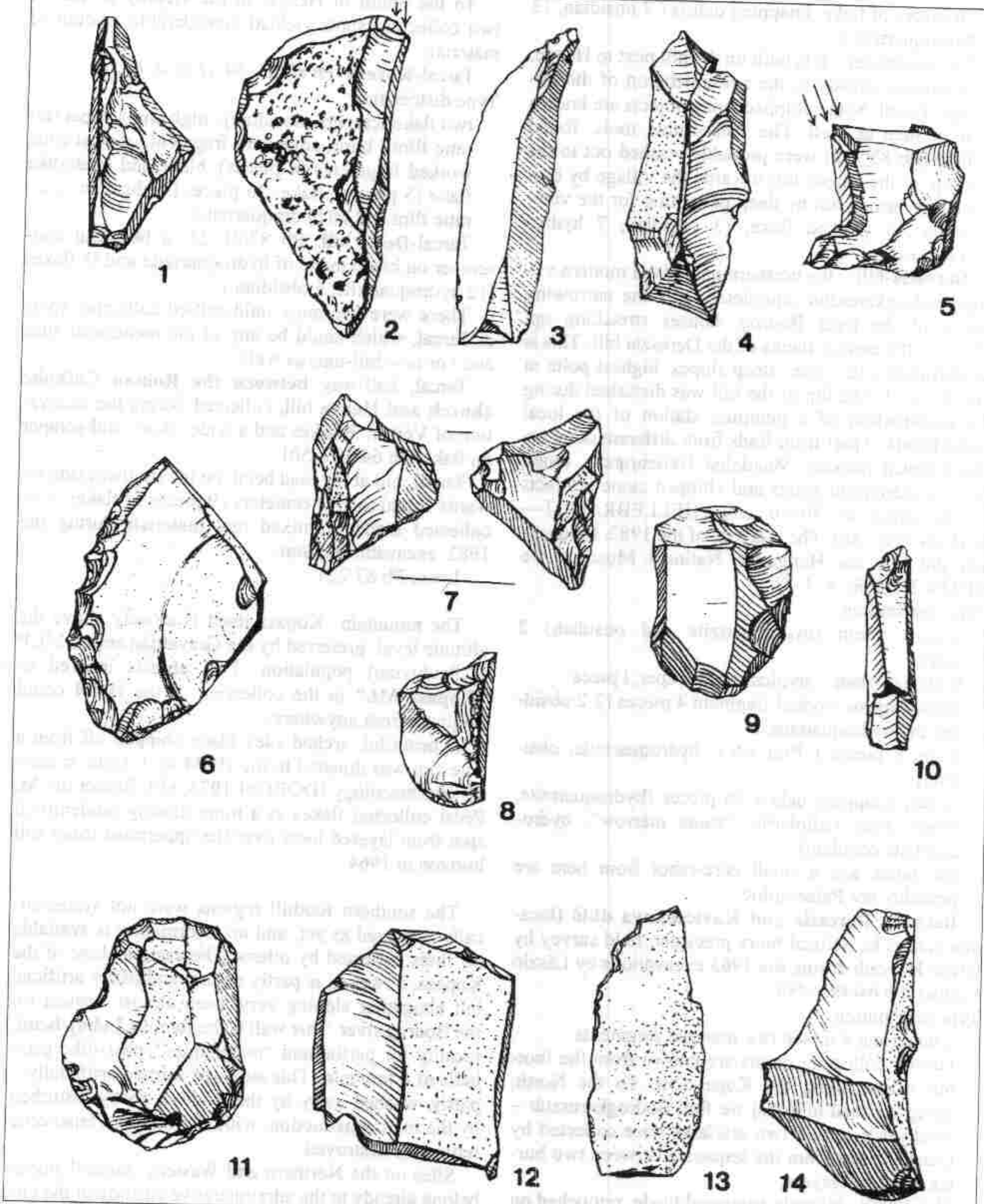


Fig. 4 Stray finds from the environs of Henye

two collecting spots, same as on Kastélytábla, Kavicsos and Dereszla, material similar to the Henye site was collected, as much as we can say on the basis of the scanty material. Quantity of finds and extent of area covered with finds cannot be compared to Henye. A possible appealing interpretation of the phenomethe area was deep-ploughed again and the near-surface cultural layer was threatened with destruction. Therefore Vértes planned authenticating excavations on the area (HNM 1966).

Between **1 October – 15 October 1963** –, László Vértes performed excavations on the site (HNM 1966). Vértes aimed at finding the original camp site on the many times ploughed, disturbed area, a detail of the settlement or at least the cultural layer. He set out trenches and sections in a roughly 100 m circle around the geodetic spot height (concrete block), comprising altogether excavated 165 m^2 surface *(Fig.5.)*.

His investigations yielded partial results:

* he could not find the central area of the settlement or, judging from the results of his research, they must have been on the area most disturbed by erosion and soil cultivation

* the archaeological material collected from the present surface and the settlement surface (cultural layer) was uniform, found in surprisingly large quantities, of excellent quality both in technique as well as raw material.

* the accompanying fauna is not rich but adequate for a biostratigraphical classification of the site

* charcoal could be collected for radiocarbon dating

* during the excavations, the site Kavicsbánya, later Kavicsos dűlő could be identified (field survey by I. Horváth).

By the end of the excavations, László Vértes made the following remark in the excavation diary: to the north, north-west and south-west of his sections, towards the slope of the Henye hill covered during the time of his excavations by lucerne on the area covered by thicker loess there was still hope to find undisturbed cultural layers. The campsite must have settled there not on the andesite but the loess thus settlement features might be observable. He did not anticipate much chances for further work because the area was planned to be planted by vineyards, preventing chances for research for years and decades. The hilltop must have been cultivated or disturbed already in the time of Jenő Hillebrand as he did not consider the area suitable for further research. Under the "charm" of the still fresh Cave Palaeolithic, he did not even think of authenticating these surface finds. The forty years of soil cultivation between Hillebrand's collection till Vértes's excavations were observable in the form of mixed, disturbed stripes of humus in the sections (VÉRTES 1966, 3.). The planned vineyard plantation, however, was held off.

In 1977, the author performed a field survey in the region together with Ágnes Salamon for the authentication of the site Tiszaladány-Nagyhomokos, Ürgehát. On the way, they visited the Henye site. It was found that not only the deep-ploughed area remained a waste-land but also the lucerne fields that were in use in 1963 became wild and was not utilised for agriculture. Finds were collected on the surface.

In 1981, archaeologist Magdolna Hellebrandt from Miskolc performed rescue excavations at Bodrogkeresztúr-Dereszla prior to the construction of the village water plant station and collected, among others, Palaeolithic finds as well. She was informed that the idea of planting vineyards to Henye was raised again and soon the preparation of the soil would be started (that is, a new deep-ploughing could be expected). Thus the continuation of the excavations started by László Vértes became topical.

This work was performed **between 28 June and 22 July, 1982.** Costs of archaeological excavations were covered by József Fülöp, chairman of the Central Geological Bureau (Központi Földtani Hivatal).

During the excavation, sondage was planted around the flat plateau of the Henye hill, though the strongly disturbed artificial surface did not give any clues for the reconstruction of the original surface. The extent of the site could only be estimated because the surface occurrence and concentration of the finds had been strongly influenced by multiple disturbances. The Vértes's "fix point", the spot height could be found broken on still identifiable place.

Excavation trenches were planted at three units: *(Fig. 5)*

Bodrogkeresztúr-Henye I. unit

– to the north and east of the spot height, partly intersecting section A by Vértes. This was necessary to be able to connect the new excavation areas to Vértes's sections. 8 exploring trenches were opened in the length of 80 m. On finding the cultural layer in the second trench, A-B-C-D-E were opened to trace the settlement surface. During the 1982. campaign, altogether 42 m, adjoining settlement surface could be opened in the A-B-C-D-E sections.

Bodrogkeresztúr-Henye II. unit

About 80 to the NW from the spot height 4 exploring trenches were opened, 20 m long each. Scattered settlement features, some in situ bones and stone tools were observed as well as some surprisingly large blocks of stone.

Bodrogkeresztúr-Henye III. unit

4 exploring trenches to the W of Vértes's sections. Mammoth tusk found in trenches 1. and 2. might have belonged to the same animal the mandible of which was found by Vértes in his section E.

Excavations in 1963. and 1982. opened up at Bodrogkeresztúr-Henye altogether 425 m^2 surface.

In course of the 1982. campaign, collecting spots from former survey were identified on the hill-tops lying 20–30 m lower than the Henye site and collected further finds. The strayfinds could not give any data for a possible interior chronology. All we can say that they do not differ, in raw material or technique, from the Henye material.

3. Archaeological finds (Photos 1.-4.)

All finds from Bodrogkeresztúr-Henye (including several field surveys, collections and the two excavations) seem to belong to one cultural layer of one settlement. Therefore tools are presented together. Comments by Vértes on individual tool types are quoted.

3.1. Tools

(S-B number refers to type list nr. according to **D. de Sonneville-Bordes–J. Perrot)**

End-scraper on blade (S-B 1–2 type)
75 pieces *(Fig. 6.)*

"One of the most common implement types is the end-scraper (21%). They are generally made of unretouched blades but occasionally of retouched blades even on the end of Aurignacian blades. There occur oblique-edged shaped and short end-scrapers too. The "carinated" types are also made on blades".

(VÉRTES 1966, 10.)

Base form: Mainly regular, with triangular or trapeze cross section, on average, 30–40 mm long blade which can be slightly arched. The detachment of the blade is generally of Upper Palaeolithic character but clactonian technique is also met. The bulb can be thinned. Depending on the raw material (mainly in the case of obsidian lumps) they can be slightly arched. There are blade-like slices as well: one of the dorsal planes of the triangular cross section blade is covered by cortex.

Working edge: most typical is the arched working edge at the distal end of the blade. It can occur also at proximal end. There are some straight or concave edge end-scraper on blade as well. A local speciality is the steep (high) scraper edge with projecting front (12 pieces), Aurignacian type elongated nosed end-scraper (3 pieces). 12 artefacts have asymmetrical edge.

Others: side of the blades is more or less worked, commonly with continuous or scattered line retouch, in 4 cases with step-like (Aurignacian) retouch. The other end of the blade, opposite to the working edge can be straight or obliquely struck. Among the two shouldered end-scraper on blade, one is formed by notches, the other dorsal "alternating" retouch.

Double end-scraper on blade (S-B 3)
8 pieces, *(Fig. 7. 2,7)*

Arched-arched or arched-straight working edge-combination made on regular, generally shortish blade. Margins can be retouched. Two objects deserve special notice: on one tool, by the combination of two slightly arched and one deep concave scraping edge a thick "L"-form, triple scraper was made; on the other, alternately directed double concave working edge was formed on two edges of a thick prismatic flake.

Average length of the tools is between 30–40 mm.

End-scraper with broken arch ("ogilvy" scraper) (S-B 4)
1piece

Regular scraper edge on retouched blade with triangular cross section, the proximal edge struck off.
Hydroquartzite
40 mm long

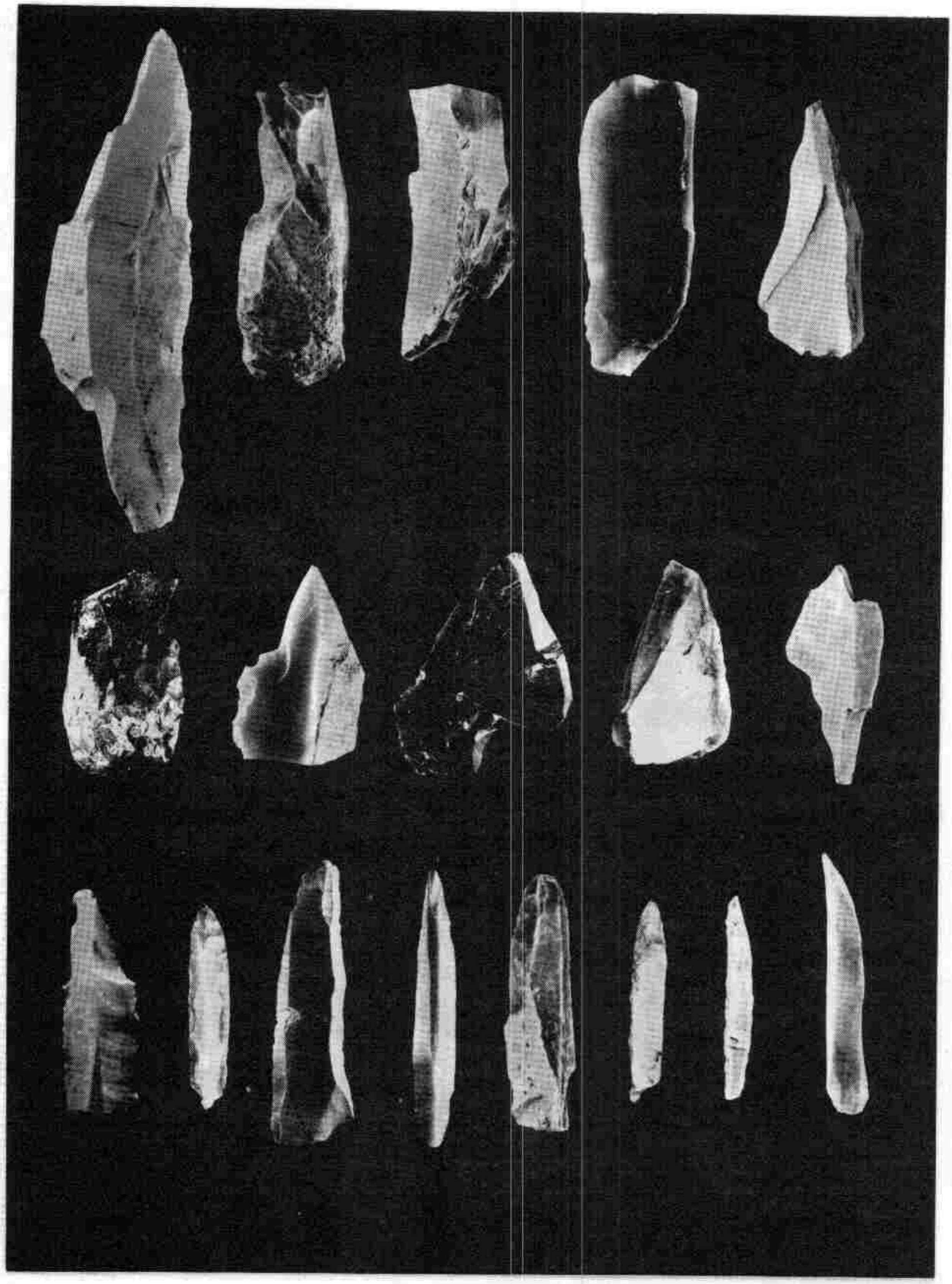
End-scraper on retouched blade (S-B 5)
This type was not separated because this type group is only a variant of S-B 1–2 with little typological value. As it was mentioned at S-B 1–2, different working of the blade margins is frequent and is done to different degrees of perfection

End-scraper on Aurignacian blade (S-B 6)
5 pieces
(Fig. 8. 1, 2 Fig.10. 2,3,5,)

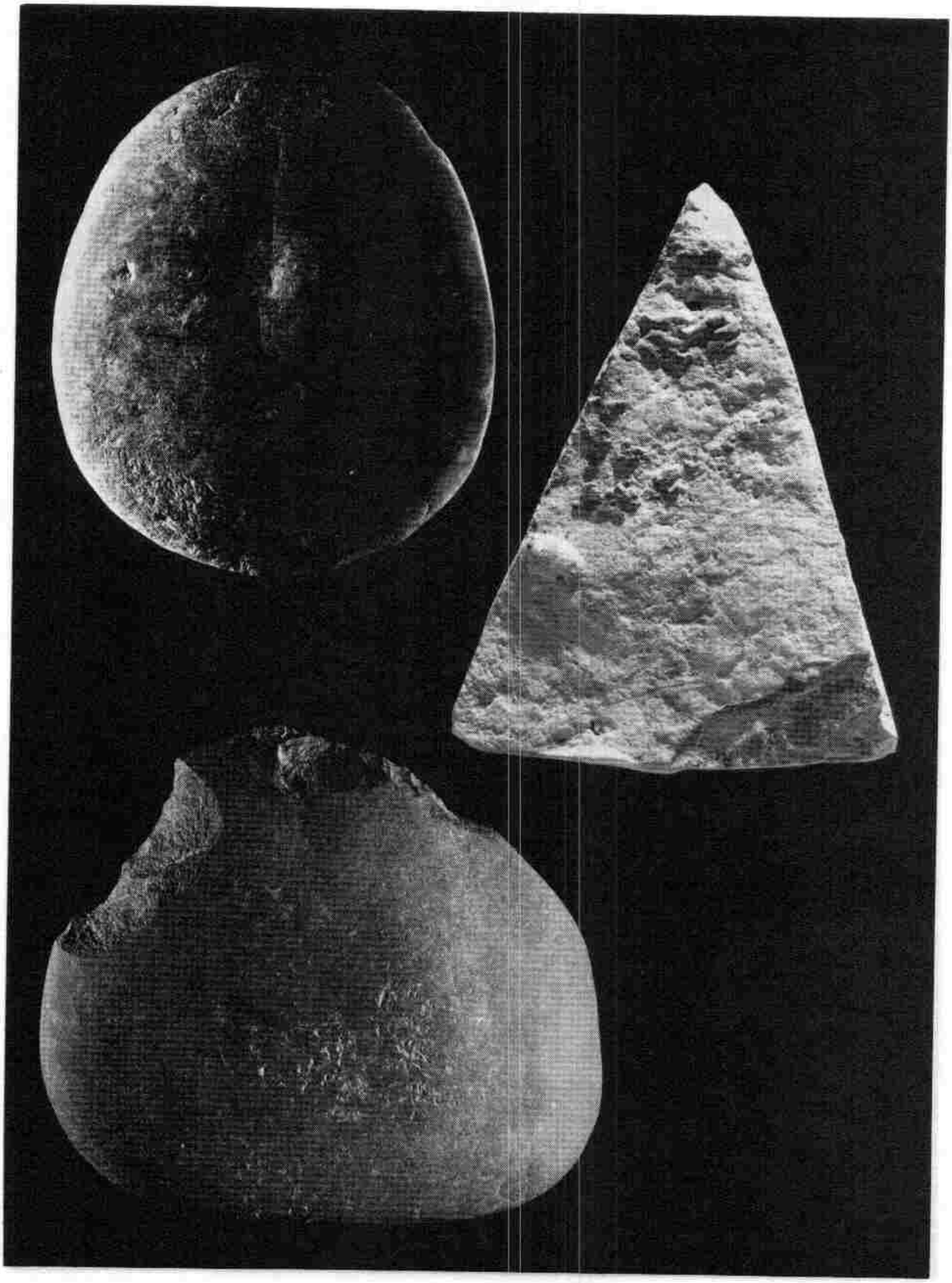
The tools classified to this typological category could be fit on the basis the quality of the working edge into the former end-scraper categories. Their separate treatment is necessary because of the Aurignacian type step-like retouch we can find on these tools (or, blades) is one of the diagnostic elements of the archaic character of the industry within the Gravettian circle.

These scrapers are generally characterised by careful workmanship, neat, symmetrical finish. The working edge is arched or double, also containing forms with projecting front, steep (perpendicular) retouch, and also pieces where the working edge is placed on the proximal end of the blade.

Average length between 40–60 mm.



Burins



Serpentine disc, chopper, triangle

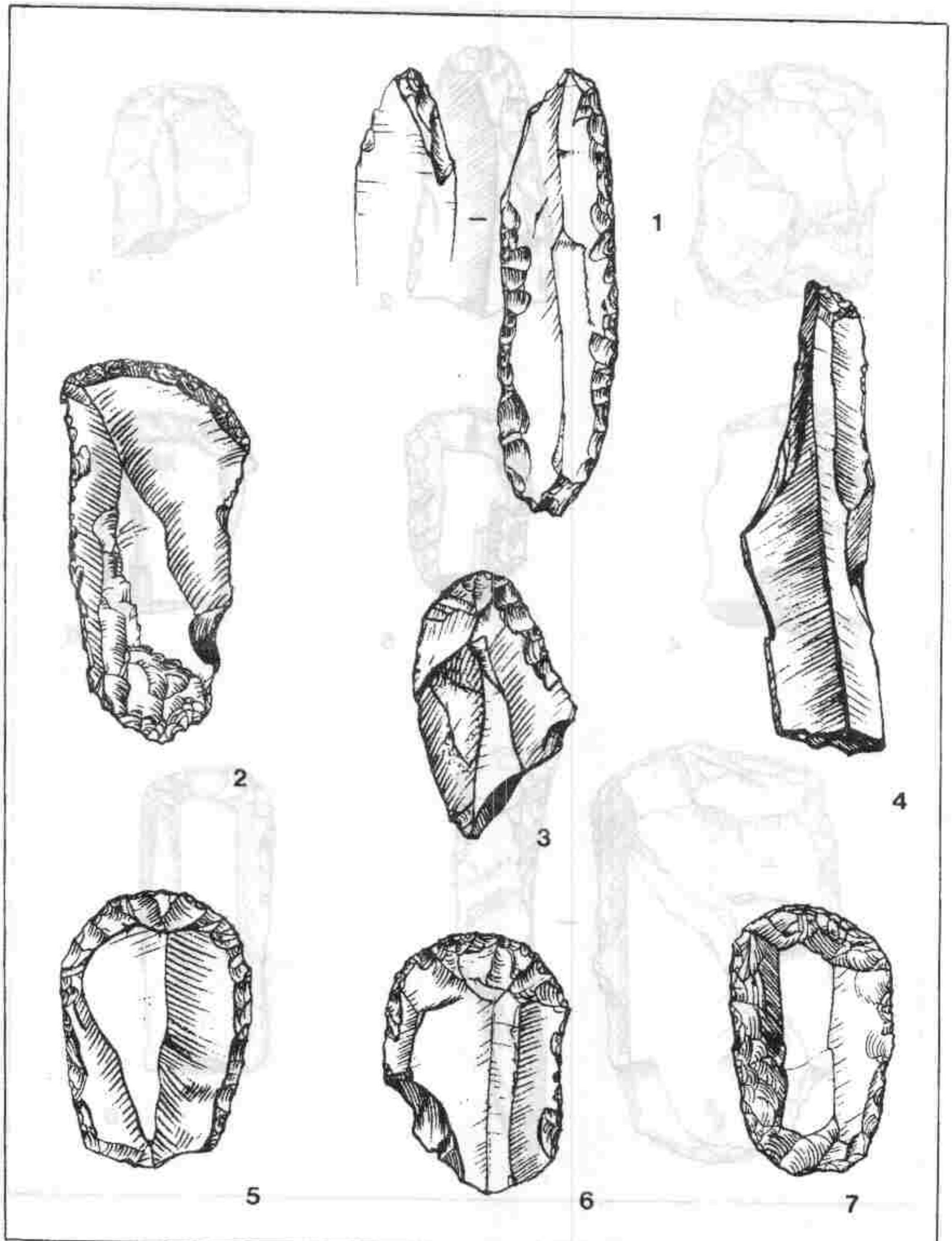


Fig. 7 End-scrapers on blade, flake and retouched blade. Scale 1:1

"ogivals" are missing. There are altogether 3 nose-scrapers in the finds but even these are not characteristic. Some end scrapers having a protruding tip on their front above the scraping edge due to too steep flaking resemble the types known from Arka."

(VÉRTES 1966, 10.)

Base form: typically, wide, large, rough flake. There are core fragments or regular cylindrical cores split in two in its length, slice pieces (made of pebble) or corticated slice-like flake, core basis or prismatic raw material pieces.

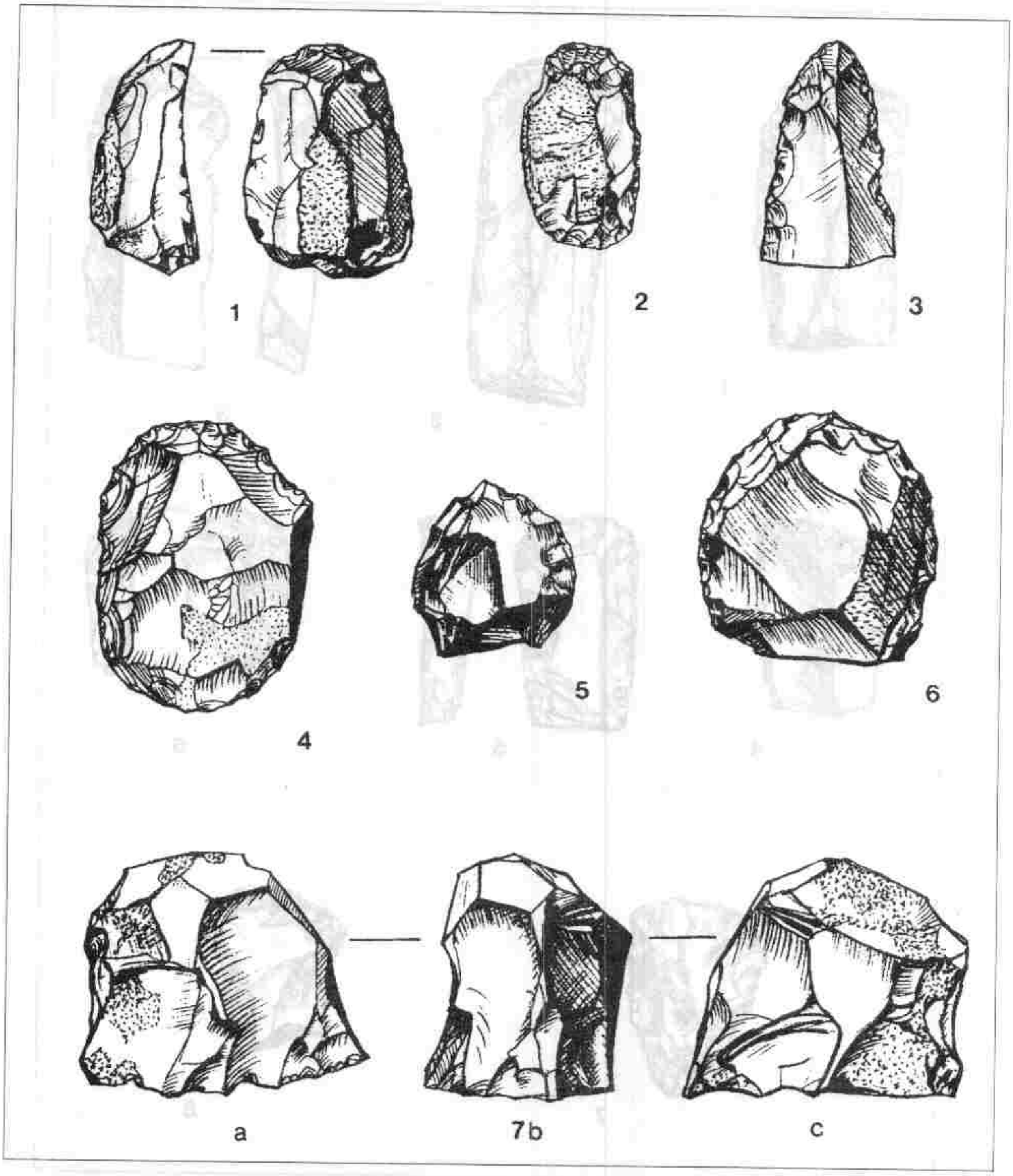


Fig. 9 End-scraper on flake. Scale 1:1

The working edge can be placed at the proximal edge of the flake, the tool can be hafted ("hafting" by occasional or natural cleavage surface of the a flake).

Retouch: traditional fan-shaped retouch, linear retouch, on the margins, occasionally bifacial and alternating retouch could be observed.

Variance of the dimension is great, this form also comprise tools exceeding 100 mm.

Thumbnail or semicircular end-scraper

No significant difference from S-B 8, only the base form of the tool is shorter and wider and the working

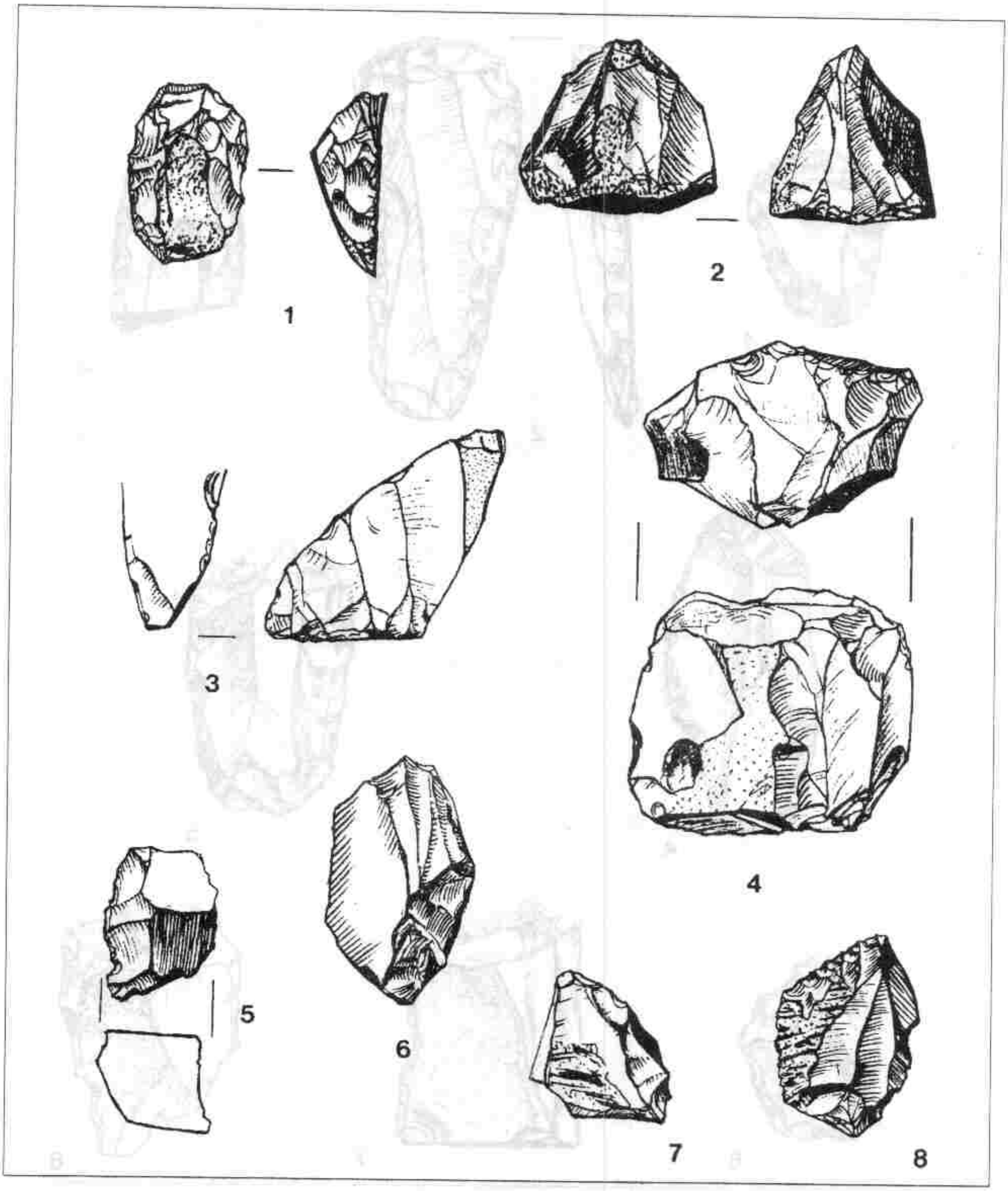


Fig. 11 High end-scrapers, end-scrapers on flake, combined tools. Scale 1:1

This type group is decisive in the cultural assignment of the industry. The quality of finish is not as high as in the Aurignacian industries but the carenoid character of the tools is evident. Among the tools of archaic character we can find two split longitudinally, on one of them a double burin edge is found opposite the scraper edge.

It should be noted that on the two Hungarian Aurignacian cave sites, classified with certainty to this industry on the basis of split base bone points we can

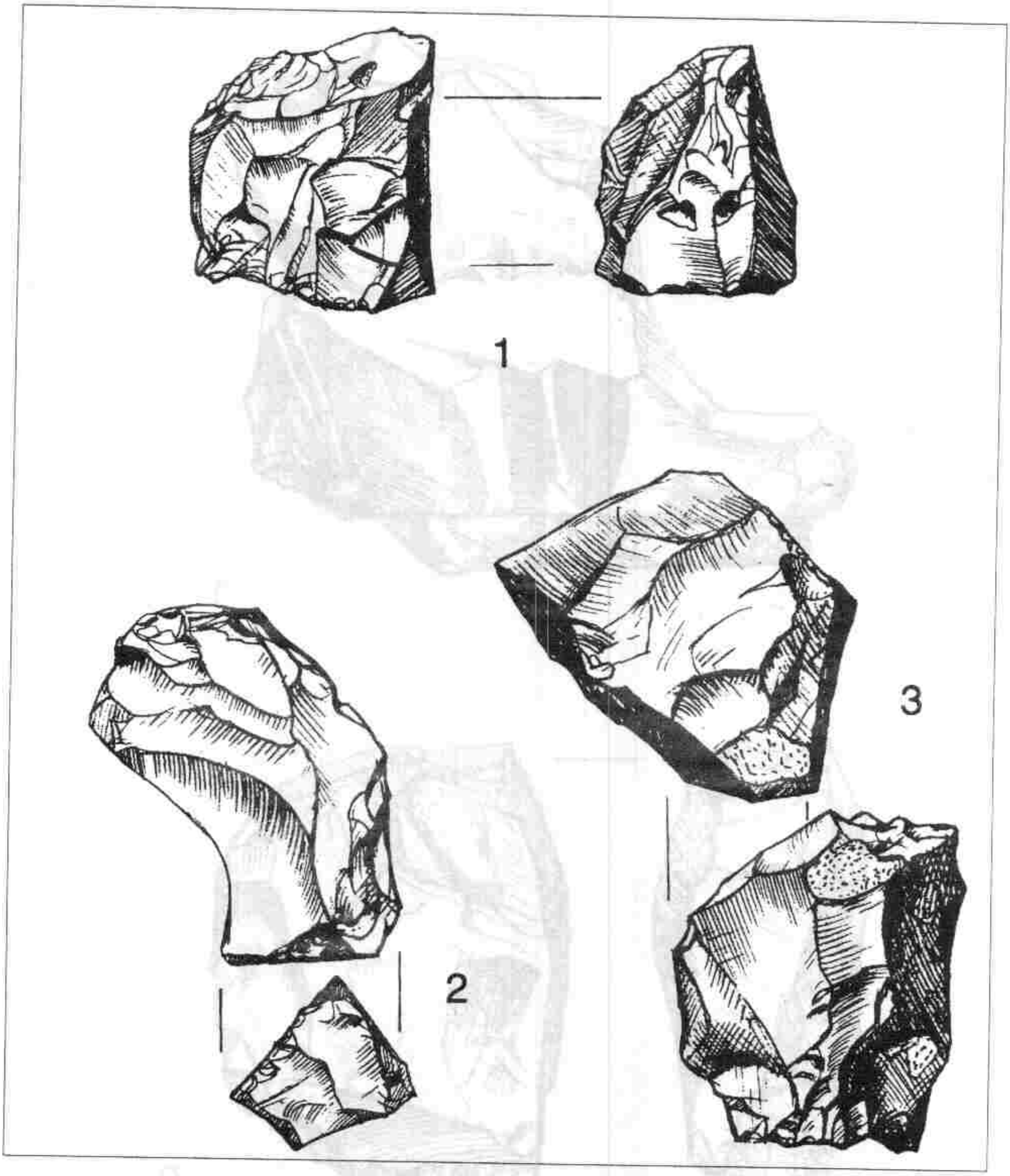


Fig. 13 Rabots (planes). Scale 1:1

Nosed end-scraper (S-B 13)
7 pieces

The Bodrogkeresztúr items differ from the classical "grattoir museau" that they are less carenoid-like: the slightly nosed working edge is mainly formed on flat/"mince" end-scraper on blade. Among the tools of this group we find an angular end-scraper: the nose is in the right distal corner of the tool.

Rabot (plane) (S-B 16)
19 pieces *(Fig. 12, Fig. 13, Fig. 14)*

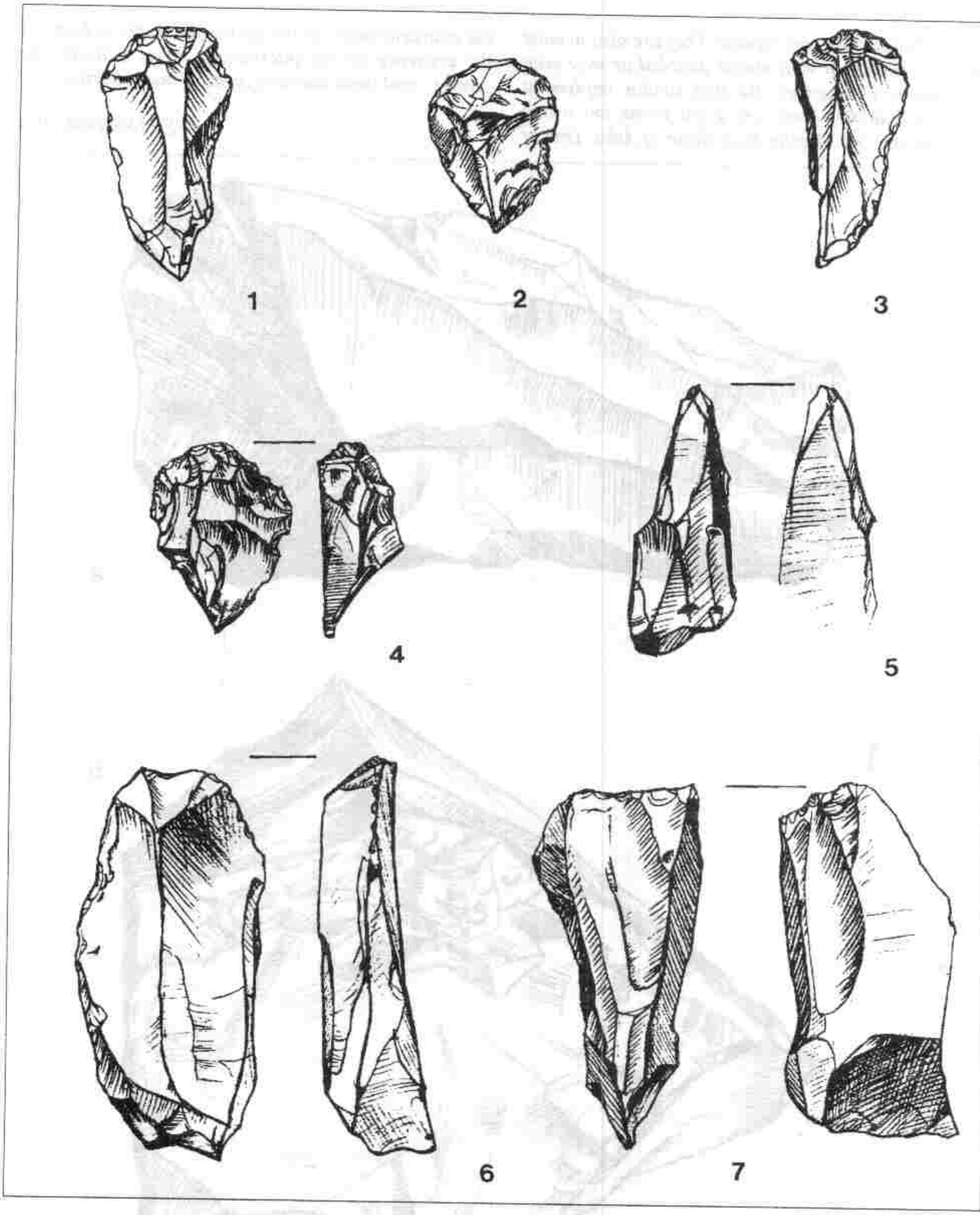


Fig. 15 End-scraper-burin combination, angular burins. Scale 1:1

Base form: most typical, naturally, core: large, conical, cylindrical or multiple cores but they can be also found on rough flakes, pebble fragments and core remnants, core bases cut in different ways.

The working edge can be simple or double, within the latter, parallel or alternately worked.

The working edge, independent of its direction to the axis of the tool, can often be lobate or concave.

be made by some posterior working especially suitable for rough work.

Others: one of the tools was made of "stone marrow" with some defect. By roughing out the base form, a handy haft arose rendering the "rabot" a very suitable tool provided its function and use really correspond to modern planes. *(Fig. 12. 1)*

Average length: 60–80 mm

Raw material: The correlation of raw material and type is generally not significant, only the finish of more fine – more rare materials is more careful. In case of the rabots, however, the so-called "stone marrow" occurring on geological source close to the site is seemingly the most common raw material. It was an ideal raw material for this large and not very minuteously worked tool type.

End-scraper–burin (S-B 17) 30 pieces
(Fig. 15. 1–3)

Base form: It can be a chisel/plane edge core (3 items), traditional blade (7 items) and different flakes, partly worked in the style of a scraper: 20 items

Working edge: The scraper edge can be different, depending on the base form: the plane is typically thinned core base or crest with burin edge. The end-scrapers on flake are strongly arched, sometimes asymmetrical or thumb-nail form, with some fan retouch or linear retouch. The end-scrapers on blade are also traditional, generally retouched on the blade side. The burin edge can be opposite the scraper edge or combined with the latter, in medial, flat, lateral, diedre or angular variations. The burin edge can be made on intact or truncated end of the blade.

Others: This is not a standardised type, there is great variation within this tool group. Apart from simple end-scraper-burin combination, multiple combination is also occurring: at the corner of the scraper edge as well as both sides of the proximal edge of the blade, that is, a triple burin + end-scraper on flake combination can also be found.

Average length: due to the mainly flake base form, it is short and wide: 30–40 mm.

Borer (S-B 23)
15 pieces *(Fig. 16. 1)*

This tool type is rarely represented in all three settlement waves of the Hungarian Upper Palaeolithic period. The existing few forms are also different from the regular Western European borers or the types frequently met in the Pavlovian. The base form is a fine, slender blade or part of it, the finish is careful both at the margin of the blade and the formation of the borer tip. The tip is typically straight in the longitudinal axis of the blade, worked with steep / alternating retouch. There are some forms which are slightly bent like a gabled chisel ("bec"-like), also short tips, some can be formed by notches or using the elongated natural cleavages of the blade, making the naturally pointed distal tip sharper by small linear retouch. Some tips were completed by burin chip. It is not a characteristic group of tools but the ones made were carefully made and of good raw material.

Their size is variable depending on the raw material: on average, they are 40–50 mm long.

The margin of the blades is typically retouched, blunted. Aurignacian type step-like retouch is also occurring.

Medial burin (S-B 27)
58 pieces, *(Fig. 17, Fig. 18, Fig. 19)*

"Approximately 22% of the industry are burins. These are the most variable in type have the best workmanship and among them the finest are those made of blades: the terminal angular and side-edged "diédre" burins. The types combined with blunted blades characteristic of the East Gravettian are frequent, as well as the double and multi-edged burins. The angle burins made of large flakes – frequently of tabular flint – are also characteristic of the industry as well as the similar made lateral burins. Among these latter we find an especially well-worked subground whose implements are probably the most similar to the so-called "burin caréné" of the French Palaeolithic.

The core burins comprise 4.8% of the industry. They have varied shapes, are well-worker implements including forms which present an archaic effect. Some of them were also made in a caréné form and certain specimens are gigantoliths."

(VÉRTES 1966, 10.)

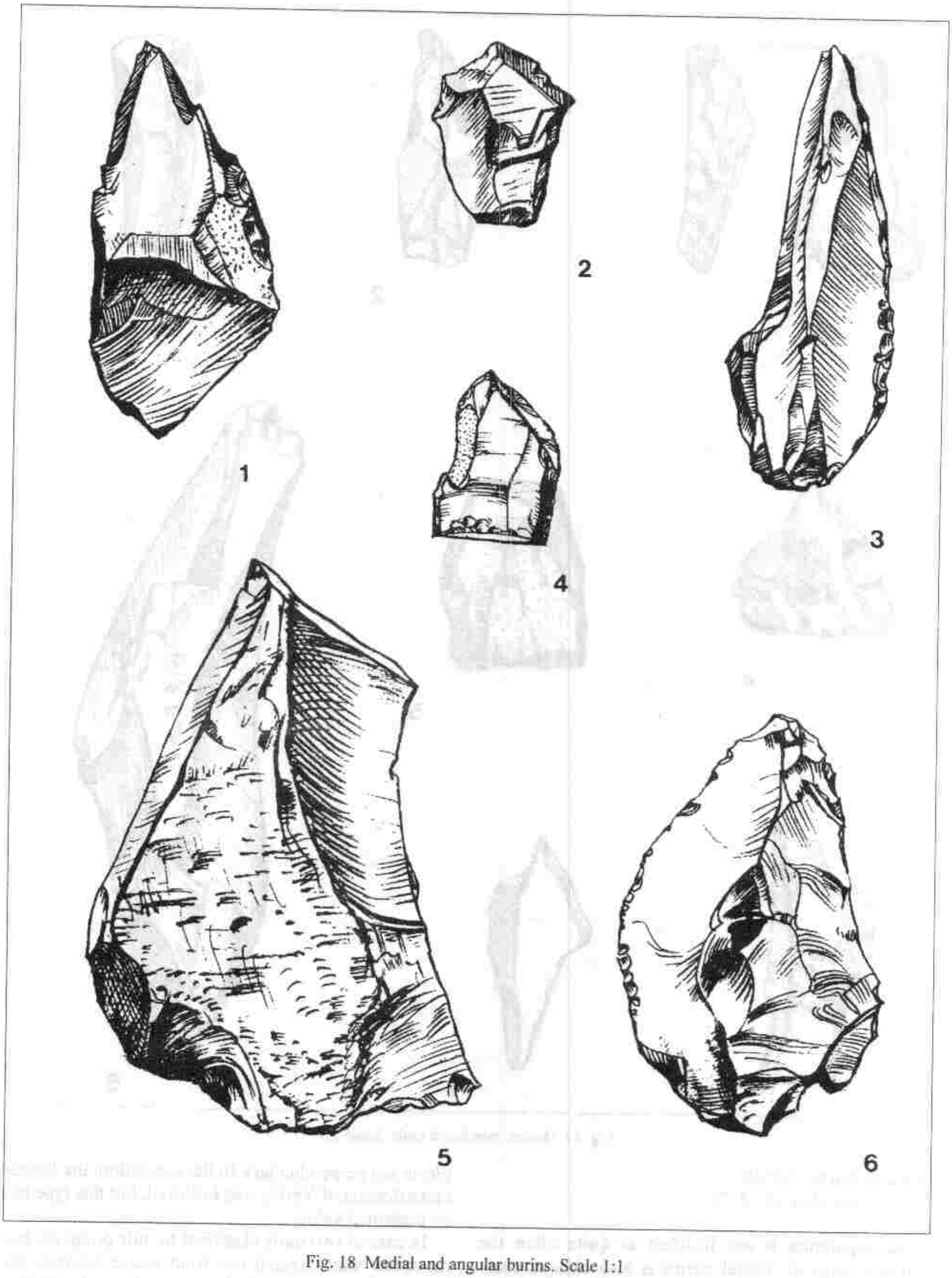
Dominant type within the most characteristic tool type group, i.e., burins.

Base form: variable – blade, blade-like flake, pebble slice, core-fragment or -remnant. Base form seemingly has no importance for the finished artefact.

Working edge: in the axis of the tool, perpendicular or oblique to the planes, in case of high crest blades sometimes on the crest. Could be produced by burin stroke as well as the combination of retouch and burin stroke.

The margin of the blades or flakes can be more or less retouched. Macrolithic tools also appear in this group, separated mainly on the basis of large dimensions. Some items which are closer to the average are also classified here because of their character and hypothetical function.

Fig. 18 Medial and angular burins. Scale 1:1



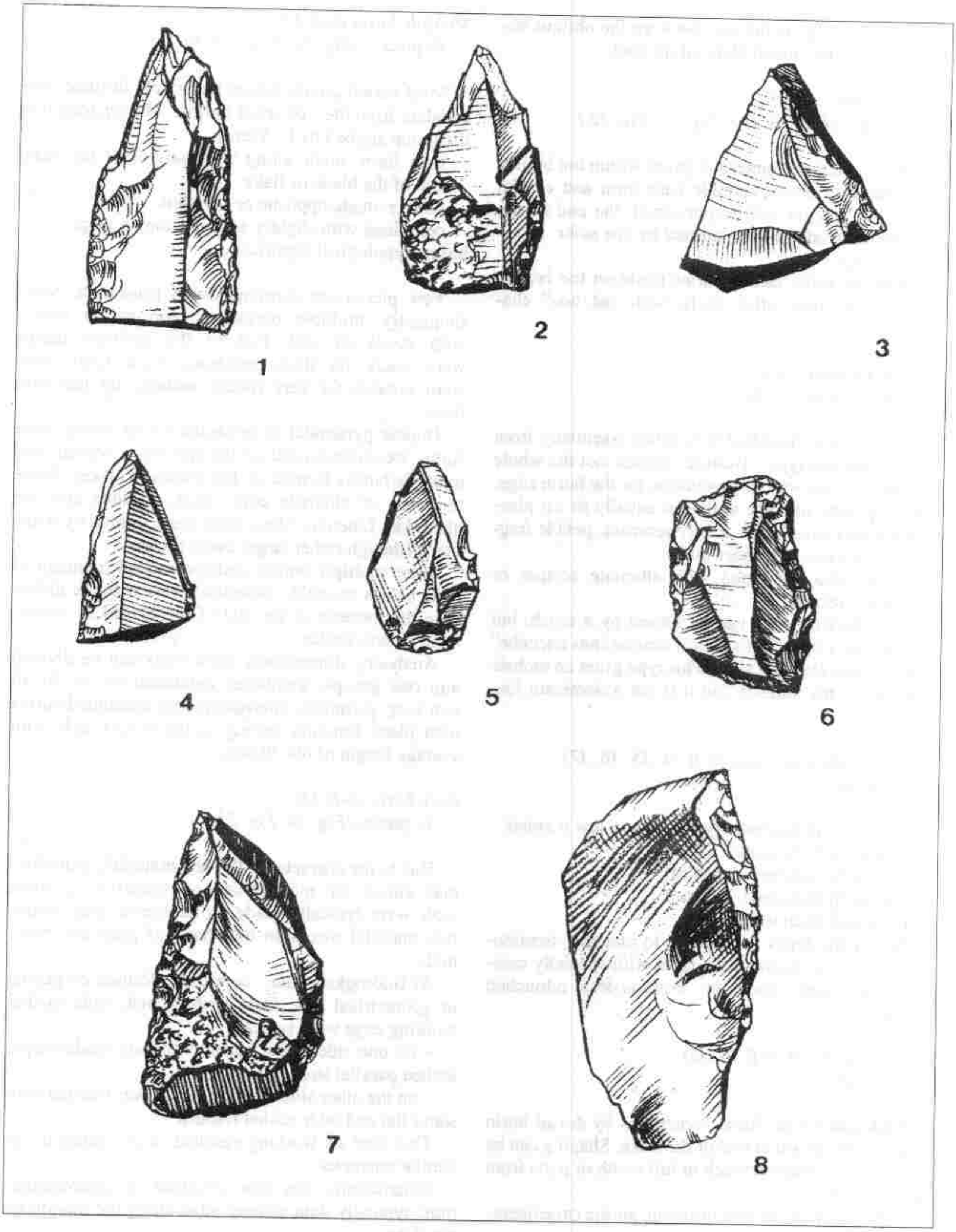


Fig. 19 Medial and angular burins. Scale 1:1

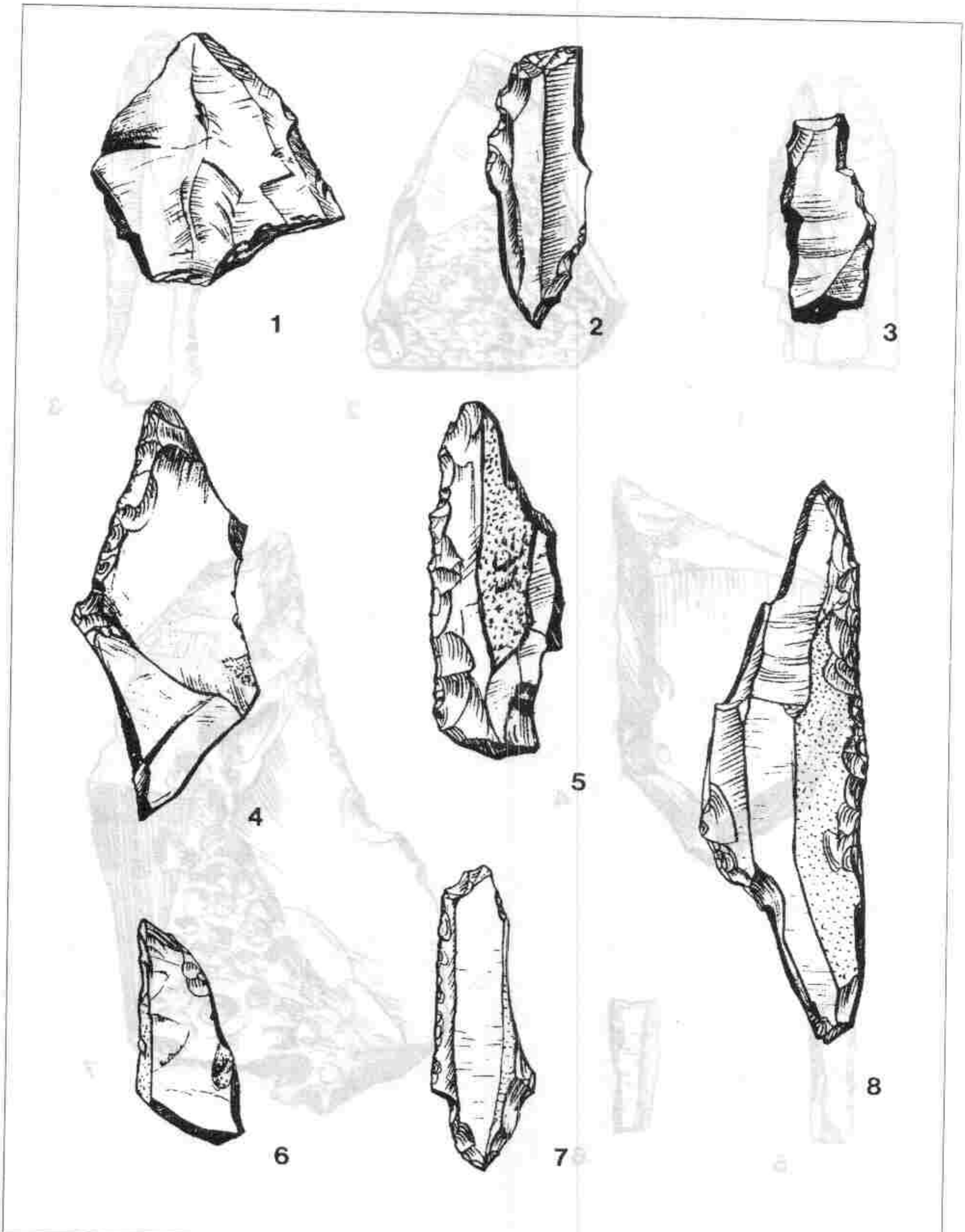


Fig. 21 Angular, lateral and multiple burins. Scale 1:1

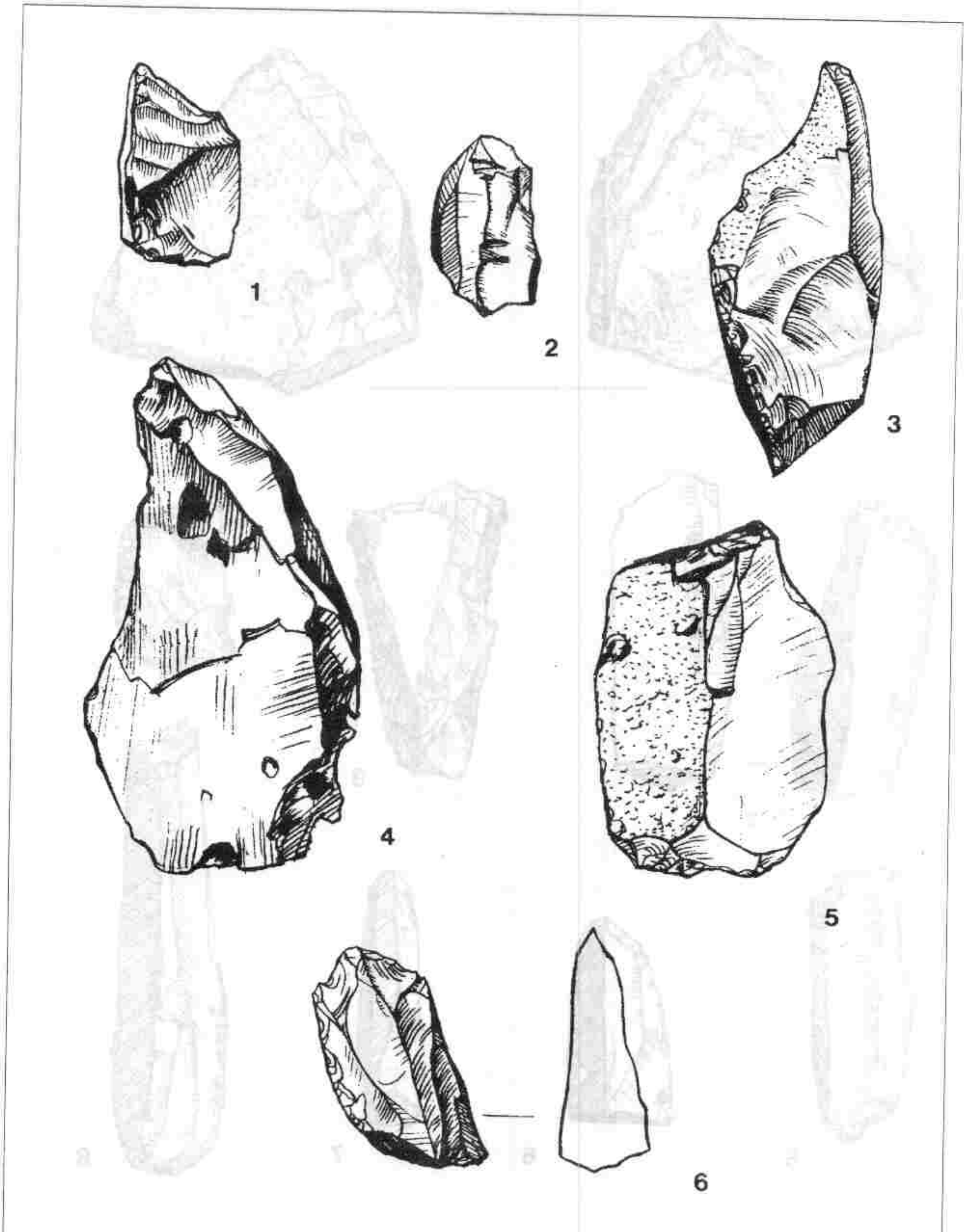


Fig. 23 Carenoid and transversal burins. Scale 1:1

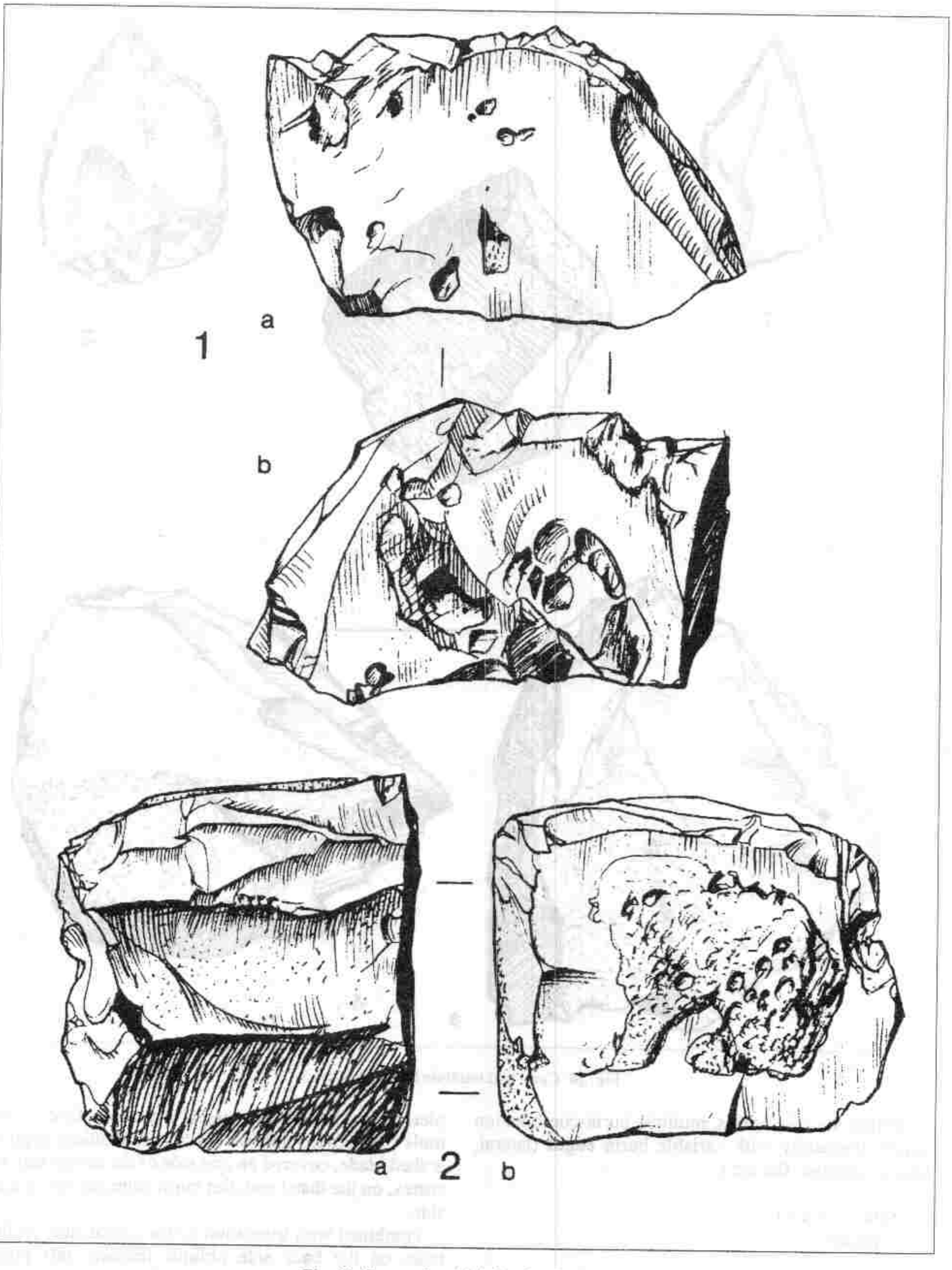


Fig. 25 Core and multiple burins. Scale 1:1

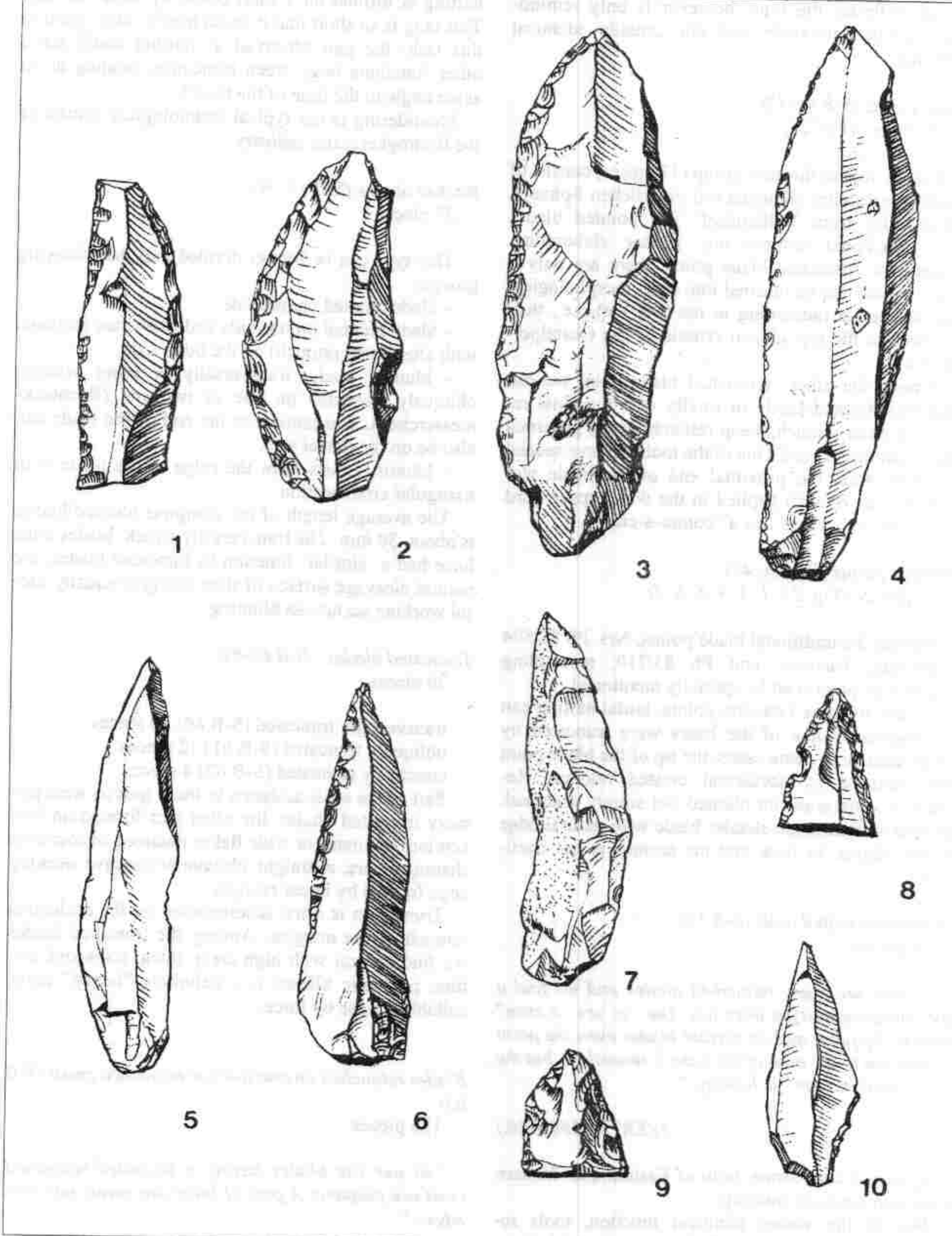


Fig. 26 Retouched blades and blade points. Scale 1:1

This tool type does not need much explanation. The blades are on variable base forms with variable finish.

The retouched crest blades assigned to this groups are obviously not core margins. They are typical blades with triangular cross section and blunted crest. This group, together with retouched flakes are the real "ad hoc" tools where shaping is minimal but probably just adequate.

Blade retouched on both sides (S-B 66)
24 pieces

Variable base forms and shaping, on different places. Some of the blades can be struck off on one end, obliquely or transversally. This "terminus technicus" is used when the end of the blade is broken off by one blow, i.e., not by retouch. This procedure is used in large series and the result is close to truncation. Retouch can be marginal or slightly step-like, both from ventral and dorsal sides.

Though inverse retouch was also found (marginal or scaled retouch) in several tool type, ventral working is not typical of the Bodrogkeresztúr material

Blade with Aurignacian retouch (S-B 67)
15 pieces, *(Fig. 27. 9, 10, 12)*

The Aurignacian retouch is typically characteristic of the older Gravettien industries, thus also of Bodrogkeresztúr. This type group contain blade tools with Aurignacian retouch only; should they be on other types, they were classified into their own category.

Aurignacian blades are typically large, bulky blades, so-called "heavy" types.

There are no exact data available, but according to the impression of the author both the Aurignacian industries and the older Gravettian industries with Aurignacian character are more large and bulky here than the neighbouring Slovakian find assemblages. It is not certain that this difference in size relate the average of the industry but it is apparent in some key tool types.

The geographical proximity and the narrow temporal limits cannot indicate that these attestable differences would mean temporal or spatial separation, other genetics or differences on facies level. The exact explanation is not known yet: one possible answer can be the accessibility or physical qualities of the raw material.

Mousterian point (S-B 69)
2 pieces *(Fig. 28. 1, 2)*

"Also there are no "Solutréan-type" leaf-points but the surface retouch in a few instances, especially on blades, can be found. This technique was used for making the edge and a part of the surface of an usually fine mousteroid point made of obsidian. This implement could be determined as belonging to the a face plan group, it seems to fit the best here."

(VÉRTES 1966, 10.)

One of them is a wide decorticating obsidian flake (covered on dorsal side with pebble cortex).

The other one is made of hydroquartzite, obliquely stroke on the proximal edge and the left margin with natural cleavage plane; on the right edge, corticated surface and steep retouch.

Notched - lobate flake (S-B 74, 75)
18 pieces

Flakes are typically wide, high base form, core base or core remnant also occurring, often with pebble cortex. They are bulky tools, the notch can be formed by one blow or retouch, sometimes the margin of the flakes are retouched or truncated.

Piece esquillée (S-B 76)
9 pieces

Atypical tool type, flat, mainly square or similar form flakes with certain amount of retouch on their margin.

Side-scrapers (S-B 77)
37 pieces *(Fig. 29, Fig. 30)*

" The side-scrapers and notched implements are frequent. There are three esquil, forms, one which reminds us of the typical East Gravettian concave-edge burin."

(VÉRTES 1966, 11.)

Important tool type, strengthening the slightly archaic character of the industry with significant number of finds. The base form can be flake, core *(Fig. 29. 1)* core fragment, pebble slice, or platy, flat raw material piece of hydroquartzite.

The form of the working edge is basically arched: 17 pieces

Concave: 1 piece

Straight: 9 pieces

Multiple: 10 pieces

This later is pointed (the two working edges meet at 90 degrees), angular (at around 90 plain degrees), double or multiple when the two working edges are independent of each other. On some of the tools, other working independent of the scraping edge(s) is also

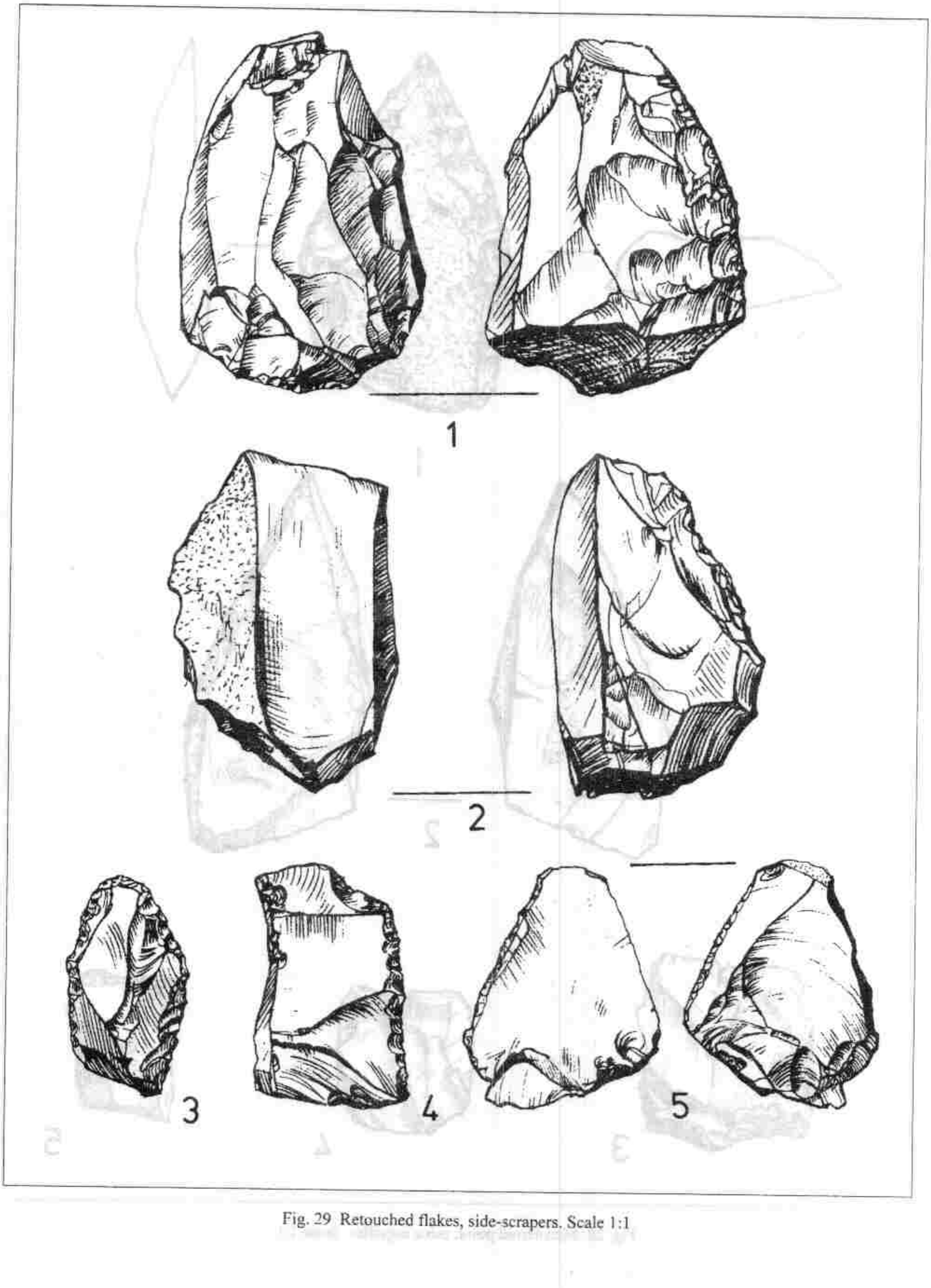


Fig. 29 Retouched flakes, side-scrapers. Scale 1:1

observable: scattered marginal retouch, scaled retouch, truncation or notches). There are some scraper combinations, e.g. with burin (Fig. 29. 2, 3).

Raclette (S-B 78)
1 piece

Quadrangular, flat flake, with alternate retouch of variable intensity along all four edges, straight and concave working edges. Dimensions: 25 x 21 mm.

"Others" (S-B 92) were further divided:

Retouched flake (93)
60 pieces *(Fig. 31)*

Same as retouched blades, they are also ad hoc tools fit to purpose, person and working style.

Hand-axe (94)
7 pieces

Not the classical hand-axe forms, more leaf-like or amygdaloid forms with zig-zag edge line, pointed hopping-tools. They are suitable, however, to perform any task associated with hand-axes.

Chopper – chopping-tool (95)
25 pieces *(Fig. 32)*

Classical Lower/Middle Palaeolithic types, made on pebbles, pebble fragments, raw material plates; chisel-edge artefacts formed by zig-zag alternating retouch

On several tools we can find two generations of retouch. (Bodrogkeresztúr finds often contain, apart from the heavily patinated old shaping, fresh retouch)

Pebble fragments
13 pieces

Geometrically split pebbles, slices, segments

Cores
156 pieces

"The cores are characteristically Upper Palaeolithic with pointed, cylindrical, double based and flat forms which were frequently transformed into scrapers or burins. The boat-shaped core fragment is frequent. It possibly had its own special function."

(VÉRTES 1966, 12.)

Cores can be grouped according to form:

Cylindrical	23
Conical	33
Flat	17
Double	15

Multiple, core base, core remnants, atypical raw material pieces: 68

Blades
551 pieces

Raw material:	pieces
Exotic	7
"Stone marrow"	185
Erratic silex	49
Mixed silex	38
Radiolarite	19
Hydroquartzite	165
Szeletian felsitic porphyry	1
Obsidian	87

Flake, knapping debris, blade fragment, blade-like flake
1989 pieces, Made of variable raw materials

Hammerstones
21 pieces

Egg-shape pebbled or pebble fragments with concentrated traces of use on one or two end.

Other objects

At those parts of the excavation where intact cultural layer was found, some other non-local ore pieces (ferrous mica?), red hematite pigments were also collected.

The broken, burnt bones found in the hearth burns were in good state of preservation. Two of these bones showed concentrated traces of use. They were 7, and 8 cm long, respectively and had been in use probably as retouchers.

Incised margin limestone disk (Vértes's uterus / moon calendar)
Inv. nr.: Pb 64/408. *(Fig. 33. 1–3)*

" Among the finds was an object, carved from limestone, that was shaped like a half-moon or horseshoe, it measured 56 by 56 by 17 mm. If the object were oriented, the top is "north" left is "west" and right is "east" the base of the halfmoon is "south". Near the center of the northern edge are two near-vertical carved lines. 6 to 7 mm long, that slightly converge to the north. Eastward and westward from the lines, the sharp edges of the object are notches on the eastern

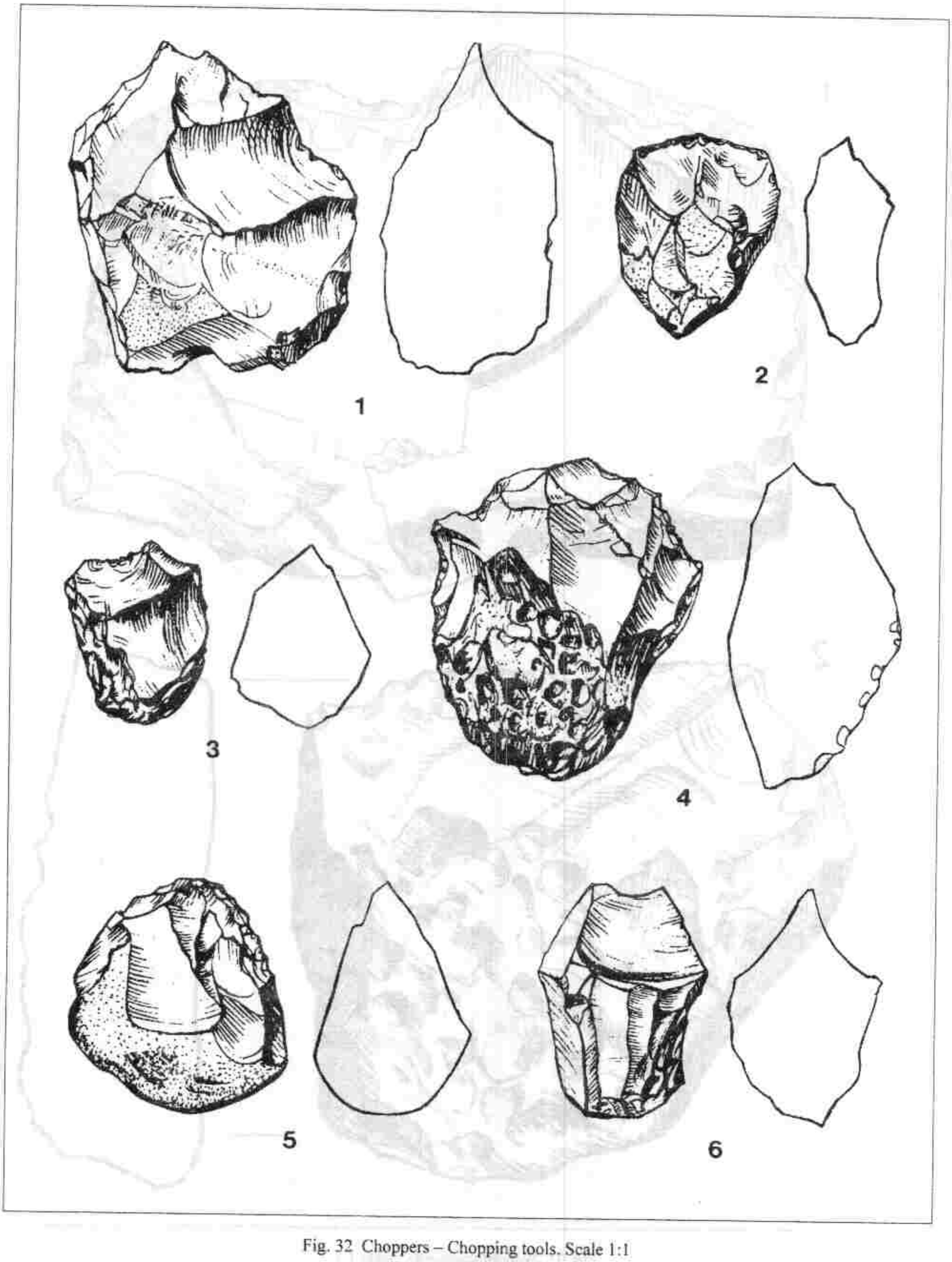


Fig. 32 Choppers – Chopping tools. Scale 1:1

side and 12 on the western, all notches extend to the reverse side. Parallel with and near the southern edge is a carved line 12 mm long.

I chose to regard the Bodrogkeresztúr object as a uterus symbol, although its lunar or solar shape was noted. The western of the pair of converging lines (northern edge) may be regarded as the symbol of the new moon. The 12 notches to the west of this line symbolize the crescent moon. The unnotched southern side may be represent the 3 days of the full moon.

The 11 notches on the east side may represent the days of the waning moon.

Finally, the eastern of the pair of lines may symbolize the vanished moon on the 28th day (or 29th day, if we allocate 4 days to the unnotched southern edge: the 28.5 days of the lunar cycle may have led primitive man to reckon either 28 or 29 days).

This interpretation does not prevent me from maintaining that the object is a uterus symbol, but the moon and uterus significances may be associated."

(VÉRTES 1965, 855–856.)

(See on front cover).

Dimensions: 56x56x17 mm

The description of the object is exact and detailed, no more completion is needed. The bright, double interpretation by László Vértes is one of possible many interpretations.

Disc

(Fig. 33. 4–5)

Flat, plan-parallel, slightly irregular, ovaloid disc made of phyllite. Carefully polished on two sides, the margin is profiled. Some small injuries along the distal end and the margin. Traces of concentrated blows on both sides, causing pits in the relatively soft material.

Dimensions: 92 x 81 x 88 mm .Inv. nr.: Pb 83/583

Retoucher (?)

Oval retoucher made of phyllite pebble, used on both sides with polished plane and margin.

Dimensions: 41 x 31 x 8 mm

The identical function of the two objects seems apparent though the former one is of much finer finish.

Inv.nr.Pb 64/80

The longitudinally split *oval limestone pebble* (Pb 64/258.) without further shaping as well as the flat, rounded limestone pebble with traces of use (as retoucher, Pb 64/236.) can be considered as forerunners of the "moon calendar".

The function of the *plan-parallel triangular sheet of silex* with patinated surface, re-shaped peaks (Pb. 64/316.) is not known.

Dimensions:: 110 x 83 x 16 mm.

3.2. Statistical evaluation of the tools

Length distribution

Length (mm)	Pieces
6–10	1
11–15	16
16–20	29
21–25	80
26–30	108
31–35	167
36–40	157
41–45	109
51–55	85
56–60	64
61–65	60
66–70	38
71–75	20
76–80	23
81–85	11
86–90	11
91–95	10
96–100	12
101–105	7
111–115	4
116–120	3
121–125	2
>126	5
Total	1124 pieces
Average:	45,11 mm

Length – width ratio of the tools:

	ratio %	pieces	%
I. group	100–66	455	41,2
II. group	66–50	204	18,5
III. group	50–33	263	23,9
IV. group	33–25	112	10,2
V. group	25–20	42	3,7
VI. group	20–16	17	1,6
VII. group	<16	10	0,9
Total		1103	100

specially suited for the given tool type (abrupt and semi-abrupt). Real scaled retouch was observed on some blades and blade points. Apart from this we can observe a type of "pseudo-scaled retouch": shallow, flat retouch running up the steep distal plane of the tool, resulting in a working edge resembling scaled retouch.

Quite often truncation is substituted by one blow perpendicular to the axis of the tool. The natural cleavage surface of the blown-off working edge is similar in its quality to the working edge elaborated by steep. blunted retouch. This type of shaping can be applied together with other techniques, combination with burin edge is especially frequent.

Burins

Burin on blown-off blade (see above) is characteristic; burin on truncated blade occurs much less. The natural cleavage surface of obsidian is similar to the slightly twisted burin chip negative. Part of the typical burin edges can be the result of unintentional burin blows, but some are certainly intentional. The working of some bulky burins are so intensive that the negatives of the detached burin chips for a shoulder or hafting. In such cases, it could have been just the burin edge itself that was in the hafting, and it is difficult to see the reason in such technical solutions (Pb 65/1269, 64/186, 83/273, 318.)

form

The surprisingly numerous "coarse", large size burins may indicate an environment rich in woods. Part of these bulky burins are close to planes: in all case, they could be used for softer material than bone or antler. (This statement can be especially relevant for combined burins over 80 mm with some other retouched working edges). Such large burins were made of local tabular raw material, therefore their form is close to geometrical (double pyramidal), resembling most to Brezillon's "burin prizmatique" in technical terms.

The working edge of lateral burins is often not perpendicular to the base but incorporates an angle (around at least 70°).

End-scrapers

Apart from traditional end-scrapers on blade, those on flakes are also frequent. Typical of the site we can find pieces with discoid base form, with slightly zigzag semicircular working edge, and end-scraper retouch (Pb 64/353, 289, 117, 2, 83/286, 802, 277.) They recall the form of chopping-tool derivatives.

Base forms on blade or flake have high crest and steep ventral planes. Therefore steep. almost rectangular scraper from is typical of this industry. Thè dorsal side of the tool is sloping steep towards the proximal side.

High crest and prismatic base form favours the presence of carenoid end-scrapers which add up to the Aurignacoid, or at least archaic character of the Bodrogkeresztúr industry.

Also occurring, there are end-scrapers where the shaping of the working edge hardly exceeds an arched truncated blade.

Characteristic type of the assemblage is the high end-scraper, split longitudinally. Such tools resist use better and probably do not break easily. Splitting the high fronted, carenoid end-scrapers was not accidental but intentional.

Planes (rabots), chisels

Similar to large, bulky carenoid tools that were, probably, used for wood working, just like burins with similar shaping (Fig 12–14). Together with these, the shaping of the margin of the cores can be hardly separated from the preparation of the core base. The intention could have been different, but the resulting rabot-like core margin could be similar at the two working stages.

In Hungarian technical terminology, due to the not very fortunate translation of "burin". Part of the Hungarian experts seem to be troubled by the translation of the term "burin" (árvéső),calling the tool types ciseau – Meissel and burin –. Stichel by the same term "véső" which is at least misunderstandable. They should be differentiated at least for the different function, therefore it is important to separate the two types. Chisels are typically bifacially worked tools of 6–8 cm size, the angle of the working edge is smaller than right angle (on the average, about 70°), the working edge is in the plane of the blade/flake, having a wedge-like function. The working edge of the burin is formed perpendicular or at an angle to the plane of the blade, with typically carving function. With a little effort, flat cores, core remnants can be shaped to this type by flattening the distal or proximal end. At the same time, core preparation or use can result in similar forms. The two functions do not exclude each other.

Geometrical lamellae

Not mentioned in the type list, medial fragments of blades or part of them might have had the same role as geometrical retouched blades. (See also comments on retouch: the perpendicular blow can have the same result as blunting retouch)

Cores

Apart from traditional Upper Palaeolithic core forms, the high number of prismatic – pyramidal cores should be emphasised as a consequence of the special qualities of the raw material, as well as the generally tabular raw material pieces, ill fitted for the production of traditional blades. Diagonally split base fragments of cylindrical – conical cores are frequent.

There are numerous flat obsidian core remnants covered on one side by cortex with fine blade flake scars.

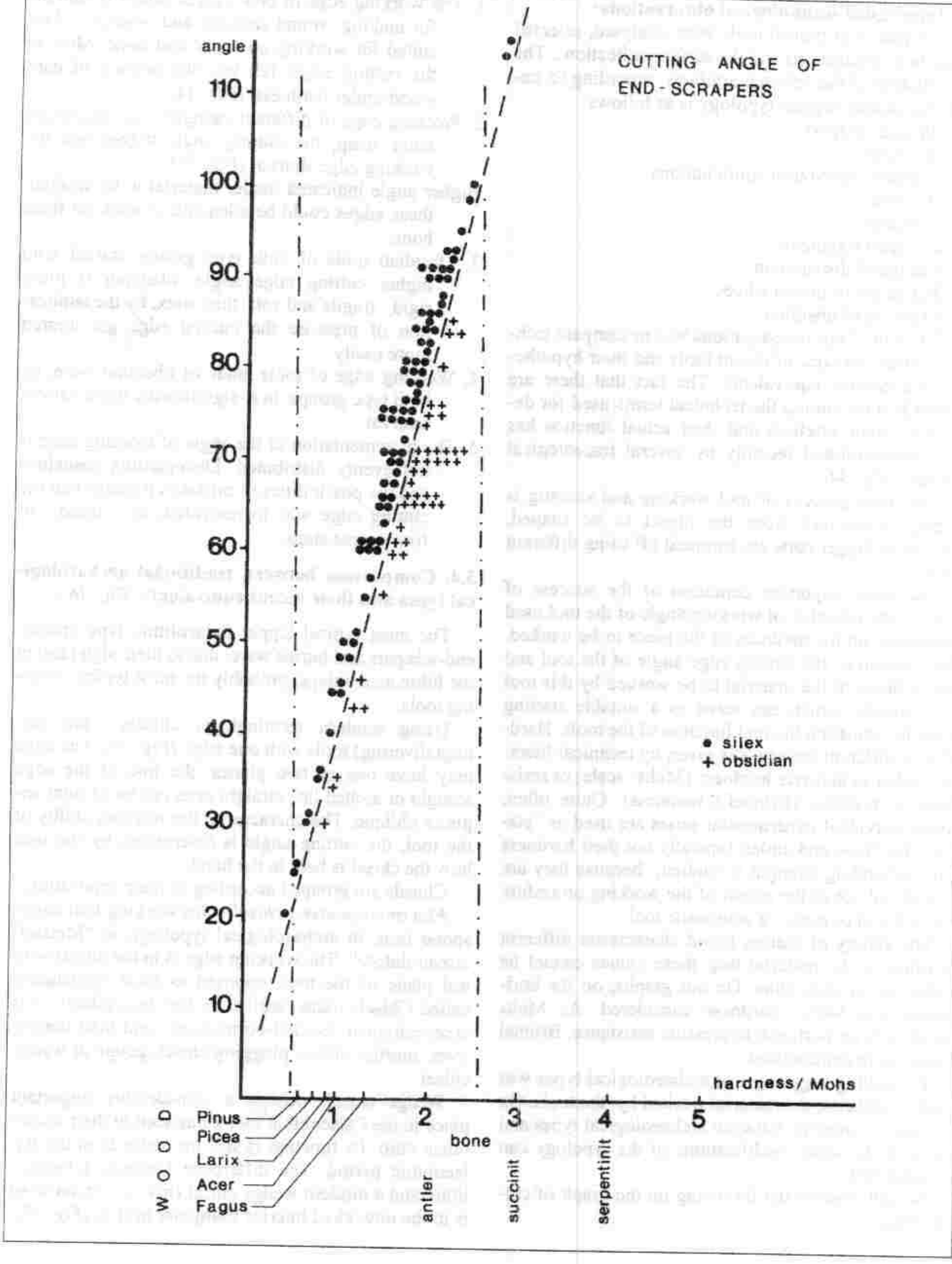


Fig. 34 Cutting angle of scrapers

Traditional (Archaeological) types		Experimental-functional types											
		chisel						plane					
		straight flat	with handle	gouge shell-gimlet	reed-plane	under-cut wedge	"V" shape	spokes-have	with setting angle	knife	howel	drill	saw
endscraper	*silex*		5	3	4		6	50	6	3	1		
	obsidian				2	2		26					
burin	*silex*	19		4		26	25	1	4			2	7
	obsidian	2				3	8	1					
endscraper - burin	*silex*						4	4					2
	obsidian												
blade	*silex*	1				4	6						
	obsidian					2		4					
other	*silex*					2	1	1	1		1		1
	obsidian							2					
rabot	*silex*					1	1	2	6				
	obsidian							1					
TOTAL: 256		**21**	**5**	**7**	**6**	**40**	**51**	**93**	**16**	**3**	**2**	**2**	**10**

Fig. 36 Archaeological types and hypothesed functions

as the metal working chisels also follow the Palaeolithic full form.

Among the end-scrapers, the double end-scraper Pb 83/582 was analysed in *(Fig. 37)*. Its raw material is Szeletian felsitic porphyry. The blade base form is of trapezoid cross-section, at the distal end containing a 75° cutting / slivering edge and a semicircular style-edge, at the proximal end, a 82° cutting / slivering edge and a straight / oblique style-edge was formed. This tool can be used in two ways:

– Taking in hand the margin of the blade, sliding along the smooth, flat ventral side. Working on wood or bone, forming or smoothing a plane, the straight working edge should be used as the convex working edge would be contacted with the surface to be shaped on a very small surface and the effectiveness of the work would be irrationally low. Using the traditional, even end-scraper edge, a concave trough could be deepened. The modern correspondents of this function are called mortise chisels with different arch radius.

– The other possible way of use is taking the tool at the dorsal-ventral plane and slide along the 75° and 82° degree scraping edge. Using it with force this way would hit the hand against the substance to be worked, and the pressing force should be extended over the full length of the blade to get it into the material to be worked. This is not imaginable for a tool of this size, therefore it is suggested that in this function it could be used only hafted as a scraper inlay. Thus, similar to most of the modern cutting / slivering tools, it was functioning as a composite tool. Modern tools are made, starting from the hardened working edge till the tang used for fixing the handle are made of one material, while the handle is made of a softer, more elastic material to resist more forces encountered during the working process.

As this end-scraper on blade in the latter function, most of Upper Palaeolithic - and, generally speaking, Palaeolithic stone tools could not be simple tools (made of homogeneous material alone), judging from size alone. Apart from the shaping of the working edge, a firm grasp and optimal transfer of working force had to be ensured, occasionally by comforting retouch. The tools which were used, deduced from small working edge angle, against very hard materials could only function as stone inlays in composite tools.

Fixing the stone inlays into wood, bone or antler socket, apart from sticking probably the stretching stress encountered as a counteraction to slivering was also utilised.

The analysis of *rabots (planes)* proved that the tools classified to this group according to traditional terminology were probably used in such function.

They are tools held directly in the hand suitable for working on a simple (level) surface. Its variations are the following:

– arched edge, narrow plane, the cutting angle is 45° (resulting in concave ribs on the worked material)

– smoothing plane with cutting angle 45–48°

In general, we can consider the tools with one level surface, 45–50° working edge, fit immediately in the hand (without handle) as planes. The cutting angle of the metal inlay at modern planes used by carpenters is about 25–30°.

We are still at the beginning of a comparative study of recent and Palaeolithic stone tool functions and technology. On the basis of our modest results we cannot make any finite statements in problems like the atypical borers or, generally, the "non-standardised" tools. For example, the notched or pointed flakes which were not retouched could function as ",ad hoc' tools, using the natural cleavage qualities of the raw material sparingly. Another possibility that these flakes were intentionally left in a rough-out, half-ready stage.

The absence of *saw* blades in the Upper Palaeolithic industries of the interstadials with rich arboreal vegetation can only be explained by not expecting the typical Western European saw blades to occur here. Flakes with zig-zag edge could be used as stone inlays for sawing. Unlike the teeth of a typical saw blade placed in one row, these flakes with zig-zag line, resembling however in their cutting angles to modern saw-blades were used in a different way. It was not the saw moved to and fro' in the wood but the wood itself was moved on the edge of the fixed saw. Cutting angle data of modern saw-blades are 60° for pine-wood and deciduous soft trees and for hard wood, 75°. On the flakes considered suitable for sawing on the basis of the array of "teeth", the cutting angles were somewhat bigger: 70–80°.

Wedges are already tools for shaping without cutting / slivering, i.e., splitting. They are important tools for working wood, especially without the saw. Their effectiveness increases by the increase of the wedge angle; at the same time, the difficulty of the work, the force necessary for driving in the wedge is also growing.

Typically, wedges were used as inlays fixed in a socket. The ideal wedge angle for metal is 20–30°, in case of stone wedges it is necessarily higher. Hafting is perforce necessary for the safety of the worker. According to the injuries found on the butt end of the stone wedges, however, this surface was not covered by hafting to get maximal force of the blow.

Compared to the average tool kit of Gravettian/Pavlovian settlements, the ratio of so-called "heavy" tools is unusually high in the Bodrogkeresztúr material. These are really bulky, robust tools. A reason for this could be, in the first place, needs of the people: due to the rich arboreal vegetation in the interpleniglacial period, the ratio of heavy wood-shaping tools was probably high.

The ecological conditions of the Pavlovian entity were rather favourable (interstadial periods) all over Central Europe. In the Bodrog–Tisza–Takta region, rich in waters, the natural endowments were even more favourable. The forestal environment, rich in arboreal species and the high number of tools suitable for timber working indicates a varied scale of wooden tools. Needs were also supported by the proximity of abundant raw material sources.

3.5. Raw material

The 1963 excavations by László Vértes yielded about one third of the total material collected from the site which is deposited in the public collections today. Vértes evaluated the raw material distribution in the followings:

"RAW MATERIAL:

Nineteen per cent of the implements are made of obsidian.

Thirty-seven per cent of the implements are made of so-called ""stone marrow"", a white homogeneous amorph silica-gel. This material frequently is found in planparallel tablets 2–3 cm thick. The multi-angular burins and triangular amulets are made of such material.

The raw material of the remaining 44% of the implements are mainly of local limnoquarzite while a few of them are of sandstone (retoucheurs, hammerstones) and only a few are made from radiolarite or jasper, i. e. from raw materials which they probably found in the form of pebbles at the not too distant northern river valley. Two flakes or rather blades made of a speckled hornstone characteristic of the Polish Swieciechow originate from farther away. This raw material is found at other Hungarian sites, too, and we can count on the fact that it travelled greater distances during the Upper Palaeolithic already as commercial goods."

(VÉRTES 1966, 11.)

The finds collected from two excavation and surface surveys are uniform in respect of raw material utilisation, the variation in the ratios do not exceed normal fluctuation due to different quantities collected.

In 1982, Ernő Mátyás, geologist of the Mád Ore- and Mineral Mining Co. investigated some raw material samples from the Bodrogkeresztúr site (control samples inventoried at Pb 83/924–935. in the HNM According to his results, most of the tool kit of the Upper Palaeolithic site originated from the immediate neighbourhood, the Rátka-Mád-Tállya limnic basin of Sarmatian (Upper Miocene) age. The geomorphological scheme of the formation of Sarmatian limnic quartzite in the Rátka-Mád-Tállya triangle was also reconstructed by Ernő Mátyás. *(Fig. 38)* The silicification process can be connected to several phases of postvolcanic activity: silicified rhyolite tuff, pyrogenic silt, geisirite and limnic quartzite *(Fig. 39)*. (MÁTYÁS 1966.). Siliceous bodies were easily prepared by local surface forming forces, mainly erosion rial; whereas the source is located in the middle of a triangle of 20–30 km long sides.

In the late seventies, K. Biró surveyed the obsidian industry of Hungarian Upper Palaeolithic sites. In course of this work she also studied the material excavated at Henye hill (Vértes's excavation) as well as material from field surveys around the site.

On the basis of the finds collected by Vértes, Biró recorded the followings:

"The first obsidian workshop sites appear in the immediate surroundings of the Tokaj-Eperjes sources... at Bodrogkeresztúr, exploiting the Hungarian (Carpathian II) sources. Here, though the complete tools were generally made of both of the known obsidian genera, cores were made, almost exclusively, from local non-transparent Carpathian II. obsidian". (BIRÓ 1984, 17.)

K. Simán drew conclusions on the function of settlement on the basis of the distance of the raw material used on the site from their sources and the character of the hunted booty (SIMÁN 1988, 65.)

	Bodrogkeresztúr	
	pieces	%
Szeletian felsitic porphyry	9	0,8
Hydroquartzite	329	28,1
Silex	74	6,3
Radiolarite	54	4,6
Obsidian	276	23,6
Opal and jasper	13	1,1
Stone marrow	415	35,5
Total	1170	100

The relative balance of local and distant raw materials, together with the fauna fit well to local environment denote, according to Simán, a generalized settlement character for Bodrogkeresztúr (i.e., not exploitation site or workshop, SIMÁN 1988, 65.)

The contradiction between the two statements (i.e., if the Bodrogkeresztúr site was a workshop or a settlement) is only ostensible. It is clear that Bodrogkeresztúr was not a quarry site, and the location of the settlement, the accompanying fauna indicates a general settlement with no specific function. By grouping facts and phenomena in a novel way, Simán found further proofs for this. The elaboration of local obsidian as Biró supposes (BIRÓ 1984, 17) – is, at the same time, just natural. The existence and extent of local obsidian working cannot serve as a proof for obsidian workshops in industrial scale for trade and transport, i.e., proofs of a classical workshop site.

Examining part of the raw material spectrum, e.g., the distribution or utilisation ratio of Northern Flint varieties, the extent of different origin raw material is given below, after Simán:

"Raw material distribution in percentage:

Bodrog-keresztúr	Local	Mescolocal	Long-distance
cores	91,70	2,59	2,7
blades	78,33	3,98	14,12
flakes/waste	77,36	1,12	8,18
tools	62,88	4,25	15,78

In Bodrogkeresztúr *"...most probably the population came relatively quickly through the Slovakian territories to settle on the southern slopes of the mountains: the mesolocal raw material had a smaller role, while there is still a large tools."* (SIMÁN 1989, 93.)...

In Europe the earliest Gravettien dates are around 28000 years both at Willendorf and Bodrogkeresztúr. In Bodrogkeresztúr, *"...this Gravettian population uses much foreign raw material from the north and north-east. Consequently, this type of industry must have existed even earlier in more northern territories. At Willendorf, at the same time, the industry seems to be result of an inner development".*

(SIMÁN 1990, 18.)

Simán's hypothesis on the origin of the industry do not exclude that the fast migration across Slovakia could be of N-E direction as the sources of almost all of the mesolocal raw materials are located not only to the North, but to the West of the site.

Simán's grouping of the sources corroborates the seemingly obvious fact that distant raw materials were in higher esteem than locals: all partial results of the technological chain, made of far-fetched raw materials were utilised maximally. The observation that cores – primary forms – were made, in very high ratio, from local material corroborates the same phenomenon described by Vértes in case of Arka, i.e., part of the tools made of long-distance raw materials had been brought to the settlement in ready-made form. The ratio of mesolocal raw materials is strikingly low. This can be probably explained that we do not know all the raw material sources of the Bodrogkeresztúr hunters; in this case, this category is merged into "locals" Another possible reason can be that mesolocal geological sources were only collected accidentally, in an ad-hoc manner. The reason can be both – or a lot of another – factors together.

Analysing the raw material use of the complete archaeological material in details we find that the ratios are modified only to some extent.

Types	pieces total	Erratic silex	other	radio-larite	exotic	hydro-quartzite	stone marrow	obsidian	Szeletian f.p.	Quartzi-te
retouched flake		60	7	7			17	15	14	
fabrication debris	1928	51	105	6	13	621	654	459	3	16
Type (total)	812	117	117	25	10	223	151	162	7	
Others (total)	2777	107	162	29	28	873	898	643	5	32
Total – all artefacts	3589	224	279	54	38	1096	1049	805	12	32
%		6,2	7,8	1,5	1,1	30,5	29,3	22,4	0,3	0,9

Apart from local materials, raw material varieties obtained from considerable distance have special significance in "cross-cultural connections". For indicating the distance of acquisition, the symbols used in the Lithotheca are used:

"*L = local; distribution of the rock not exceeding a day's walking distance*

R = regional: raw material of regional distribution. Flexible category changing by age and culture. Roughly, this term denotes raw materials used by the people/cultural unit inhabiting the environs of the source. The category can be delineated very tediously as yet but has a very important historical message.

LD = long distance goods: travelling over hundreds of miles from the source area, a "cross-cultural" item."

(BIRÓ-DOBOSI 1991, 8.)

The term "regional" used in the Lithotheca approached the problem of the individual raw materials not from the side of acquisition but that of supply. A certain raw material can be of regional importance if its distribution is in the order of the territory of a given archaeological culture or community using this raw material. It is evident, that this category corresponds, by and large, to Simán's "mesolocal" group. Anyway, this category is certainly between the two clear extremes, local and long-distance and separated within the archaeological material on the basis of "feeling" or "anticipation" rather than certainty. In distance, this category denotes the same as "medium-distance".

Local raw materials

The study of the primary geological sources of obsidian and raw materials of hydrothermal origin is adequately studied, mainly due to modern industrial utilisation of some hydrothermal raw materials.

Along the south- margin of the Tokaj-Eperjes range, the postvolcanic activity centres formed the Mád Basin sediments, closely connected with the Upper Sarmatian active volcanic processes. Variable hydrothermal silices formed in different physical, chemical, biological conditions here constitute about 60% of the Bodrogkeresztúr lithic industry: hydroquartzite, limnic quartzite, "stone marrow".

The veins of the Mád limnic basin are located within a circle of 10 km from the site, to the North-West, North and North-East (p.c. by Ernő Mátyás)

Obsidian can be considered also local: counting them together, the ratio of local materials exceed 82%. Lumps of obsidian, from size of a nut to that of an apple can be collected even today on the hills around Mád. Carpathian 2 type obsidian, known throughout the Upper Palaeolithic within the Carpathian Basin must have been distributed only from this region.

Local raw material occurring in tabular, laminar or nodular on the surface could be collected without special expertise and tools in unlimited quantity; these sources were the basis of more than form 80% of the total lithic industry. This fact in itself could offer a stable basis for the settlers and, at the same time, can explain the lavishing use of the raw material as well. Further local raw materials which could be collected practically from anywhere in the neighbourhood include basalt or silicified breccia/conglomerates, silicified volcanic ash (Pb 83/695, 732, 478 etc.) as well as the quartz- and quartzite

Rock crystal should be specifically mentioned occurring from time to time in variable quantities on Hungarian sites during the full length of the Gravettian entity. Rock crystal and hyalite can be collected, in about a day's walking distance from the site, in the central regions of the Tokaj-Eperjes Mts. The "rock crystal" flake collected at Bodrogkeresztúr, however, could not be made of local material: hyalite occurring in the region of Sima and Baskó differs in quality while rock crystal occurring around Telkibánya differs in size range and were not used for the production of stone tools.

The fluid inclusion study of Hungarian Upper Palaeolithic rock crystal artefacts by I. Gatter excluded the use of local-regional pure quartz for stone tools. Most probably, rock crystal from "Alpine" paragenesis were used from epi- or mesometamorphic environ-

589, 616. "Prut silex" in archaeological practice is often mixed with "Volhynian flint" as well.

This exceptionally good Cretaceous flint variety crops out some 300 km o the North of the upper reach of the river Prut at the border of the famous Ukrain "polesie" region, as a geographical (Eastern) continuation of the Polish Lublin table. The experts of this region separate 6 categories within the raw materials used in the Upper Palaeolithic and Mesolithic of present-day Ukraine (p.c. by L. L. Zalizniak, Kiev, Arch. Institute). Of these, we can consider the North-West Ukrainian raw material region with fine, compact, dark grey – slightly yellowish chert having a smooth light colour cortex. Analytical data on the raw materials are missing as yet.

The other type of raw material possibly encountered at Bodrogkeresztúr is also dark grey, easily patinated with bluish white patina reminds us most to "doniecki kremen". It should be emphatically stressed that the observed macroscopical similarity of raw materials do not allow us to suppose any direct contacts.

There are "intermediate" items considering the difficulties of raw material procurement between local and long distance raw materials, which could be obtained from the Carpathians or the Northern Mid-Mountain range (Bükk). We can call them medium-distance raw materials, which term fits well to this north-westernly exposed semicircular zone with a radius of cca.100 km.

The primary geological sources of different Carpathian radiolarites and the Vihorlát menilite (e.g. L 86/185, L 83/696, L 85/7) can also be reached within this distance; they can be also collected on the molass are from river sediments in form of pebbles as supposed by Vértes for the jasper and radiolarite tools from Arka (VÉRTES 1964–65.)

Some "appropriation" concerning the raw material sources is expressed in the presence of locally specific materials, as an exchange item. Such is the presence of Szeletian felsitic porphyry from the Tatár-trough of the Eastern part of the Bükk Mts. (12 pieces). The distance from the source is 60 km, as the crow flies.

The contacts of Bodrogkeresztúr-Henye indicated by the raw materials point at longer or shorter distances but always to North, North-East, North-West. As regards the topography of the site, this is not substantive information as the site is situated at the Northern margin of the Alföld (Great Hungarian Plains), thus it is bordered by vast areas void of raw materials but rich in living waters, which should be crossed before reaching areas with suitable raw materials.

Long distance raw material acquisition is not very likely though the macroscopical features of the Henye hill radiolarites resemble to some extent to radiolarites of the Gerecse or Mecsek Mts. (p.c. by K. T. Biró.)

More close Western connections are best shown by the presence of Szeletian felsitic porphyry from a distance of 60 km, crossing two major rivers, Hernád and Sajó. The raw material from the Tatár-trough in itself is an "enigma". The geological outcrop is limited to a very small area (today we know about the Tatár-trough only). The raw material is of uneven structure, platy, seems to us not the best: still it was used in the Northern stripe of the country, from the Danube bend till Bodrogkeresztúr from the Early Gravettian till the Epigravettian industries. (Its occurrence in the older industries of the Bükk Mts. is reasonable)

3.6. Settlement features

The value of our conclusions on the material of Bodrogkeresztúr-Henye is unfortunately lessened by the unfortunate fact that most of the finds were found on the surface, in near-surface position and / or disturbed layers.

Among the reasons we find antropogeneous interference (constant cultivation, deep-ploughing several times) as well as natural causes.

The intensive surface forming effects of the climatical conditions before and after the Interpleniglacial period can be demonstrated also in the sections cut in the flanks of Henye hill. On the less disturbed / eroded sides, below and over the signal-like cultural layer (some bone morsels, flakes, or charcoal grains) a more significant bunch of loess was sedimented and remained to these days than on the hilltop. Collecting the sequence of the most distant sections, opened at a distance of 230 m in NW – SE direction, 90 m in N-S direction we can conclude that in the two phases of the Pleniglacial the ruling direction of the wind was different. Before the existence of the settlement here (under the cultural layer), loess was accumulated in larger quantities on the south-eastern side, while the covering loess is more thick on the northern side.

Realignment of the surface can also be caused or influenced by the physical and chemical features of the base rock. The basement here is of volcanic origin with great hydration capacity which is reacting faster to climatic changes. Denudation and planation effected most the eastern, southern and western foothill regions; however, most of the area was moved before the young Würm loess covered the hillsides.

"... the orography formed up to the end of the Tertiary was subjected, during the cold period of the Pleistocene to a substantial upheaval. Periglacial processes have not only transformed these surfaces, but they produced also a new kind of orography."

(PINCZÉS 1977, 30.)

– no traces of the sediment typical of the main cultural layer was found, characteristic of all sections (with embryonal soil)

– quantity and quality of the archaeological finds found here did not allow traditional archaeological comparison for detecting possible differences within the industry

A most plausible explanation of this phenomenon can be that a deep cleft, (the side of which prevented erosion) could be used here for some fire-related activity (conservation? drying?) The thickness of the intact loess covering the cultural layer here represent the total time span of the formation of sediments.

To the **North** of the geodetic point we find unit I of 1982., the main excavation area.

The stratigraphy is thin and poor, the original surface strongly eroded and disturbed most by modern cultivation also on these parts. On the western parts of the sections, cultural layer appeared at the depth of 30–35 cm and below this, the base rock appeared at 70 cm. On the eastern part of the sections, base rock appeared in the depth of 40–80 cm below the uneven surface.

To the **North-West** of the geodetic point, a little further on, the modern surface is flattened a little, forming a small plateau immediately before the steep slope of the hill-side. We had good hopes to find undisturbed layers at this point.

In the four exploring trenches of unit II. in 1982. A weak cultural layer was found here in the depth of 60–70 cm. Immediately below the cultural layer, 80 cm below the surface the base rock was appearing.

Characteristic features for the margin of the settlement appeared in the ditch facing the core of the settlement. The centre of this settlement patch was not found but obviously it is not the central (in position, not in importance) settlement part reaching that far. The area between our sections here and the geodetic point, at a distance of cca. 100 m was almost completely void of finds. Probably, this area was one of the habitation surfaces among several within the settlement.

To the **West** of the geodetic point, unit III of 1982. connected the main sections by Vértes in 1963. In the excavation diary,. László Vértes marked the possible extension of the settlement surface towards these parts. These sections were planted here to clear the possibility of a western continuation of settlement traces in Vértes's sections.

The depth of the cultural layer here was uneven. Between the two terminal trenches, in a N-S distance of 20 m the level of the cultural layer was elevated by 40 cm compared to the present surface: the depth of the cultural layer was 90–100 cm in trench 2. while in trench 4., only 40.

Vértes observed in 1963 that the original surface must have been more steep towards the west than today. Observations made in 1982. Prove that it was also stepper towards the south.

Completing these observations with experiences on the NE side we can suppose a constant erosion, reworking of the sediments for the whole hill-top. Levelling the uneven original surface was started much before human interference and resulted in considerable differences in the thickness of the sediment. There was, however, no possibility during the excavations to trace the position of the cultural layer by archaeological methods all over the hilltop.

The main sections of the 1963. Excavation were located to the South of point C. The profile of the initial exploring trench by Vértes tempted us with undisturbed settlement surface here. Sections E-J-G were consequently planted at this place. Some exploring trenches of the 1982. Excavation were also connected to the southern end of the first exploring trench.

On the basis of the first exploring trench László Vértes remarked in the excavation diary:

"*... the level of the cultural layer is getting deeper more fast, discordantly compared to the present surface; in squares 2–3 of section "E", some flakes were even found at the depth of 1 m*" (LÁSZLÓ VÉRTES: Excavation diary, HNM Archives)

At the southern end of trench "A", andesite appeared at the depth of 2.5.

Two small sections were opened by Vértes to the **South-East** of the geodetic point. Their relative position was only tentatively fixed: "C" section was marked on Vértes's comprehensive site plan but its place was not found in 1982. Section "D" was opened at a distance of 113 m from the geodetic point and 6 m lower in absolute height, the position of which was not fixed and could not be found and mapped in 1982. According to the excavation diary, 70 cm deep in this section a piece of charcoal and one blade was found here in clear, slightly stained loess (embryonal soil?). István Vörös identified the fauna labelled "stray finds" hypothetically with animal bones coming from here. He is supposing a fourth settlement patch on the basis of the poor but authentic find material on the south-eastern side of the hill. Archaeological arguments support only the extension of the settlement till this point.

The stratigraphy of the Henye hill on the side facing the Kopasz Mt. was similar to the other profiles.

Considering together the observations made on the two excavations we can conclude the followings:

– The present surface is considerably transformed. The position of the undisturbed cultural layer indicate that the original hill-side used to be much steeper in all directions (stratigraphical relations can be only similar to those encountered on the hill-top at the south-eastern side).

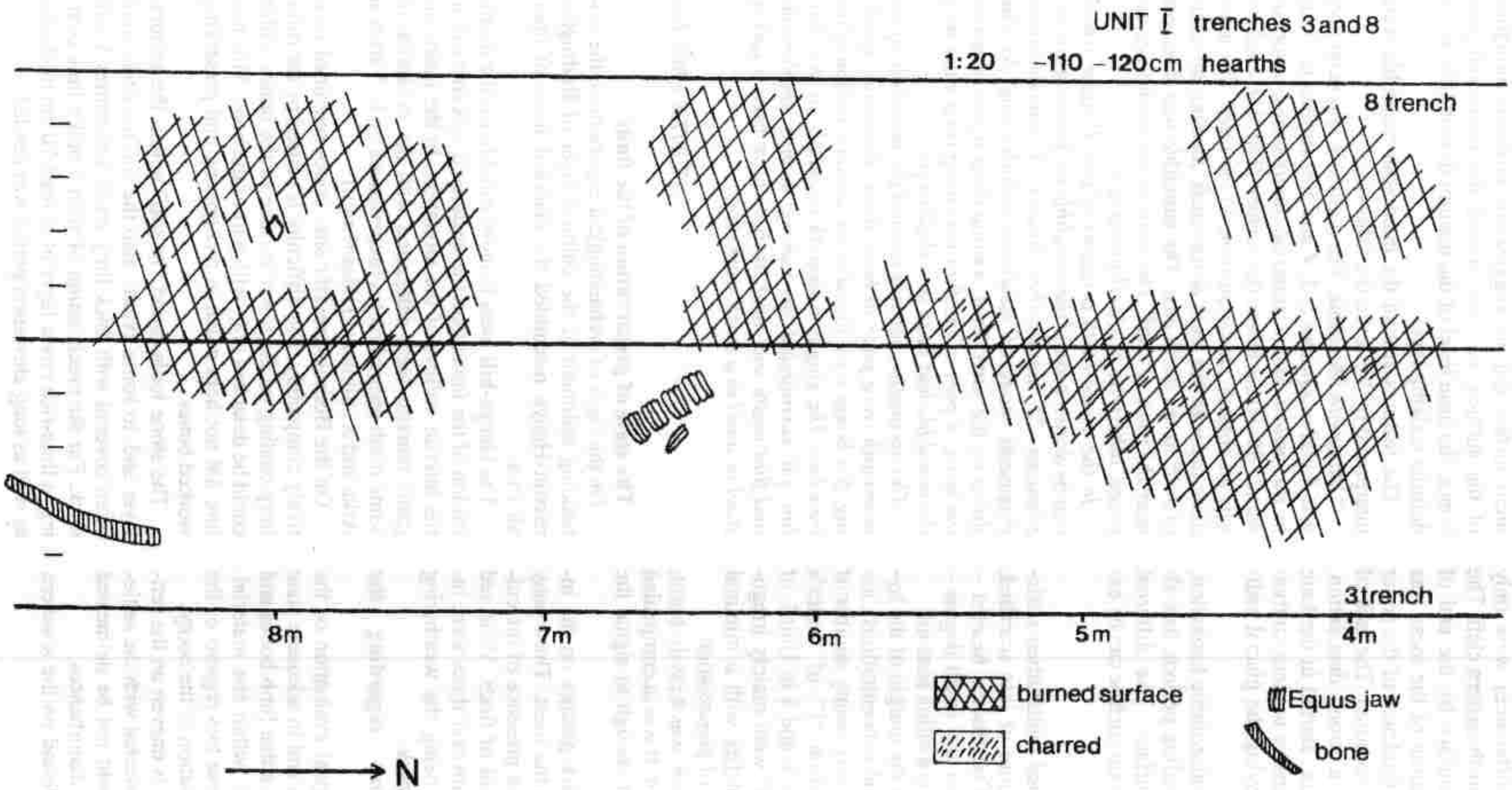


Fig. 40 Hearts and burnt surfaces in the trenches 3. and 8.

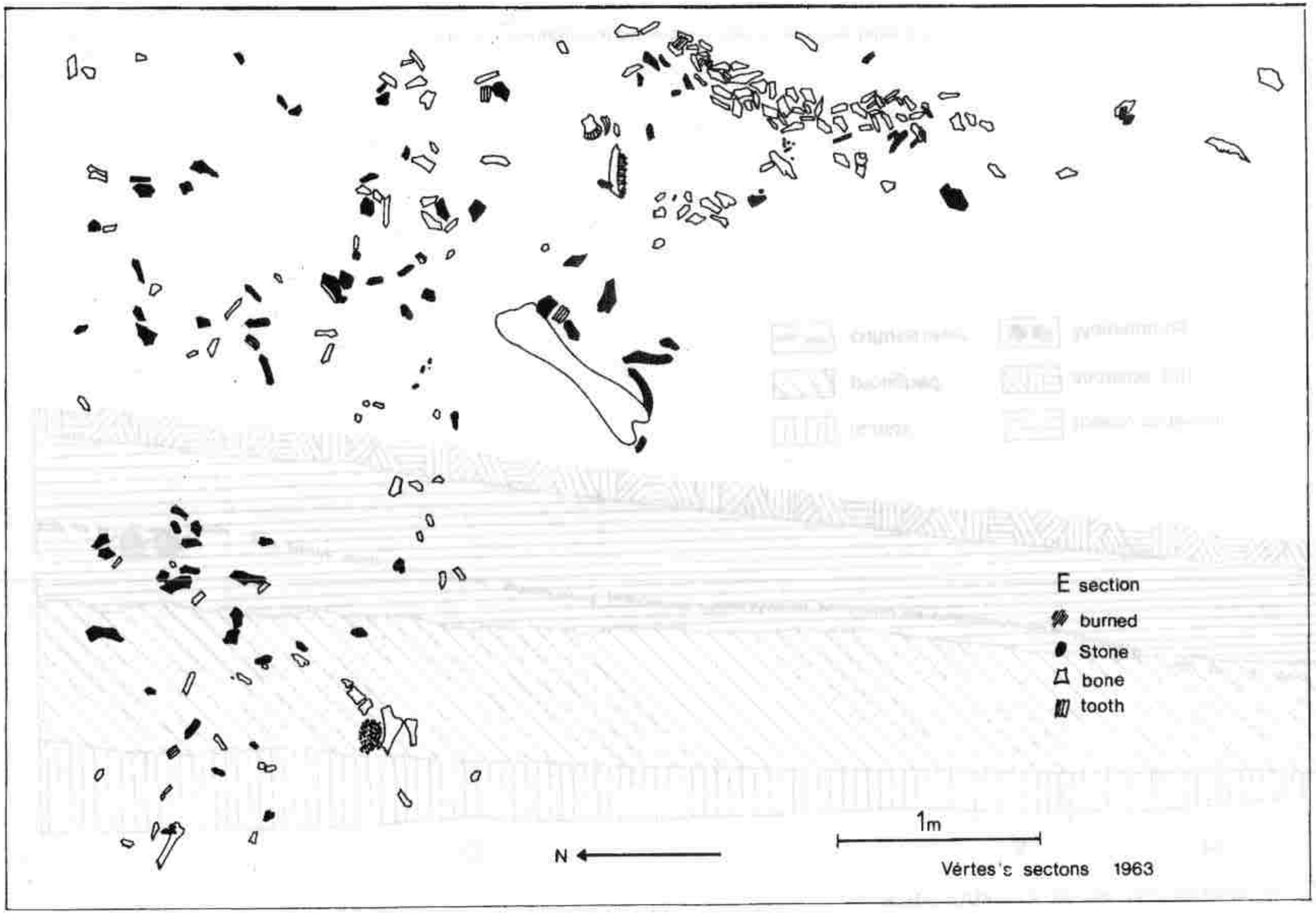


Fig. 42 "E" section, Vértes 1963

Bodrogkeresztúr–Henye 1982 UNIT I. B–C–D sections

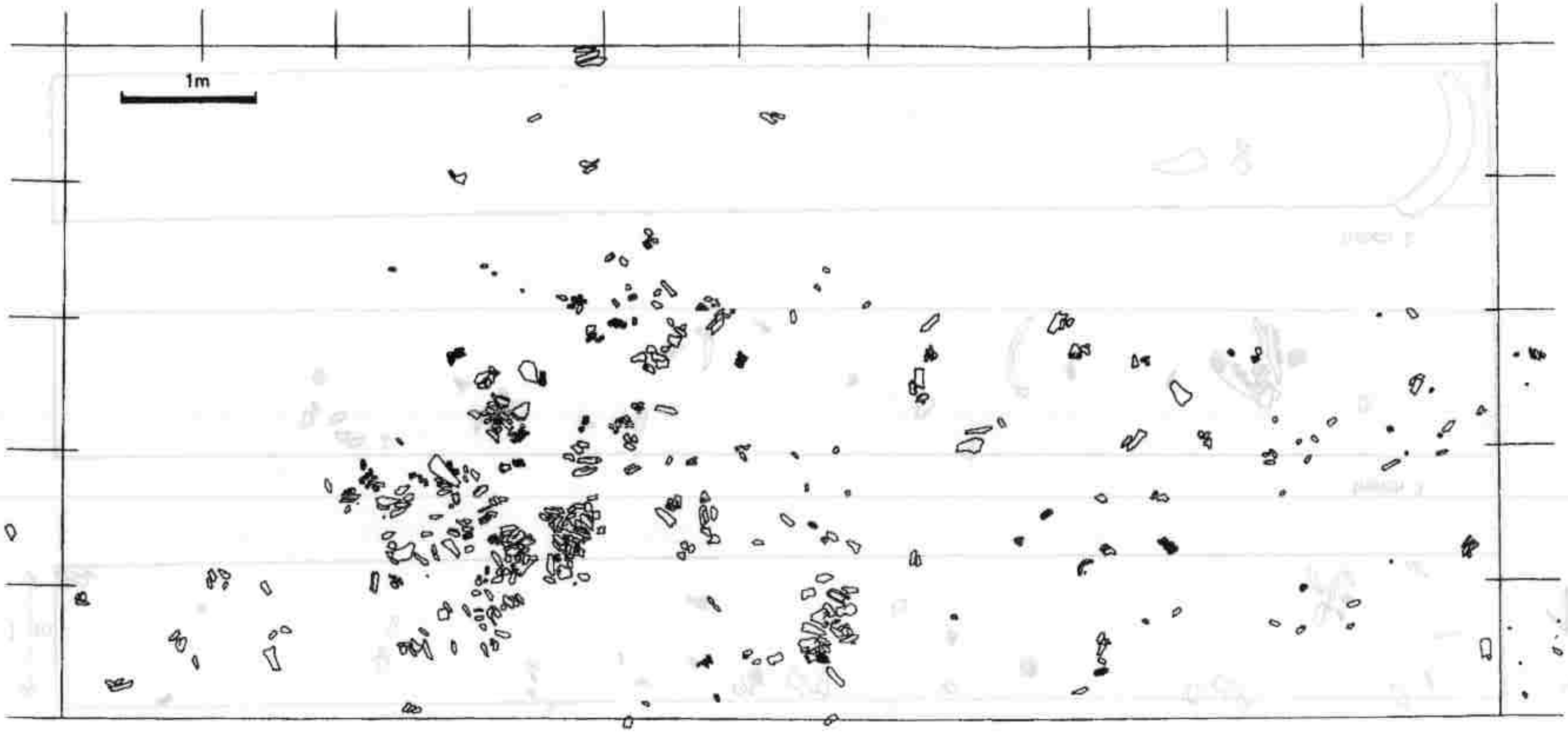


Fig. 44 Unit I, B–C–D sections, Dobosi 1982

On the surface of obsidian tools, hydration crust could be observed. As the thickness of this crust depend on, apart from the time elapsed since its shaping, the conditions of embedding to a large extent therefore the thickness of the hydration layer in itself cannot give information on the time of preparation of the tool. (BIRÓ–POZSGAI 1982. 132)

On the raw materials which were ready to patinate, a thick layer of patina appeared on the whole surface of the tools. The surface of Northern / Erratic flint varieties, which were typically fine grained, homogeneous, good quality raw materials were typically covered with bluish-white patina. The original colour of the raw material could be observed on fresh fractures only.

Settlement units *(Fig 5.)*

Scattered, marginal settlement features with "in situ" finds covered the whole surface of the hill in a circle of 250–300 m.

The density of finds can be considered average within Hungarian Palaeolithic settlements. After the quantity of surface finds, more tools were expected. The relative scarcity compared to expectations can also be explained that the "in situ" surface was found in the sections deepened at the starting point of the slope at the Northern, North-Western part of the hill, and probably these parts were already marginal. The scarcity of tools on the "in situ" surfaces corroborate the hypothesis that the central parts of the settlement was destroyed over a large area which resulted in the appearance of a great number of tools on the surface. The centre of the campsite was probably settled immediately over the bedrock around the point "0" of the 1982. excavations. Due to erosion, the cultural layer and its cover used to be very thin here which was disturbed by ploughing, leaving a lot of flakes and tools on the surface. At the point where the hilltop turned into slope the Pleistocene layers were getting more thick, the original habitation surface was preserved – partly, immediately over the bedrock, partly – at lower parts - over more or less thick layer of loess. These parts were, however, only the peripheral parts of the former settlement.

On the basis of the 1963. excavations Vértes supposed that the central part of the settlement used to be to the East of trench "A", on a small plateau of the Henye hill (on the basis of the large number of finds found in the disturbed layers of section "H"). Judging from the experiences of both excavations, this could be only one of the settlement units. Probably, it used to comprise several contemporary settlement units.

On the basis of the surface concentration of finds and the intact settlement surface details, four settlement units were reconstructed with great probability. The limits of the settlement patches are not sharp, the finds decrease gradually.

The four supposed settlement patches were the following:

1. The southern part of Vértes's (1963) trench "A", together with sections E-J-G of the 1963. excavations, in section " J", the small hearth and in section "E", the mammoth mandible and the surrounding workshop assemblage *(Fig. 42)*. The trenches opened after Vértes's intuitions to the west of this area, the surface of the sections of unit III in 1982 *(Fig. 43)* belong to this settlement unit. It is remarkable that to the south of the geodetic point surface collected tools abounded in stone marrow items.

2. Some 40–50 m from these parts and exactly to the North of the geodetic point, 8 exploring trenches were opened in one stripe during the 1982 excavations. These sections were opened to unfold the cultural layer appearing in exploring trenches 2. and 5., of these, settlement Unit I. of 1982. was separated in sections "B-C-D- E " *(Fig. 44)*.

3. Settlement Unit II. of the 1982. excavations was found 80–100 m to the North-West of point 0. It was less intensive than the former one but contained a continuous surface which was possible to open completely in trench 4. and further finds in adjacent trenches marking the level of the settlement *(Fig. 45)*.

The depth of settlement units / cultural layers 1, 2, 3 was about the same from the present surface, i.e., the plateau-like top of the Henye hill used to be, probably, a plateau in the time of the habitation as well and the factors forming the surface had even effect on the sediments.

4. Far from the central sections (around the geodetic spot height), in a distance of 100–113 m on the South-Eastern slope of the Henye hill, pieces of charcoal, blades and several animal bones were found in the usual depth (70 cm). Their archaeological evaluation is not possible because of low quantity of finds. I. Vörös placed Unit IV here because of the significant fauna and the obviously authentic settlement features.

On the basis of the distance of the settlement units from each other, partly measured partly calculated and their arrangement, the extension of the Bodrogkeresztúr-Henye Upper Palaeolithic settlement reached or slightly exceeded 200 m diameter and incorporated the plateau-like hill top and a part of the South Eastern slope.

Three hearth opened at unusually deep position at the supposed north-eastern margin of the settlement have to be mentioned specially. They were found in section "F" in the 1963 excavation by Vértes 1963 and in two marginal conjoining trenches (3. and 8.) at Unit I. of 1982. (see ground plan). They contained no archaeological faunistical finds. Probably, these hearths did not belong to the main cultural layer of the: the great difference in depth between the cultural layer of Unit I and the level of the hearths cannot be explained

4. Analogies *(Fig.46)*

4.1. Contemporary sites in Hungary

The (approximately) contemporary sites to Bodrogkeresztúr were the following: Megyaszó, Hidasnémeti, Sajószentpéter-Margitkapu, Püspökhatvan, Hont/Parassa III, Nadap. Among these, only the material of Megyaszó and Hidasnémeti can be compared statistically, due to several reasons:

– low number of finds: e.g. Nadap (less than 100 typical tools)

– asymmetrical tool kit due to special settlement function, e.g. Püspökhatvan

– material not published yet, e.g.: Sajószentpéter-Margitkapu or Hont

Megyaszó-Szelestető (DOBOSI–SIMÁN 1996)

The Szerencs hills are connected to the south-western margin of the Tokaj-Eperjes (Zemplén) Mts. as a fore-hill range with maximal altitude 340 a.s.l. On the southern part of the range, in the second row of hills facing the Alföld (Great Hungarian Plain) we can find Szelestető, a plateau of 230 m a.s.l. In course of several excavations details of a two-layered settlement were opened on 180 square m surface. The locality lies in the meeting point of several ecological niches with most favourable natural endowments, in the immediate vicinity of the north-eastern raw material sources. The settlement surface is of scattered character. It was just the totally undisturbed lower cultural layer of Megyaszó which convinced us that this is a typical feature of the interpleniglacial settlements or at least part of them. We cannot expect intensive find concentrations like those found on the Epigravettian or Ságvárian sites. It is therefore probable that the "scattered character" of the Bodrogkeresztúr industry was not caused only by soil cultivation and modern disturbances. At Megyaszó, the size and quality of the assemblage, the complexity of the type list and the variety of raw material basis indicated a more lasting occupation. The site was a bona fide settlement, (i.e., not a hunting camp and / or workshop). The two cultural layers were found separated from each other by 60 cm sterile loess. The cultural layers is located in sediments slightly turned to soil. The find material collected from the cultural layers and the surface, respectively, show a mature, uniform image. The two cultural layers used to belong to the same cultural phylum, both being representatives of the Older Blade /Pavlovian facies. Finely worked end-scrapers, versatile set of burins, the absence of geometrical microliths and "Aurignacoid" features in the shaping of the tools were typical (many high-crested blades and flakes in the base form, consequently the finish is often steep, step-like with relatively high number of blade points and side-scrapers; these features were typical of the Hungarian Pavlovian industry.)

Fauna: *Coelodonta, Equus, Bison.*

C-14 date: **deb. 5372: BP 27 070 ± 680**

Püspökhatvan–Diós, Öregszőlő (CSONGRÁDI–BALOGH–DOBOSI 1995)

Workshop at the western margin of the southern parts of Cserhát Mts. facing the river Galga site planted on the hydroquartzite benches occurring along the margin of the hill-side. Authenticated by field surveys and excavations. The type list is asymmetrical and deficient. It is evident that the site was a workshop planted on the exploitation and shaping of the rich local hydroquartzite benches. Palaeontological finds: (*Mammuthus* and *Cervus*)

Radiocarbon chronological date:

deb 1901: BP 27 700 ± 300

It is one of the closest contemporary site to Bodrogkeresztúr.

Hont-Parassa III/Orgonás (DOBOSI–SIMÁN in press)

Four decades after the work of M. Gábori, sites around Hont were located on several field surveys. On the area of cca. 12–13 square km, more than 15 collecting spots were found. Among the authenticated finds, we know so far only the site Orgonás which could be classified with certainty to the Pavlovian culture, thus can be considered here as related to Bodrogkeresztúr.

The topographical position of the site can be considered most traditional. The flood-plain of the river Ipoly is separated from the loess terraces formed on the north-eastern slopes of the Börzsöny Mts. by the present highway. The stratigraphy was observed till 140 cm depth: humus – leached B soil level – typical loess – carbonatic loess – brown / interstadial soil - weathered pyroxene andesite.

Traces of Palaeolithic settlement level was observed in three horizons:

at 60–70 cm, under the loess

at 80–90 cm, within the carbonatic loess

at 130–140 cm, within the brown soil

The preliminary study of the artefacts indicated that the three settlement levels used to belong to the same Upper Palaeolithic culture appearing on the site in three different periods separated by a considerable time from each other.

The age of the lower cultural layer was dated by radiocarbon measurements:

deb-5027 BP 27 350 ± 610

Sajószentpéter-Margitkapudűlő
(RINGER 1994, 76–78.)

A 6 meter high profile opened in a quarry pit in the interior parts of the village, the opening of a small active side-valley of the river Sajó was studied here by Á. Ringer. On the terrace-like shoulder of the valley at 155 m. a.s.l. a series of palaeo-soils was observed, dissected by thin loess-like sediments. Layer 2 counted from upwards (at a depth of –80–120 cm) was described as a cernozem-like dark grey fossil soil which could be correlated with the Stilfried B soil horizon. Within this soil, an Aurignaco-Gravettian industry utilising mainly local wooden opalite raw materials was found. Most characteristic types were high crested end-scrapers, blunted blades and Gravette-points. The site is unpublished.

Pilismarót (DOBOSI 1996)

Loess terraces of both side of the Danube-bend have been investigated for more than sixty years. There are several, unique stray finds known from different localities that can be classified on typological basis to the Older Blade industry of the Gravettian entity. Such items include pieces collected from the loess profile of the Basaharc Brickyards and field survey and sondage on the Basaharc plateau The great Pilismarót series (from Pálrét till the Öregek dűlő site) belong to the younger blade industry, the Epigravettian cultural facies.

The small patches of settlement excavated in a distance of 800–1000 m of each other along the terraces framing the alluvial plane of the Danube were typical representatives of small transitional hunters' campsites planted along the route of reindeer migration. The modest faunistical material of Pilismarót-Pálrét was classified, in accordance with this view as "kill and depot site" by I. VÖRÖS (see Chapter C., Environment and hunting strategies in this monograph).

Nadap (DOBOSI–JUNGBERTH–RINGER–VÖRÖS 1988)

The site is located at the south-eastern entrance of the valley transsecting the Velence Mts., at the margin of the foot-hill slope, facing the plains (later to be occupied by the shallow Velence-lake).

The site is well stratified, lying within the loess sequence Dunaújváros-Tápiósüly, between the Mende Upper and Tápiósüly H2 soil horizons. The quarry pit planted for the extraction of sandy loess destroyed a large part of the settlement. The extent of the settlement must have been much larger than the surface opened by authentic excavations, judging from the quantity of the faunal remains alone. Among the 1100 pieces of artefacts found, partly during the excavation, partly in course of field surveys there were only 77 pieces of tools in the strict sense (according to the type list of Sonneville-Bordes); calculating percentage ratios therefore is not meaningful.

It is remarkable that about half of the tools (38 pieces) were blade points and blunted blades. The function of the settlement is undoubtedly reflected in the scanty material: hunting camp of a community specialised on hunting *Equus*. The average dimension of the tools is 42 mm.

Raw material of artefacts comprise 65% "Erratic flint", more exactly it is called erratic without knowing primary or secondary geological source. This material is bluish-white patinated, very fine texture, silky grey and 35% liver-coloured Gerecse radiolarite.

Fauna: 31 *Equus germanicus*, 4 *Equus sp*. II, 2 *Asinus*, 4 *Rangifer* and *Bison*

Hidasnémeti (SIMÁN 1989,)

The site was excavated by K. Simán on the right side (Western) terrace of the river Hernád. The industry shows typological similarity to the Pavlovian (more exactly, cultural layer II/9 of Willendorf). Shouldered blade points lend a unique character to the industry among the contemporary Hungarian sites. Living in almost identical natural milieu to Bodrogkeresztúr and Arka, it is different from both sites in typological composition as well as raw material basis. Chronologically the site was dated between Bodrogkeresztúr and Arka. The cultural assignation of K. Simán was corroborated by recent studies. Accepting the most recent arrangement of the Pavlovian culture by J. K. Kozłowski, the "group with shouldered blades" is the youngest facies of the Pavlovian (24.–20 kyear BP, 1996). On a mere typological basis, Hidasnémeti is the only known representative of this cultural facies in Hungary so far.

In the first publication of the site Bodrogkeresztúr-Henye by Vértes, **Arka Herzsarét** (VÉRTES 1964/65, 79–132.) was the most important – and almost only – site comparable to Bodrogkeresztúr *(Fig. 47)*.

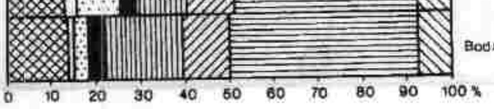


Fig. 47 Technological indices of Bodrogkeresztúr and Arka (VÉRTES 1966, 10)

	Bodrog-keresztúr pavlovian	Megyaszó pavlovian	Mogyo-rósbánya Ságvá-rian	Esztergom epigravet-tian
Débitage, déchets de fabri-cation	74%	84%	87%	60%
Outils "a posteriori"	3	9	4	5
Outils façonnés	23	7	9	35

The statistical investigations only support the facts visible to the naked eye. The percentage ratio of Otte's 1–11 categories is highest at Mogyorósbánya. In this sense, the fragmentary character of Ságvárian is reflected which served as a primary factor in the separation of the industry. The high ratio of débitage can be a signal of abundant raw materials but also it can show that pebbles were less suited for the production of Upper Palaeolithic types. Just the opposite is valid for Esztergom where excellent quality raw material was used with great efficiency to produce perfect tools. Blades and flakes belong to the same category of artefacts, i.e. blanks which served mainly as the base form of tool types. Turning back to Mogyorósbánya: the unusually high ratio of pebbles, pebble fragments and flakes compared to blades mean at the same time the relative scarcity of traditional Upper Palaeolithic tool types.

4.2. Contemporary sites outside Hungary

Before comparing Bodrogkeresztúr-Henye to contemporary sites available in published form, let us comment on the difficulties of comparison by typological and other methods.

The scheme suggested by F. Bordes' (applied for the Upper Palaeolithic by D. de Sonneville-Bordes and J. Perrot) typology working adequately for several decades for the comparison of sometimes very different materials was found already inadequate, as stated by M. Otte: "Le temps ou les publications d'ensembles lithiques s'arrétaient aux diagrammes cumulatifs est aujourd'hui dépassé." (OTTE 1989, 10)

The application of the French type cumulative curves for Hungarian Upper Palaeolithic materials was always tedious. First of all, because Hungarian tool types were very different from those the categories used to be set upon; second, priorities in setting the technical terms denoting the types were not always clear.

Information condensed in the typological curves, however, cannot be substituted by the rather minute and complacent figures by modern computer-assisted elaboration. Cumulative curves represented the material in totality, gave a prompt impression on dominating tendencies within the industry and the ratio of main types. The need for reflecting certain details of technological niceties were not always fulfilled, even by the indices, but this does not necessarily mean that we have to disregard the method totally.

In the well illustrated comprehensive type book of P-Y. Demars and P. Laurent, the authors aim at presenting the complete European type spectrum. In reality, they were only collecting the Upper Palaeolithic types from Central and Western Europe (DEMARS–LAURENT 1989).

Apart from the cca. 60 types presented in the glossary, besides 27 general Upper Palaeolithic type there 28 tools typical of a narrow range of sites, almost site-specific, the general significance of which is negligible in a European Upper Palaeolithic type spectrum.

Knowing the Hungarian Gravettian find material the author is convinced that a great typological overview valid for Central and Eastern Europe will not be based on the Hungarian material directly, which is neither excessively rich nor very characteristic. Though the triple division of the Gravettian can be furnished with typological content, the almost 40 sites of the three settlement waves yielded hardly enough material for such a synthesis: less than half of the sites can be evaluated statistically. Simply, time has not come yet for the elaboration of a generally valid typological system illustrating both similarities and differences, if such a system can be achieved at all without falling captive to traps

– la terminologie est confuse, utilisant des qualificatifs d'origine fonctionnelle, technique, morphologique, toponymique, statigraphique;

– il existe une incohérence à plusieurs niveaux dans la classification des catégories, à l'intérieur de certains types notamment au niveau des fossiles directeurs;

– la classification des types laisse place à la subjectivité, notamment dans les problèmes de dimensions;

– elle ne rend pas compte de toute la complexit, de la forme de la pièce.

In the present comparison, sometimes hardly compatible systems used by several authors have to be used. As a compromise of formal vs. functional typology, the most realistic platform for comparison is analysing type groups: that is a necessary favour for functional typology, once the strict prescriptions of a formal typology cannot be accomplished.

The new system suggested by P-Y. Demars (DEMARS 1990) could not be adopted for the study of the Bodrogkeresztúr material as yet.

Emphasis in comparison was given to closely related sites, however, some sites which were neither contemporary nor spatially connected were also com-

48	2,40	1,7
49	1,05	1,7
50	0,25	0
54	0,05	0
55	0,05	0
56	0,05	0
57	0,05	1,7
58	0,41	3,3
59	0,35	3,3
60	0,88	1,2
61	1,57	1,5
62	0,93	0,5
63	0,47	0
65	3,78	15,5
66	3,72	3,0
67	0,10	1,8
68	0,05	0
69	0,25	0,2
74	1,15	2,2
75	0,52	0
76	1,51	1,1
77	1,83	4,6
78	0	0,1
84	0,1	0
85	21,93	0
86	0	0
87	5,87	0
88	0,25	0
89	1,10	0

Comparing the two type lists, they agree well in the lack of certain tool types (negative identity) which can be considered culture-specific: general lack of borers or low number of them, total lack of Western type blade points and classical leaf points

In most types, the differences are not significant (Bodrogkeresztúr is less complex). In case of differences, Bodrogkeresztúr seems more archaic (higher ratio of side-scrapers); its more rough, bulky character is manifested (type 65. in favour of Bodrogkeresztúr, type for 85–89. Dolní Věstonice)

Dufour-lamellae considered "fossile directoire" at some other sites are missing from both sites.

The typological system used by J. Svoboda, for the analysis of Dolní Věstonice II – Western Slope (SVOBODA 1991) could be adopted well:

His types were grouped in 5 units, similar to the taciturnity of Demars's column graphs (DEMARS–LAURENT 1989, Fig. 62.), thus investigating the distribution ratios of the tool kit. This condensation of information, however, has its draw-backs:

• finer details of the industry are lost – just the ones which elucidate its chronological position, roots and contacts (such characteristics for Bodrogkeresztúr would be the archaic, Aurignacoid character, the trend for macrolithisation due to abundance of raw material or other reasons, e.g., forest environment)

• high ratio of "other tools" covers up the contraction of heterogeneous tool groups. In case of Bodrogkeresztúr, 40 % of the total material would be disregarded this way, and it seems just too much information wasted

• backed implements and microlithic tools overlap considerably.

Comparison between Dolní Věstonice and Bodrogkeresztúr according to Svododa's categories is presented below:

Comparison of type groups from Dolní Věstonice and Bodrogkeresztúr, Svoboda's categories:

Type group	Dolní Věstonice I (KLIMA 1963)		Dolní Věstonice II (SVOBODA 1991)		Bodrogkeresztúr	
	pieces	%	pieces	%	pieces	%
End-scrapers	283	14,8	32	10	200	26,1
Burins	536	28,1	102	31	213	27,8
Backed implements	562	29,5	112	34	54	7
Microliths	147	7,7	20	6	–	–
Other tools	378	19,8	63	19	300	39,1
Total	1906	100%	329	100%	767	100%

The arch of Upper Palaeolithic settlements with mammoth huts, ranging now from Southern Moravia till the Central Russian plain in an arch, the stations of which may represent milestones of a possible connection from the Don-bend via the settlement along the Dniepr (Mezin) and Southern Poland (Kraków), through the Moravian hills till Lower Austria (Langenlois), with important "evasions" to the North like Zaraisk.

The Hungarian equivalent of the younger Palvovian horizon, represented in Moravia by Milovice can be Nadap. Its geochronological position allow this supposition. Over 60% of the 58 tools of the heavily disturbed settlement were made of erratic flint (supposed Northern, at least Silesian connections!). The fauna is dominated by *Equus germanicus remagenensis* (DOBOSI et al. 1988). Traces of mammoth huts, even mammoth bones were not found at Nadap.

West

The Upper Palaeolithic of the territories adjacent to Hungary from the West

– belong to the base tribal area of the given cultural entity

– fortunately for us, has been investigated well and for a long time

– has been complacently published, mainly in details

Within a circle of not more than 20 km, classical sites line up in the vicinity of each other from – Wachau till the Kamp valley like Aggsbach, Willendorf, Krems and sites of the Kamp-valley: Langenlois, Kamegg and Grubgraben.

The area must have been densely populated in some periods of the Upper Palaeolithic (or, studied most intensively in our age). The topography of the area is similar to the Danube-bend area in Hungary:

"Bei Melk betritt Donau, die bisher in einem breiten, alttertiären Tale fliesst, ein enges, romantisches Durchbruchstal, das in das moldanubische Massiv tief und mit steil abfallenden Wanden eingenagt ist, die sogenannte Wachau. Bei Krems verlässt die Donau das alte Gebirge, um das grosse, bis zu 15 km breite Becken des Tullner Feldes zu durchströmen, das in Norden von einem vorwiegend aus teretiären Ablagerungen bestehenden Hügelgelände begrenzt wird, dessen mehr oder minder steiler Rand "Wagram" genannt wird. Das Hangende des Wagrams bildet allenthalben der Löss."

(BRANDTNER 1954–55, 7–8.)

Either immediately on the terraces of the Danube, or on the plateaux over the adjacent wider stream valleys, the utilisation of natural endowments resulting from the meeting point of several biotopes created similar conditions for habitation to those of the Danube-bend region.

Settlements here are also ranged into two chronological horizons:

• the older horizon is represented by Willendorf II/5 and the associated sites like Aggsbach

• the younger horizon is represented by Grubgraben and other Epipalaeolithic sites in the Kamp-valley

Recently, Haesaerts compared sedimentological experiences in the recent Willendorf stratigraphy with C 14 dates (HAESAERTS 1990, 212.)

• his results, partly, contradict Hungarian observations: Upper Palaeolithic settlement waves and interstadial phases did not overlap, moreover, the cultural development is more continuous than discontinuous

• By finding the Pavlov soil horizon, he draw attention to an important fossil soil level which was not found yet in Hungarian loess stratigraphy. (Between Mende Upper and Tápiósüly horizons). Accepting the first C-14 date for Bodrogkeresztúr literally, the settlement fits in the uppermost layer of Stillfried B soil horizon; the settlements found closest as archaeological analogies are, however, younger.

Stillfried in itself is a key site. Its topographical position is optimal: the cca. 400 m a.s.l. hilly region of the Morava/March valley is slowly opening towards the plain extending till the Danube, the Moravian Field. It is an ideal setting for a Palaeolithic settlement.

Stillfried is a key site for Hungarian geomorphological research as well, because the key section of its loess profile served as an type section for Hungarian soil- and loess-formation periodisation as well. The humic level of the Bodrogkeresztúr-Henye cultural layer could be paralleled to Stillfried B soil horizon. In respect of the site itself, it could serve as a station of the route leading from Bodrogkeresztúr-Henye towards the base areas of the Pavlovian culture, Willendorf and Pavlov.

The result of the studies over 25 years is the publication of Westwall's new excavations.

The archaeological finds comprise: 4% end-scraper, 2,8% burin, 14% Gravette and microgravette, 26,9% Gravette blade, i.e., backed blade[3], 16,4% backed blade, 33,7% others: altogether 249 objects.

The cultural affiliation of Stillfried was described in the followings:

[3] Here we have to note that is is difficult to decide on a proximal fragment if it used to belong to a Gravette point or a Gravette blade, thus this value is tentative.

Comparison of Kadar and Bodrogkeresztúr–Type groups according to the Sonneville-Bordes-Perrot

	Kadar %	Bodrog-keresztúr %
End-scrapers	9	26
End-scraper combinations	1	2,7
Borer	1	3,2
Burin	5	28,9
Backed tools	28,1	2,2
Within the former, microliths!	23%	
Retouched blade	20,3	19
Side-scraper group	6,8	14,3
Lamelle group	28,6	3,3

As it is apparent, Kadar is a typical young Epigravettian industry, with very high ratio of backed blades and microlithic tools, specialised on shouldered points. There are very few common elements with Bodrogkeresztúr: only the indifferent retouched blade ratio seems similar (MONTET–WHITE et al. 1986, 59.)

The archaeological material of Lušcic (Aurignacian), a contemporary site to Bodrogkeresztúr towards the south, south-west, cca. 500 km far from Bodrogkeresztúr, did not reach the lower limit of statistically valid quantities (MONTET–WHITE et al. 1986, 83.)

South-East

Because of opinions expressed on the Gravettian culture and references to Hungarian material, it is necessary to deal with the material of the Temnata-Cave.

Apart from the general theorems on the origin, distribution directions and rhythm of the Gravettian culture, there are three reasons for discussing this site in the monograph on the Bodrogkeresztúr-Henye site:

• It belongs to the earliest Gravettian settlements, so it is a contemporary site. Its analogies in the Central Danube-Basin and to the east of the Carpathian Arch agree with the list presented for Bodrogkeresztúr. The site can be hardly fit to the chain of events hypothesed by DROBNIEWICZ–GINTER–KOZŁOWSKI 1992, 412, i.e., formation of the Gravettian culture in the Central Danube-Basin, spreading towards the West and after getting stronger there, invasion towards the East and flourishing between the Don and Dniepr rivers. Temnata lies, even as the crow flies, minimum 800 km from the central area of events in a cave of the Karlukovo karst.

• Branching off the Gravettians to SE Balkans in the early phase can only be raised yet, without connecting evidence, as a "tentative" hypothesis. In treating the contradictions between theories and finds, the facts should receive priority: in our case, the Temnata-Willendorf Gravettian analogy.

• On the occasion of Temnata cave, scattered finds from the Epigravettian of the Southern part of the Alföld (Bácska region) are mentioned by the authors (DROBNIEWICZ–GINTER–KOZŁOWSKI 1992, 420.), which cannot be connected to the Bulgarian site. The real analogy lies some 250 km more to the north-east, which is not so much more (250 km) further on, at Bodrogkeresztúr.

One of the raw mater types described from Temnata cave was classified as Northern Hungarian limnic quartzite by the authors (DROBNIEWICZ–GINTER 1992, 420.). If this opinion can be proved, it will also serve as a corroboration of another observation made on long distance spreading of raw materials at such an early date. Namely, the bulk of the Esztergom–Gyurgyalag Upper Palaeolithic site was made of Prut silex, tested by neutron activation analysis as well (VARGA 1991, 269.). Some preferred raw materials could be traded/carried much further than in the "*the original cradle territories of this taxonomic unit*" (DROBNIEWICZ–GINTER–KOZŁOWSKI 1992, 420.). Should the raw material Nr. 17 from Temnata really originate from North-Eastern Hungary, this fact would also indirectly corroborate the connection between this site and the contemporary Bodrogkeresztúr, lying in the centre of North-East Hungarian limnic quartzite sources.

East

Examining the Eastern connections of Bodrogkeresztúr-Henye we have to consider territories with different level of cognisance and/or documentation. Thus the potential contact direction, content and chronology will be presented here in geographical order.

Transcarpathian Ukraine

The importance of the "marginal"-regions is underlined by the settlement pattern of the north-eastern limits of the Alföld (Great Hungarian Plain) in the Upper Palaeolithic period.

Either because cultures were "jammed" before the arch of the Carpathes or just as a consequence of using well-known advantages of the meeting point of several ecological niches, on the small area belonging to Ukraine a range of varied Upper Palaeolithic industries were found.

1991, 12–14.). Most probably, these sites belong to the circle of Bodrogkeresztúr. This observation seems to be supported by the map published by Chirica (CHIRICA 1986, Fig. 1.), on which the Transylvanian Basin is strikingly empty. Sites are concentrated mainly along the Eastern slope of the Carpathes along the rivers Siret and Prut as well as the valleys opening to these river basins, running down from the high mountains.

Topographically, mainly the Gravettian settlements in the Szamos (Somes) valley in the Avas (Oas) region should be considered as potential connections for Bodrogkeresztúr l (CHIRICA 1986, sites 61–67.)

The more large, populous and more important Upper Palaeolithic centres were found outside the Carpathian arch, in the middle part of the Prut valley. The "chief site" is Mitoc-Malu Galben. Apart from the completely identical chronological position (HONEA 1994 , 144), some further details offer further important analogies: amulet pendant with incised margin and carved surface (CÂRCIUMARU–CHIRICA 1987, 68.; GRIGORIEVA–ANIKOVITCH 1991, Fig. 9.)

The importance of the incised margin discs is envisaged by the author less in their supposed or real symbolical meaning but rather the connecting role of this object type, allowing an asymmetrical connection between Bodrogkeresztúr and Moldova.

Asymmetry is understood in distance: the distance between Bodrogkeresztúr and Mitoc extend to some 4/5th of the distance between Bodrogkeresztúr and Moldova. The importance of incised margin discs is seen by the author not in their hypothesed or real symbolical meaning but their significance as direct proof of common roots. The identity of shape and ornamentation on objects not influenced by functional requirements of everyday work can be a strong argument on common cultural roots and close relation.

Mitoc-Malul-Galben belongs according to the chronological system by Chirica to the second period of Gravettian industries in Romania, dated between 28/29 Kyear–24 Kyear. This period is represented by eminent sites like the great Austrian or Moravian settlements. Bodrogkeresztúr with slightly older C-14 date belongs to this horizon, but in the opinion of Chirica the absolute chronological date of the Hungarian site "*...contains a very great range of uncertainly...*"(CHIRICA 1989, 150.)

Ripiceni Izvor is the other multi-layered Palaeolithic site along the central parts of the Prut basin with significant Gravettian settlement (28 thousand artefacts, two cultural layers with four levels). This site contains an important industry of the Molodova-Mitoc circle, showing continuous development during the Upper Palaeolithic period.

The area between the Podolian plateau and the Carpathes known as "Ukrainian Switzerland", dissected densely by rivers and with ample excellent Cretaceous raw material deposits offered ideal environment for the interior development of Palaeolithic cultures condensed before the Carpathian arch.

In four levels of the Gravettian period starting with the Tursac interstadial period the lithic industry is fairly homogeneous (the ratio of end-scrapers increase linearly towards the younger levels from 26 to 38% while the ratio of burins decrease to some extent from 16 to 15%). The specific character of the industry is due to bifacial working and the low ratio of the eponym type (Gravette-points, PAUNESCU 1993, 153–171.).

Molodova

Among the eastern connections the localities of this region should be also mentioned briefly.

Bodrogkeresztúr lies about midway between Molodova-Corpaci and Willendorf. The distance between Bodrogkeresztúr and Willendorf towards the West is roughly 500 km as the crow flies, the environs of Molodova (Central Dniestr region, CHIRICA–BORZIAC–CHETRARU 1996)) is roughly the same to the East.

The connection, however, is far from symmetrical: while towards the Wachau, the route leads along the Danube valley amidst mountains well below 1000 m, towards the East the Carpathian Basin is closed by the range of the Eastern Carpathes surpassing 2000 m, which was not the typical living area for the Gravettian people even in the possible ice-free periods.

The gates of the Eastern Carpathes, the passes (Verecke, Tatár-pass), are narrow passages at an elevation of 900 m. The circumstances were not favourable for the diffusion of cultural effects (DJINDJAN–KOZŁOWSKI–OTTE 1999, 30). Information based on condensed large scale maps however can be contradicted by personal observation. The Alps which had similar or even more rough orography were not impassable during the Upper Palaeolithic period. Regular, stable connections, however, were not established.

The possibility of Eastern direct contacts could only be imagined for those who, as F. Bordes put it, "were eager to know what was over the mountains". In Western – North-Western direction (Moravian basin, Danube-valley) there were no obstacles to lasting contacts.

Towards the south-east, the climate of the Transylvanian Basin is much colder than the average temperature of the Carpathian Basin even today. Apart from the unfavourable conditions, large distances and high altitude separated them from the settlements of the

5. Cultural affiliation

In the first publication on Bodrogkeresztúr-Henye, László Vértes wrote the followings:

"ANALOGIES OF THE INDUSTRY OF MT. HENYE. The industry is evidently a manifestation of the East Gravettian group and absolute chronological date places it to the older ones. Typologically this is shown by the frequently found Aurignacian retouch on the implements, while the Aurignacian-type end-scrapers are missing; by the relatively low percentage of backed pygmy blades, by the uniformly large size of the implements, i. e. the lack of microlithization – which occurred already in Arka – it creates a striking contrast with the gigantholiths there. Every old East Gravettian material contains analogies to some of the types known from Mt. Henye. (VÉRTES 1966, 13.)

The seventeen thousand year old material from Arka and Ságvár, the 10000 year old material from Szekszárd and that from Szob being also young (younger than the maximum of the W 3) contain certain elements which could be defined as aurignacoid i. e., thick, short or almost circular end-scrapers which are fairly close to the keeled scrapers...

...This means that the "aurignacoid" features found in the industries of W3 or even sooner do not necessarily relate them to ethnic units with temporal and spatial contiguity, i. e., to relate them directly to the inheritance of human groups living 10–15000 years earlier. These types may be regarded as the result of new invention connected with increasing microlithization. In this connotation the two types of Gravettian "groups" found in Hungary might represent two temporal horizons of an identical cultural phylum.

(VÉRTES 1966, 14.)"

The large amount of scientific knowledge accumulated during more than three decades passed since the first publication re-arranged our information on the Upper Palaeolithic of both Hungarian and other Central European sites. Its seems that the cultural development we are able to follow by archaeological methods is getting more and more precise: valid for shorter time span and smaller regional units. In 1966, the more or less generally accepted view stated that the population of a uniform culture was present during some 20 thousand years from the Ural Mts. till the Rhine, i.e., the Gravettian culture. The gradually accumulating wealth of knowledge made possible the separation of several chronological-areal groups and technocomplexes in recent years. This fact, however, was not so fortunate for the **nomenclature.**

Let us briefly survey the most important essays for dissecting-grouping the Hungarian Upper Palaeolithic period:

KOZŁOWSKI-KOZŁOWSKI 1976, 1983 ,1996

The whole "Pavlovian" terminology was introduced to public awareness of the profession in the sixties, as summarised by the important paper on the history of research by K. Valoch (VALOCH 1996, 205–206). This terminology was taken over by J. K. Kozłowski and used in their review paper written together with S. KOZŁOWSKI, as well as in his own more recent articles.

On the map published by J. K. Kozłowski in 1983 the core of the s.l. Gravettian culture was transposed to the Pavlovian base areas. The cultural emanation (in respect of certain characteristic types) was started from this core to different directions in the different periods.

The base form of the Kostenki knife also appeared first in the "*Industries de tradition Pavlovianne avec points á cran du type oriental Moravany Podkovica*" and reached from here partly to the West (Willendorf) and the east (towards Cejkov-Kasov, later Molodova).

Cejkov and Kasov represent the Pavlovian sites in Eastern Slovakia. From here, culture radiated immediately towards north-east (Kostenki), or to the north towards the South-Polish (Krakow-Spadzista, Zwierzynec, Witkowice) sites – and maybe from here direct to the East, in direction of Kostenki. In the meantime, the route of the Molodovian culture proceeding slowly towards the North was crossed (Lipa). (KOZŁOWSKI 1983, Fig. 19.)

In respect of nomenclature (i.e., "Pavlovian"), again we can raise the question – can it be valid over such a large area?

Though from reasons to be specified below the author herself is using the Pavlovian terminology, there are some intriguing points here:

Condensing such wide temporal range and such variable tool kits under the name of one culture reduces the information simply to the name of a time span, more exactly, a chronological phase of a certain area. There are also arguments for keeping the traditional term "Gravettian" for the specific industries of several small communities as the name indicates something common (basically, though in a secondary manner, presence of the tool type named after the original site) rather than preferring the term Pavlovian, which has more regional connotations.

His views were modified to some extent in the review paper published in 1996 (in which the Hungarian Upper Palaeolithic is still irrationally under-represented): The Gravettian of the Danube-basin was divided into the following chronological levels: Early Pavlovian (30–27), developed Pavlovian 27–24) and the horizon of shouldered points (24–20) (KOZŁOWSKI 1996). On the basis of this grouping, the for belonging to this "entity" were defined rather magnanimously, it is true that at Bodrogkeresztúr more of these features are missing than present. Leading finds of the entity like Kostenki knife and point or fléchette were not found at Bodrogkeresztúr.

Considering the missing and existing features it is suggested here that Bodrogkeresztúr still belongs to this group.

The evident contact direction was to the north-west (immediate connection to the western units of the entity along the Danube-valley). Direct contact with the sites to the east of the arch of the Carpathes was hardly probable.

Arguments for integrating Bodrogkeresztúr to the above entity are the following:

• chronological position of the site

• presence of mammoth as prey (even in low quantities: SOFFER 1993, 43.)

• the topographical position of the site

• typological similarities with the relevant sites: few by types but more in general image

• technological-formal criteria which are very difficult to turn to written text, more like general impressions on the Bodrogkeresztúr industry

M. MUSSI AND W. ROEBROEKS 1996

The study period is divided into three major parts by the authors, according to the terminology of the 1995 Pavlov conference/convention:

EUP / Aurignacian culture: both chronologically and archaeologically falling outside our present inquiries. The C-14 dates however do not exclude the possibility that Aurignacian II (Olschevian), identified by László Vértes in the upper cultural layer of the Istállóskő cave lived here till the turn of the 30th Millennium bp. (VÉRTES – de VRIES 1959: 195). The last third of the Würm period, which can be divided in the Carpathian Basin into three phases, served as the chronological framework of the s.l. Gravettian period. On the basis of chronological and

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Technical / typological features this large cultural complex was divided into three phyla, all of them corresponding a cultural facies of this complex. It means that among roughly identical ecological conditions, similar way of life and similar "leading finds" (at least, as regards the gravette-points) site groups for three different stone-working traditions, technologies could be separated. The triple division of the Hungarian Upper Palaeolithic period partly follows the division suggested by the Pavlovian convention:

– Older Blade Industries, suggested terminology: Pavlovian = Gravettian

– Ságvárian /Pebble Gravettian is intercalated (temporally) these two, partly contemporary with the younger phylum, characterised by preferential use of pebble material.

– Younger Blade Industries, suggested terminology: Epigravettian = Epigravettian

Summarising the efforts for the division of the Gravettian entity in Hungary: the best possible solution for a generally valid but easily adaptable system, liberal but adequately precise system in time and space is a mixture of Soffer's entity-t and the division of the Pavlov convention. The range of sites all of the demonstrating some individual features which were in loose contact with each other, the "big mosaic" can be easily covered by the term Gravettian entity, separated geochronologically as MUP and LUP, comprising a range of local cultures.

The considerable theoretical and practical differences apparent in the determination of traditional archaeological cultures, the differences in attributes and / or certain group of sites these cultures cannot be delineated convincingly enough. It is also doubtful if they will be ever more evident because the increase of the authentically excavated sites increase, or can increase the scale of individual characteristics just as much as the possible common features necessary for the determination of the cultural units. It is also doubtful that once it is so uncertain, is it really necessary to force sites into any chronological-geographical framework or rather we should describe individual features within the loose frames of the "entity".

The real contents of the name Willendorf-Kostenki culture can be questioned on the basis of the large distance between the two eponym sites (1800 km).

The route of the Aurignacian migration was even longer than this distance; but this route was not a range of contemporary sites but a well dated movement from place to place. Such a vast area could not be covered by one culture already in the Middle Palaeolithic. To the West of the Wachau (Willendorf), the same distance would be already deep in the Atlantic ocean. The two eponym sites are separated from each other in the given period by a rich and versatile culture area (Upper Palaeolithic cultures on the European part of Russia, Ukraine, Moldova, ROGACSEV–ANYIKOVICS 1984, Fig. 72.) It is hardly possible that the same population with full contents and culture were present at the far ends. Therefore the name "entity" is more justified than culture which has too strong implications. Population of the contemporary (MUP) Hungarian settlements could be the "filials" of the base areas in Central Europe for whom the almost identical natural endowments offered similar conditions for living. In a relatively short period, "missiles" from the core areas invaded North-Eastern Hungary. The closest Eastern centre, along the river Dniestr

• LUP / Epigravettian culture suggested by the Pavlov convention mentioned in Hungarian technical literature as "Gravettian with younger blade industry".

The framework of space and time where the archaeological industry of Bodrogkeresztúr-Henye could be fit is adequately circumscribed geographically as well as chronologically. The difficulty of comparing sites and features is hidden in the approach of specialists considering different typological-technological or other features they consider important for defining a cultural phenomenon.

The methods comparing these different features with variable success do not always allow us to quantify the identity or difference of sites. The very general and elusive, but existing identity within the Gravettian culture or which can serve for the separation of groups within the large entity is almost impossible to express by mathematical terms, same as the definition of individual features of one site, i.e., how much it can be fit within the framework of a given cultural unit.

Notions on the "quality" of Hungarian Upper Palaeolithic settlements is ambivalent. There are some settlements where the stone tools are of comparable quantity and quality to other Central European settlements.

The permanent base camps, however, were missing. The Hungarian settlements (Bodrogkeresztúr, Hont, Megyaszó) could be large enough with ample, typical, good quality tools: but the settlement features, constructed objects, exotic and artistic material which were associated with them were missing.

The bone industry of open-air Upper Palaeolithic sites in Hungary was strikingly poor: this could be explained by unfavourable fossilisation conditions supported by the condition of the fauna found on the settlements.

The connections of Bodrogkeresztúr in this comparison point at the older Pavlovian sites of Central Europe.

It is worth to deal with some papers by M. Otte at some length because in his summaries (OTTE 1981) the Hungarian sites were also considered to some extent. Bodrogkeresztúr was connected by Otte on theoretical basis, possibly its chronological position – to the Willendorf II/5–6 settlement level. His Gravettian chronology (1986) was based on the re-considered layer sequence of Willendorf.

The main attraction in a chronological / typological grouping is the comparison of chronological / typological levels, "facies" rather than "cultures". The "cultures" of the Gravettian circle, probably having a common root cover probably small local groups because the ecological, geomorphological background necessary for the introduction of the slightly mystical technical term "culture" were identical for all. In other words, in vain we try to separate on the basis of technical-typological features small find assemblages naming them "cultures" when the settlement features, the ecological (faunistical, botanical etc.) background is identical over the area of half continent. In the recent work of Otte, the chronological levels were filled with typological contents.

Bodrogkeresztúr preserved its place among the earliest Gravettian sites, the stratotype (leading site) of which was: Willendorf II 5/6 (OTTE 1991, 50). This place was maintained only on the basis of chronological position, based on Vértes's publication.

The analysis of the complete archaeological material – the general image of the industry, its typological-technological features - supported the validity of this classification. At the same time, in Bodrogkeresztúr as well as all the Hungarian MUP sites, the leading finds of this "stade" were either completely missing (Kostenki-knife) or present in negligible amount (microliths, flechette).

The Hungarian sites seem to be more strongly related on typological grounds to Stade II, the blade-point facies.

Considering the connection establishes between the chronological position and the fossile directoire defined by Otte valid for Hungarian MUP sites, the Hungarian sites were shifted typologically compared to the core areas.

Partly, at Bodrogkeresztúr the early date is accompanied by young types; partly, the ratio of side-scrapers and some retouch-type strengthened the archaic character of the industry.

The sites contracted in Otte's group 4. were in fact settlements of contemporary Gravettian population related to each other. The Hungarian relations of Otte's group 8. were certainly slubbered (OTTE 1981, 134–135.); our current state of knowledge allow the delineation of a much more detailed picture on the "rest". The summarily contracted "other Hungarian finds" where Ságvár and Arka were contracted can be divided into several chronological and cultural levels (DOBOSI 1998 , 131–132).

The theory of a polycentrical origin of the most varied and colourful industry of the Upper Palaeolithic called in short "Gravettian" characterised by "backed blades" was delineated by the mid-seventies (KOZŁOWSKI 1979, Fig. 13.). The individual, variable tool kit of contemporary sites support this theory. Though the only real common element is the backed blade, they appeared fairly early, during the Arcy interstadial on the basis of local roots in SW France, S-Italy or Central Europe. They were considered descendants of an early Upper Palaeolithic industry, which is independent of the Aurignacian (KOZŁOWSKI 1979).

The formation area of the Pavlovian (MUP), as we know today, was in Western Slovakia, Southern lead to the North of the Carpathian arch along the ice-free South Polish corridor. The contradiction hidden in the data set on the possible directions of migration and its chronology can hardly be solved on the basis of finds within the Carpathian Basin. Faunal waves proceeding from east to west and theoretically closely related movement of "human waves" are opposed to absolute chronological data which show a trend for getting younger from west to east. Theoretically, the east-west direction is supported by a more general and more significant trend in human evolution lasting much longer than the events treated in this monograph, the east-west advance of Homo sapiens.

The stirring history of the Central- and Eastern European Palaeolithic obviously cannot be stringed on one chain of events, whatever direction, chronology or topography. One possible sequence is reconstructed below which do not contradict to data known so far:

- The earliest Upper Palaeolithic with Homo sapiens and the archaeological industry called with inverse logic Aurignacian after its westernmost and youngest form of appearance arrived along the route Near East-Balkans, from the south-east into Eastern Europe.
- This population proceeded partly, conserving its archaeological industry more or less intact, towards the west; partly, had some influence on different industries with Middle Palaeolithic stone working traditions
- Arriving from the Balkans, to the east of the ridges of the Eastern Carpathes this population could reach to the North along the river valleys running from North to South. Local Middle Palaeolithic cultures flourishing there developed here undisturbed for a long time. Following the impetus of Upper Palaeolithic innovations which are very difficult to point at but undoubtedly existing, strong and vigorous Upper Palaeolithic centres were formed between the rivers Prut and Dniestr.
- The same process possibly took place on the area extending from the Wachau till the Moravian Basin which could also serve as an ideal scenery for development.
- The Upper Palaeolithic centre formed here possibly entered into constant and strong interaction with the territories to the North of the Carpathes in Southern Poland where Upper Palaeolithic cultures which had infiltrated formerly from the Balkans, spreading towards the East were met.
- The Northern stripe of the Carpathian Basin was probably populated on the margin of the great movements as a precipitation of the surplus population.

Even without knowing the exact origin of the utilised long distance raw materials called summarisingly "erratic flint" it is certain that the population of Bodrogkeresztúr-Henye used to have some northern connections. The immediate route-direction of these contacts, however, were not possible to reconstruct as yet. It was already grouped by M. Gábori among sites with apparent northern connections (GÁBORI 1968, 1969). The base area of the Pavlovian culture (North-West) and possible directions of raw material procurement (North-) confine well the action radius characteristic of population of the Pavlovian / Older Blade industry. The great alluvial plain adjacent from South to the stripe of settlements was either not suitable for human settlements or contacts have not been documented from this area as yet.

In the period around the last cold maximum of the Würm period, a new technocomplex emerged in the interior parts of the Carpathian Basin, the Ságvárian culture. It is still not known if the embryonal soil horizons of the Ságvárian cultural layers were the products of small interstadials prior or after the Würm cold maximum. Their absolute chronological position (around 19 kyear BP) seems to indicate that the settlement waves took place after the cold maximum; however the average temperature values calculated on the basis of palaeontological evidence allow the hypothesis that on the interior parts of the Carpathian Basin the cold peak was late compared to general history of climatic events in Europe. (See: Vörös in DOBOSI–VÖRÖS 1987.) So far, only four sites belonging to Ságvárian culture are known, the archaeological material is fairly characteristic. On the basis of the train of thoughts presented above, it can be rooted in a pebble-working Middle Palaeolithic tradition. The time and place of the formation of this culture is hardly known. It must have been a vigorous and strong culture as reflected by the multi-layered (Ságvár) and extended (Mogyorósbánya) settlements. The settlements of the LUP Epigravettian culture seemed to belong, according to our present knowledge, dispersed small communities all over the Carpathian Basin, which were to some extent separated from each other within the great Gravettian entity. The preserved Gravettian way of life and tool working technology / typology might have been the results of optimal adaptation rather than adherence to tradition. Their archaeological material is not very significant, both in quantity and quality.

Archaeologically, the system of contact among Hungarian sites was fairly "inbred".

Surveying references, analogies in archaeological publications, the geographically set narrow framework remained stable. There is little information hidden in listing analogies of individual tools (not types) further on to the east or west. It is difficult to decide if analogies in style were only formal convergence or real genetical affiliation. All the more as these individual analogies relate, much to our regret, not the "leading fossils" (e.g., Kostenki-knife) or decisive settlement

At the south-eastern corner of the Alföld, the Danube–Tisza–Maros–Temes alluvial plains are escorted by a range of hills in a wide stripe. From the plains upwards, following a "step" of some 1400 average altitude (Almás, Szörényi and Ruszka Mts.) we hit against the 2500 m high range of the Southern Carpathes dissected by steep river valleys. The historical name for the plains and the foothill region is Bánát (Banat). Its Upper Palaeolithic history is fairly well known. The chronological position of the rich Aurignacian sites found here seem to contradict topography. The only passable way of the Aurignacian migration from South-East (Bulgaria) must have lead along the Bánát forelands. Compared to the more northernly lying Aurignacian sites in Hungary the Bánát sites were dated at a surprisingly young age (tardiglaciére). In the opinion of Mogosanu: "*..l'aurignacien du Banat représente une étape tardive...*" (MOGOSANU 1978, 147). On the Late Pleistocene terraces of the rivers Bega and Temes, sites around the altitude 250 m a.s.l. (On the terrace of the Temes, Tincova, on the terrace of the Bega, Romanesti-Dumbravita I.VI. levels) agreed chronologically with the younger blade industry facies in Hungary (Lascaux – Romanesti interstadial); their find material was poor (MOGOSANU 1978, fig. 37.). The "quartzite Palaeolithic" (paleolitic cuàrtitic) industries living parallel to classical UP industries in the Bánát represent a special instance. This industry was derived by Romanian experts from the local Mousterian (MOGOSANU 1978, 148). Though so far the author had no possibility to see the material personally, the idea can be raised that this type of industry might be connected with the Pebble Gravettian of the interior parts of the Carpathian Basin, i.e., Ságvárian containing pebble tools made according to Middle Palaeolithic pebble-working traditions. Geochronologically, these sites were dated around the Herculane I. interstadial.

At Szeged-Öthalom, protruding the alluvial deposits of the river Tisza with its 90 meter altitude yielded archaeological material from several periods. In 1935, 4,5 m deep from the surface remains of mammoth and Equus were found in two well separated levels which were remains of a small Upper Palaeolithic hunters' camp (BANNER 1935). Charcoal found here was determined by P. Greguss as Abies alba. The archaeological material comprised 27 worked objects. Apart from some blades, it contained a core fragment, flakes and knapping debris. The raw material utilised included hydroquartzite, jasper, Prut (?) silex. The archaeological material, as much as we can judge on the basis of the scarce find material can be fitted well to Younger Blade industries, i.e., the LUP / Epigravettian settlement wave according to the Pavlovian convention. This chronological assignment is, to some extent, contradicted by the presence of mammoth in the fauna the stock of which was already little in the Carpathian Basin by the end of the Ice Age. The same related to the small industry of Dunaföldvár, which was even more poor than Öthalom.

The loess hills at the southern parts of the Danube-Tisza interfluvial region are known as the Telecska hills. The authentic Palaeolithic site of the region is Madaras – Téglavető (Brickyards), and possibly some stray finds can also be connected to this circle (?) to the south of Bácska region. In spite of troubled find circumstances (the site used to be an active quarry for brickyard), Madaras is outstanding among the Hungarian sites with its rich and well interpreted scientific evidence. Madaras-Téglavető used to serve for a transitional campsite for a small group of people hunting *Equus* and collecting *Lagopus* eggs (DOBOSI 1989 63–64). The settlement used to be relatively large but of low intensity with five hearths containing charcoal of Betula and Pinus. The archaeological material can be classified to the so-called "Pebble Gravettian" or Ságvárian facies. The geological sources of the raw material of the small, often corticated tools were in the Bakony and Mecsek Mts., probably also Northern Erratic flint; according to the categories used by the Lithotheca, regional and long distance materials (BIRÓ 1989, BIRÓ–DOBOSI 1991).

In a strict geographical sense, the territory of Northern Bosnia does not belong to the Carpathian Basin, the border-line being the river Sava. Kadar is on the right side of the river but it deserves to be mentioned on account of its relation to some Hungarian sites (MONTET–WHITE et al. 1986). Its chronology, part of tool types, the preference of pebble material and the length/width ratio of tools connect the site to Ságvár. The presence of the exclusive tool type group, shouldered blades however separated them from each other. Montet–White described the material of this site as an Epigravettian industry forming a transition between the developed Gravettian of Willendorf II/9 and the old Epigravettian of the Adriatic region (MONTET–WHITE et al 1986, 65).

The hunters' campsite Nadap was situated at the entrance of a valley transsecting the Velence Mts. Several meters of loess cover was accumulated here over slope sediments dissected by grit lines. The good stratigraphical position offered reliable chronological frames for the heavily disturbed and partly destroyed settlement. About the middle of the period between the Paudorf / Maisieres and the Laugerie interstadials (classical period of MUP), a group of people hunting Equidae was settled here for a short time. Complementary game hunted were *Rangifer* and *Bison*. The typical archaeological material (classical Gravette-points, slightly high end-scrapers, thick burins) was made of two types of raw material, liver-brown silky lustre radiolarite and bluish white patinated flint, com-

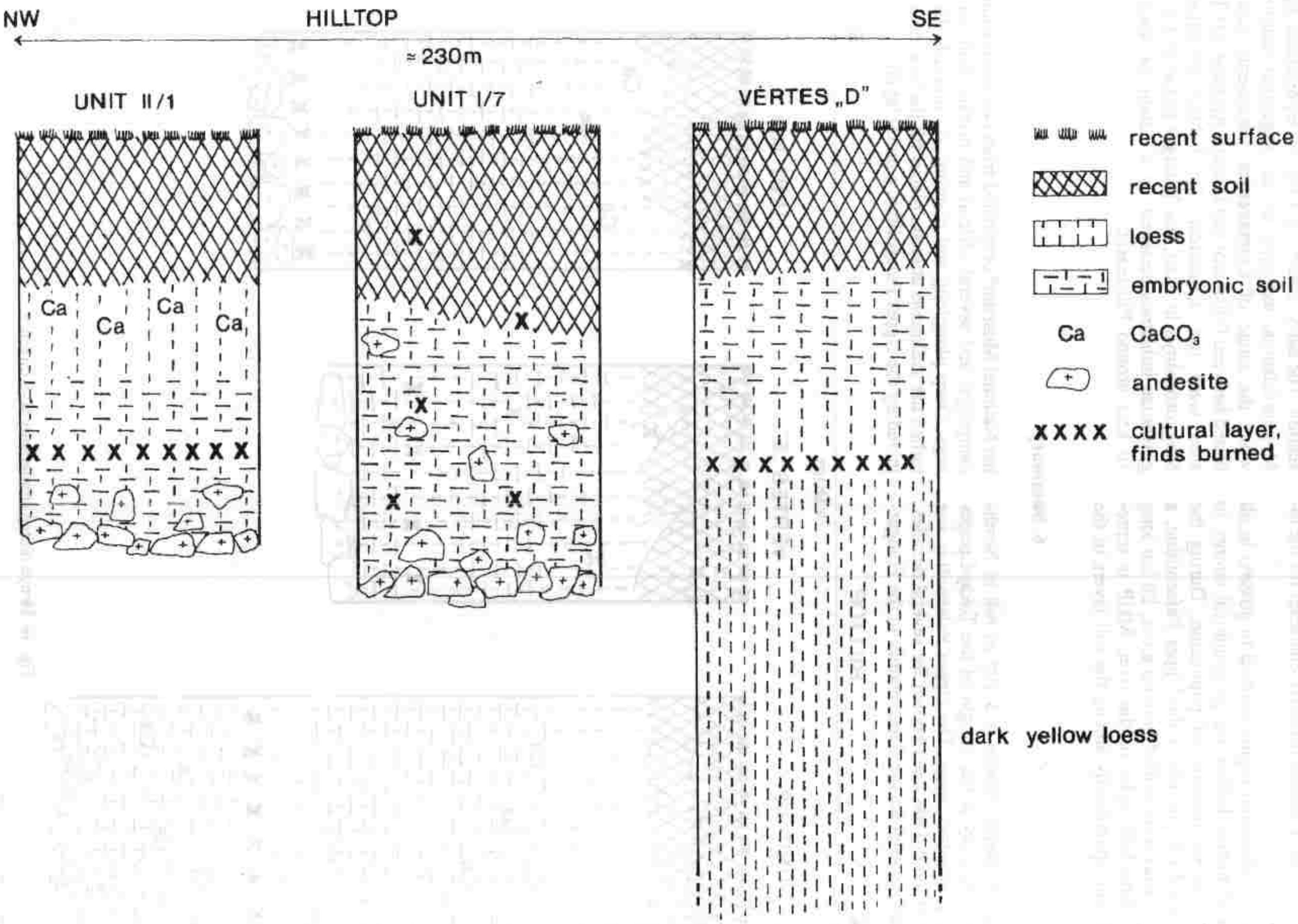


Fig. 49 Henye hilltop stratigraphy NW–SE direction

Radiocarbon dates from Bodrogkeresztúr–Henye:

GXO 195 (charcoal, cultural layer)	**28 700 ± 3000**
deb 2555 (charcoal, sediment with arch. finds)	**26 318 ± 365**
deb 3381 (bone, cultural layer)	18 575 ± 208
Hv 12986 (bone, cultural layer)	10 630 ± 270

According to the archaeological, palaeontological, palaeobotanical and pedological contributions, the **26–28 ka BP (non-calibrated) chronological position is acceptable.**

Upper Palaeolithic (Hungary) Synoptical table

kyear BP	Period	SITES /having C 14 dates	*Soil/loess* sequence Hungary	Traditional interstadials	July mean temperature °C	Climato-faunal PHASES named after main sites	CULTURES		
1		Istállóskő VI, Jankovich 5	l o	Alleröd	 15,7	B A	 G		E P
13		Arka/upper, Peskő upper layer	e		14,3	J			I
			s		13,6	Ó			G
15		Pilisszántó II upper 5/a	s		12,1	T	R		R A
16	S	Pilismarót, Budapest-Csillaghegy				P			V E
17	Á G	*Esztergom,* *Ságvár upper cultural layer*	*hl* *Tápiósüly soil*	Lascaux		I L	A	S Á G	T T I
18	V Á R S T	*Jászfelsőszentgyörgy I–II* *Arka/ lower cultural layer*	l o e s s		 14,3	I S S Z	V E	V Á R I A	A N
19	A G E	*Madaras* *Mogyorósbánya* *Ságvár lower cultural layer*	*h2 soil* *Dunaujváros*	Laugerie	16,2	Á N	T	N	
20									
21		Remete Lower, Pilisszántó I middle layers	L O			T Ó			
22		Peskő middle layers	E S		15,6		T		
23		Pilisszántó I lower layers	S	Tursac?	17	U	I		P
		Hidasnémeti Istállóskő IV–V, Nadap			16,3	N N A M	A		A V L O
28		**Bodrogkeresztur,** **Megyaszó** **Püspökhatvan,** **Hont/Parassa** **Sajószentpéter**	*Mende* *Upper* *soil 1*	Denekamp?	17,4	E D	N		V I A N
31–32		Istállóskő upper layers			17,4	ISTÁLLÓSKŐ	**AURIGNACIEN II** with olschewa-point		
> 35		Istállóskő lower layer	Mende Upper soil 2	Hengelo?			**AURIGNACIEN I** with splitted base point		

	Milleu montagnard au Paléolithique et au Mésolithique. Trento-Viote 5–11. Octobre 1992.
DJINDJIAN—KOZŁOWSKI—OTTE 1999	F. Djindjan—J. Kozłowski—M. Otte: Le paléolithique supérieur en Europe. Armand Collin 1999.
DOBOSI 1967	T. Dobosi V.: Új felsőpaleolit telep az Alföldön. Archaeologiai Értesítő 94. 184–193.
DOBOSI 1975	T. Dobosi V.: Adatok a Bodrogvölgy őskorához. Folia Arch. 25. 9–25.
DOBOSI 1975 a	T. Dobosi V.: Magyarország ős- és középsőkori lelőhely-katasztere. Archaeologiai Értesítő 102. 64–76.
DOBOSI 1983	T. Dobosi V.: Ásatás Tarpa-Márki-tanyán. Communicationes ArchHung. 1983.
DOBOSI 1989	T. Dobosi V.: Madaras-Téglavető felsőpaleolit telep régészeti feldolgozása. Cumania 11. 45–58.
DOBOSI 1991	V. T. Dobosi: Discontinuity in the Upper Paleolithic of Hungary. In: Les bassins du Rhin et du Danube au Paléolithique supériur: environement habitat et systémes d'echange. ERAUL} 43, Liége, 1991. 17–25.
DOBOSI 1992	V. T. Dobosi: A new Upper Palaeolithic Site at Mogyorósbánya Communications ArchHung 1992. 5–17.
DOBOSI 1996	V. T. Dobosi: Upper Palaeolithic in the Danube Bend. Palaeolithic in the Middle Danube Region. Brno, 1996. 25–37.
DOBOSI 1996a	V. T. Dobosi: Eastern or Central? Gravettian connections/Hungary. Vostochnyj gravett. Moszkva 1998. 125–134.
DOBOSI et al 1988	V. T. Dobosi—B. Jungbert—Á. Ringer—I. Vörös: Palaeolithic settlement in Nadap. Folia Arch 39. 14–40.
DOBOSI—GATTER 1996	V. T. Dobosi—I. Gatter: Palaeolithic tools made of rock crystal and their preliminary fluid inclusion investigation. Folia Arch. 45.31–50.
DOBOSI—HOMOLA 1989	T. Dobosi V.—Homola I.: Tipológiai-technikai megfigyelések pattintott köeszközökön. Folia Arch. 40. Budapest, 1989.
DOBOSI—KÖVECSES-VARGA 1991	V. T. Dobosi—E. Kövecses-Varga: Upper Palaeolithic Site at Esztergom-Gyurgyalag. Acta ArchHung ASH 43. 233–255.
DOBOSI—SIMÁN 1996	V. T. Dobosi—K. Simán.: New Upper Palaeolithic site at Megyaszó-Szelestető. Communicationes ArchHung 1996. 5–2.
DOBOSI-VÖRÖS 1987	V. T. Dobosi—I. Vörös: The Pilisszántó I. Rock-shelter. Revision. Folia Arch 38. 1987. 7–64.
DROBNIEWICZ—GINTER—KOZŁOWSKI 1992	B. Drobniewicz—B. Ginter—J. K. Kozłowski: The Gravettian sequence. Temnata Cave. Excavations in Karlukovo Karst Area, Bulgaria. Jagellonian University Press. Cracow, 1992.
FELGENHAUER 1951	F. Felgenhauer: Aggsbach Ein Fundplatz des späten Palälithikums in Niederösterreich. Mitteilungen der Prähistorischen Kommission der Österreichischen Akademie der Wissenschaften. V. Band, Nr. 6. 1951, 160–266.
FELGENHAUER 1980	F. Felgenhauer: Ein jungpaläolithisches Steinschlägeratelier aus Stillfried an der March, Niederösterreich zur Herstellungstechnik von Mikrogravettespitzen. Forschungen in Stillfried Bd. 4, 1980, S 7-40, Taf. 1–11.
GÁBORI 1968	M. Gábori: Archaeology and prehistory of the Hungarian "Loess-Palaeolithic". La Prehistoire 1968, 183–189.
GÁBORI 1969	M. Gábori: Regionale Verbreitung paläolithischer Kulturen Ungarns. Acta ArchHung 21. 155–165.
GÁBORI 1989	M. Gábori: Die letzte Phase des Paläolithikums in Ungarn. Quartär 39/40, 131–140.
GÁBORI-CSÁNK 1978	V. Gábori-Csánk: Une oscillation climatique a la fin du Würm en Hongrie. Acta ArchHung ASH 30. 3–11.
GÁBORI-CSÁNK 1984	Gábori-Csánk, V.: A felsőpaleolitikum nyoma Budapesten. Budapest Régiségei 25.7–14.
GLADILIN—DEMIDENKO 1989	V. N. Gladilin—Yu. E. Demidenko: Upper Palaeolithic stone tool complexes from Korolevo. Anthropologie XXVII/2–3. 143–178.

MONTET-WHITE 1990 — A. Montet-White (Ed.): The epigravettian site of Grubgraben Lower Austria: the 1986 and 1997 excavations. ERAUL 40, Liége 1990.

MONTET—WHITE—LAVILLE—LEZINE 1986 — A. Montet—White—H. Laville—A. M. Lezine: Le paléolithique en Bosnie du Nord, Chronologie, Environment, et Prehistoire. L'Anthropologie 90, 1986. 229–288.

MUSSI—ROEBROEKS 1996 — M. Mussi—W. Roebroeks: The Big Mosaic. Current Anthropology 37. 697–699.

NEUGEBAUER-MARESCH — Ch. Neugebauer-Maresch. Altesteintzeit im osten Österreichs. Wissenschaftliche Schriftenreihe Niederösterreich.Wien.

OLIVA 1989 — M. Oliva: Výzkum mladopaleolitické stanice u Milovic, Okr. Breclav výsledky trí uplynulých sezón. (The Excavation of the Milovice Upper Palaeolithic Site Three- years Results.) Soucasný stav perspektivy výzkumu kvartéru v CSSR. (The Present State and Perspectives of Quaternary Research in Czechoslovakia. Brno 1989. 102–116.

OTTE 1980 — M. Otte: Les groupes Gravettiens en Europe Centrale. In: Colloque International L'Aurignacien et le Gravettien (Périgordien) dans leur cadre écologique. Nitra, 1980.

OTTE 1981 — M. Otte: Le Gravettien en Europe Centrale. Disstertation Archaeologicae Gandenses De Tempel Brugge, 1981.

OTTE 1990 — M. Otte: Révision de la séquennce du Paléolithique Supérieur de Willendorf (Autriche). Bulletin de L'Institut Royal des Sciences Naturelles de Belgique 60. 1990.

OTTE—KEELEY 1990 — M. Otte—L. H. Keeley: The Impact of Regionalism on Palaeolithic Studies. Current Anthropology Volume 31. Number 5. December 1990.

OTTE et al. 1996 — M. Otte—P. Noiret—V. Chirica—I. Borziak: Rythme evolutif du gravettien oriental. UISPP-Colloquium XII.Forli, 1996. 213–226.

PAUNESCU 1993 — A. Paunescu: Ripiceni-Izvor Paleolithic si mezolithic. Biblioteca de arheologie LII. Bucuresti, 1993.

PÉCSI 1992 — M. Pécsi: Loess of the last glacition. Atlas of Palaeoclimates and palaoenvironments of the Northern Hemisphere. Budapest-Stuttgart, 1992.

PINCZÉS 1960 — Pinczés Z.: A Zemplén hegység déli részének természeti földrajza. Manuscript. Budapest, 1960.

PINCZÉS 1977 — Z. Pinczés: Periglacial planation surface and sediments in the Hungarian Mountains. Földrajzi Közlemények 25/1977. 45–55.

RINGER 1988 — Á. Ringer: Possible correlations between loess and cave deposit stratigraphies for the upper Pleistocene in Hungary. In: Paleogeography of Carpathian Regions. Budapest, 1988. 65–5.

RINGER 1993 — Ringer Á.: Északkelet-magyarországi geomorfológiai szintek és régészeti adataik. Miskolc 1993. Manuscript

ROGACHEV—ANIKOVICH 1984 — A. N. Rogachev—M. V. Anikovich: Pozdnyij paleolit Russkoj ravnyinü i Krima. in: Paleolit SzSzSzR. Boriszkovszkij, I., I. (Ed.). Moszkva, 1984. 162–271.

ROGACHEV—SINITZYN 1982 — A. N. Rogachev—A. A. Sinitzyn: Kostenki 15 (Gorodtzovskaia stoianka) In: Palaeolithic of the Kostenki-Borshevo area on the river Don 1879–1979. N. D. Praslov – A. N. Rogachev,(Eds.) Leningrád, i 1982. 162–170.

SIMÁN 1988 — Simán K.: Települési formák Borsod-Abaúj- Zemplén megye területén a paleolithikum idején. Herman Ottó Múzeum Évkönyve XXV–XXVI. 55–67.

SIMÁN 1989 — K. Simán: Northern flint in the Hungarian Palaeolithic. In: "Northern" (Erratic and Jurassic) flint of south Polish origin in the Upper Palaeolithic of Central Europe. Kraków, 1989. 87–94.

SIMÁN 1989a — K. Simán: Hidasnémeti – Upper Palaeolithic Site in the Hernád-valley (Northeast Hungary). Acta Archaeologica Carpathica 28/1989. 5–24.

SIMÁN 1990 — K. Simán: Populatian fluctuation in the Carpathian Basin from 50 to 15 thousand years BP. Acta ArchHung ASH 42. 13–9.

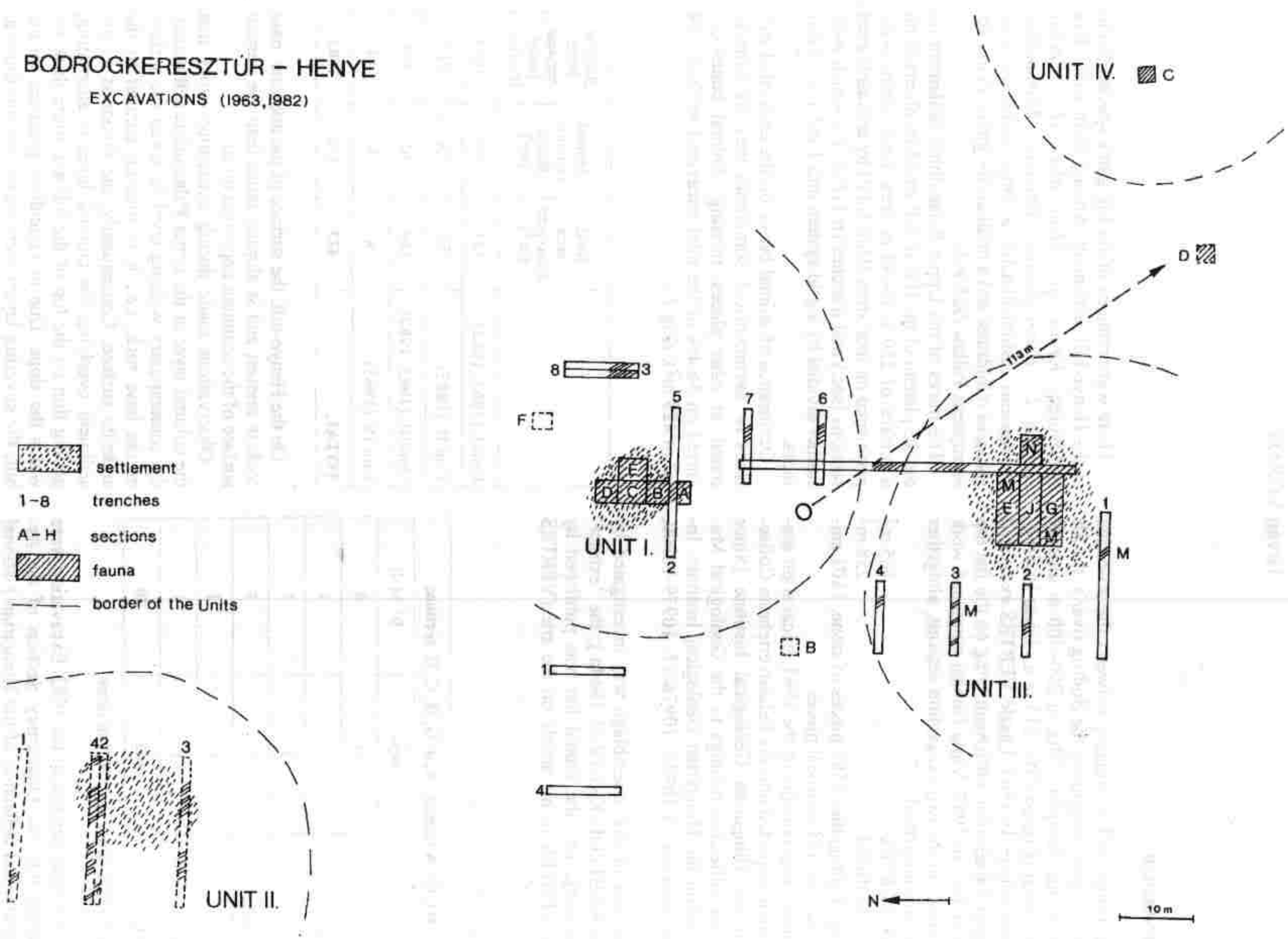


Fig. 1 Bodrogkeresztúr-Henye. Excavation areas of the Upper Palaeolithic site. Units I.–II.–III.–IV.

Table 2. Bodrogkeresztúr–Henye. Distribution of animal remains on the hunting station (Number of specimens)

Unit	I. 1982.											II. 1982.					III. 1963.					'82		IV. 1963.		Total
Section	D.	C.	E.	B.		A.					Sum					Sum	H.		E.	J.	G.		Sm.	C	D	
Trench					2.		3.	8.	7.	6.		1.	4.	2.	3.			A.				1–4.				
Surface m^2	4	12	5	8	3	5	5	5	5	5	57	10	10	6	2	28	2	12	14	6	10	7	61	4	4	154
Equus	3	189	26	35	8	4	8	–	4	7	284	4	24	15	3	46	6	39	11	10	24	52	142	1	10	483
Alces	17	43	1	12	–	12	–	–	–	–	85	16	12	11	1	40	6	16	12	40	9	14	97	–	2	224
Mammuthus	1	12	–	–	–	–	–	–	–	–	13	–	–	–	–	–	–	9	1	–	5	5	20	1	8	42
Bison	–	1	1	–	–	–	–	–	–	–	2	–	–	–	–	–	–	3	2	2	1	–	8	–	–	10
Cervus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	1	3	–	1	5
Leo	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2	–	–	2
Lepus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
	21	245	28	47	8	16	8	–	4	7	384	20	36	26	5	87	12	67	27	53	40	73	272	2	22	767
Bone frag.^{x}	22	398	73	153	7	26	–	+	14	6	699	–	45	71	9	125	–	57	55	+	–	90	202	–	10	1036
Total	32	643	101	200	15	42	8	+	18	13	1083	20	81	97	14	212	12	124	82	53	40	163	474	2	32	1803

+ Data from the excavation diary

x UnIB

I. 82. B. sec

2. □	*Equus*	2 - tib. diaph. fr. (2 ps)
3. □	*Equus*	11 - 3 M sup fr.,brain skull fr., s.tib. diaph. fr. (7 ps)
	Alces	3- stenebra fr., s. mt. diaph., mp. diaph. fr.
	UnIB	19 ps.
4. □	*Equus*	3 - d. tib. diaph., d. astragalus fr., d. calc. fr.
5. □	*Equus*	3 - d I^{2-3}, tib. diaph. fr.
6. □	*Alces*	7 - 2 hum. diaph. fr., s. hum. distr. fr., d. mc. dist. fr., d. mt. 2 trochleae, mp. diaph. fr.
7. □	*Equus*	7- hum. diaph. fr., d. (?) calc. fr., os cuneiforme lat. (T_3), os cuboideum ((T_{4-5}), d. mt. prox., 2 mt. diaph. fr.
8. □	*Equus*	5 - d. P^4 - M^{1-3}, d. astragalus
	UnIB	3 ps.
9. □	*Equus*	4 - d. rad.-ulna prox., rad. prox fr. (juv.), d. os ph. I. post.
	Alces	2 - s. tib dist. fr. (2 ps)
	UnIB	3 ps.

I. 82. C. sec

1. □	*Equus*	12 - s. tib. dist. diaph. (juv., 12 ps)
2. □	*Equus*	25 - s. $M_{1/2}$, d. rad. diap. (3 ps), os capitatum (C_3), d. pelvis (6 ps, burnt), fem. diaph. (4 ps), tib. diaph. (3 ps), d. tib. dist., mt. diaph. fr., $mp_{2/4}$ prox. fr., os sesamoideum prox., os ph. II. prox. fr., os ph. II. dist. (burnt), os ph. III. fr.
	Alces	4 - s. hum. dist. diaph. (juv.), 2 mc. diaph. fr., os ph. I. prox. fr.
	UnIB	14 ps.
3. □	*Equus*	8 - pelvis fr. (juv., 4 ps), d. tib. prox.-dist. diaph. (4 ps)
	UnIB	3 ps.
4. □	*Equus*	9 - s M_3, s. pelvis fr., d. fem. prox. (6 ps), os naviculare (T_c)
	Alces	1 - mp. prox. diaph.fr.
	UnIB	6 ps.
5. □	*Equus*	41 - 3 M sup. fr., s $M^{1/2}$, s $P_{3/4}$ fr., d $P_{3/4}$, d. $M_{1/2}$ fr., corpus mandibulae fr., hum. diaph. fr. (4 ps), s. rad. prox., 3 rad.prox. med. fr., mc.prox. fr., 2 mc.diaph.., s. mc. dist., $mp_{2/4}$ prox. fr., 2 s. caput fem., 2 fem. prox. fr., 2 fem. dist.fr., 2 tib. prox. fr., tib.diaph.. fr. (8 ps), s.-d. tip. dist., s. calc., d. os ph. II. post.
	Alces	7 - 2 tib.diaph.fr., d. mt. prox. fr., (4 ps), d. mt. diaph.
	UnIB	43 ps.
6. □	*Equus*	12 - d P^4, d. ram. mandibulae fr., d $P_{3/4}$ fr., s. M_2, hum. prox. diaph. fr., d. pelvis (burnt), d. tib. diaph. fr. (5 ps), os ph. II. prox (burnt)
	Alces	2 - mc. dist. diaph. fr. (2 ps).
	UnIB	16 ps.
7. □	*Equus*	2 - d. hum. diaph. fr. (2 ps).
	UnIB	5 ps (burnt).
8. □	*Equus*	2 – d. mt. dist., os ph. III. fr.
	Alces	12 - rad. diaph. fr. (4 ps), fem. diaph. fr. (3 ps), s.-d. tib. dist., mt. prox. fr. (3 ps).
	UnIB	6 ps.
9. □	*Equus*	15 - d P^2 fr., s. P_2, s. $P_{3/4}$ 2 M inf. fr., corpus mandibulae oral fr., d. rad. prox fr., rad.diaph.. fr., (2 ps), fem. diaph. fr. (3 ps), d. os ph I. dist. ant. (?), d. os ph. II. fr. post., s. os ph II. ant.

I. 82. 3. tr. – 100–110 cm		
	Equus	7- s. I^1 (juv.), s. $dp^3 + P^3$, s. P^2 (juv.) s. M^{1-2}, M^3 (germ).
I. 82. 3. tr. S. part, 130 cm		
	Equus	1 - costa fr.
I. 82. 6. tr. "in deep-ploughed soil" –60, –80 cm		
	Equus	7 - s. tib. dist. diaph. (2 ps), s. astragalus - calc., s. os cuboideum (T_{4-5}), mp.diaph. fr. (2 ps)
	UnIB	6 ps.
I. 82. 7. tr.		
	Equus	4 - vert. cervicalis fr., 3 costa fr.
	UnIB	14 ps.
I. 82. 8. tr.	"burnt bones"	(data from the excavation register)

2.2. Unit II. *(Fig. 3.)*

Description of the trenches from N to D:

II. 82. 1. tr. 10–20 m			
		Equus	1 - d P^2 fr.
		Alces	7 - corpus mandibulae fr., mp. diaph.fr. (6 ps).
	16. □60–70 cm	*Equus*	3 - s. mc. dist. fr. (3 ps).
		Alces	9 - costa fr. (burnt), d. tib. dist. (8 ps).
II.82.4 tr.			
	1. □	*Equus*	7 - d. M^{1-2}, 2 costa fr., d. rad.dist. fr., 2 rad. diaph. fr., os ph. I. dist. post.
	5. □	*Equus*	1 - tib. diaph.fr.
	6. □	*Alces*	2 - tib. diaph.fr., mc. diaph. fr
	7. □	*Equus*	8 - d. rad.-ulna prox., rad. diaph. fr. (6 ps).
		UnIB	3 ps.
	8. □	*Equus*	1 - s. pelvis fr.
		Alces	4 - magnum (C_{2+3}), os uncinatum (C_{4+5}), os scaphoideum (C_r), os triquetrum (C_u)
		UnIB	12 ps.
	12. □	UnIB	9 ps.
	13. □	*Alces*	5 -costa fr. (3 ps)., 2 mp. diaph.fr.
		UnIB	8 ps.
	14. □	UnIB	3 ps.
	16. □	*Alces*	1 - s. mc.prox.
	20. □	*Equus*	7 - d. caput fem., tib. dist. fr. (5 ps), os ph. II. prox. ant.
		UnIB	10 ps.
II.82.2. tr.			
	1. □	*Equus*	1 - d. os ph. II. ant.
	8. □60–70 cm	*Equus*	2 - M sup. fr., fem. dist. lat. fr.
		Alces	8 - P sup., d. tib.dist., d. astragalus, d. calc., d. os ct.fr., d. os cuneiforme interm. et lat. (T_{2+3}), d. mt. prox., mt. diaph. fr.
		UnIB	49 ps (20 burnt)

11. □	*Equus*	9 - d. I^1, d. os zygomaticum fr., carpale fr., os capitatum (C_3), os lunatum (C_i), os triquetrum (C_u), s. mc. dist., mt. dist. lat. trochlea (burnt), s. os. ph. I. prox. lat. fr. ant.
	Alces	3 - s. corpus mandibulae fr. + M_{2-3}, s. mt. prox. fr., os lunatum (C_1)
	UnIB	8 ps.
14. □	*Equus*	2 -caput hum. fr., tib. diaph. fr.
	UnIB	6 ps.
18. □	*Equus*	1 - tib.diaph. fr. (L 210 mm)
	UnIB	8 ps.

II.82. 3. tr. E part (1–10 m)

	Equus	2 - M sup. fr., d. hum.dist.diaph. fr.
	UnIB	2 ps.

II.82. 3. tr. W part (10–20 m) –65, –70 cm

	Equus	1 - s. corpus mandibulae + dp_{2-4}, M_{1-2}.
	Alces	1 - tib. dist. fr.
	Cervus	1 - s. tib.dist.
	UnIB	7 ps.

2.3. Unit III. *(Fig. 4.)*

III.63. A tr. 26–30 m

	Equus	2 –s. M_3., d. tib. dist.,
	Bison	2 – mp. dist. trochlea, os ph. II.
	Mammuthus	4 - tooth lamella fr., diaph. fr. (3 ps, tib.?).

III.63. A tr. 36–39 m. (area adjoining III.63. E. sec. 28-29-30 □, *Fig. 5.*)

36. □	*Equus*	3 - s. I_3, os scaphoideum (C_r) fr., s. mc. dist.
	Alces	3 - s. $M^{1/2}$, I inf. (juv.), d. tib.dist.epiph. fr. (juv.).
37. □	UnIB	12 ps. (data from excavation register)
38. □	*Equus*	10 - s. praemaxilla + I^{1-3}, d. I^1, d. corpus mandibulae fr. + $M_{1/2}$, costa fr., rad. prox. fr. (2 ps), d. fem. dist. epiph. fr., patella fr., tib. diaph. fr. (2 ps).
	Alces	3 - d. corpus mandibulae (inf. 8-10 months old), s. corpus mandibulae fr. (ad.), s. ram. mandibulae fr.
	UnIB	2 ps (diaph. fr.).

III.63. A tr. 39-42 m. (area adjoining III.63. J. sec. 28-29-30 □ (*Fig. 5.*)

40. □		48 bone ps. (data from excavation register)
41. □		30 bone ps.
42. □		2 bone ps.
Of these remaining:		
	Equus	10 - d. I^1, s. I^{1-3}, d. P^2, 1 s. - 2 d. $M^{1/2}$, d. corpus mandibulae fr. + $P_{3/4}$, os ph.I. ant. fr.
	Alces	8 - d. max. fr. + dp^{2-4}, d. max. fr. M^1, (M^2 germ), d. $M^{1/2}$, s.-d. mandibula symph. fr., d. corpus mandibulae + P_4 - M_{1-3}, s. M_3, d. mc. prox.
	Mammuthus	5 - "surface stray find" praemaxilla fr.; 2 costa (H. 190, 360 mm) M sup. aboral fr. tooth lamella fr.
43. □	UnIB	1 sp (data from excavation register)

III.63. A tr. "stray finds" (probably 39–42 m.)

	Equus	14 - I sup. fr. 2 d. $P^{3/4}$, M sup. fr., s. M^3, d. M^3 fr., d. P_2, d. $P_{3/4}$, d. M inf. fr., d. $M_{1/2}$, 2 s. - 2 d. M_3

	Alces	2 -. rad. dist., d. tib. dist.
	Bison	1 - s. astragalus

III.63. H sec., "disturbed layer"

	Equus	6 - s. $P^{3/4}$, M sup. fr., d. $M^{1/2}$, d. M^3, d. $M_{1/2}$, d. mc. dist.
	Alces	6 - cast right side antler beam, 2 P sup., d. rad. dist. epiph., s. uncinatum (C_{4+5}), d. os lunatum (C_i).

III.63. E sec., *(Fig. 6.)*

Data from excavation register:

3. □–100 cm	1 bone ps.
22. □	10 bone ps.
25. □	14 bone ps.
26. □	2 bone ps.
27. □	1 bone ps.
28. □	10 bone ps.
29. □	8 bone ps.
30. □	9 bone ps.

We have no further information on the large, cca. 95–100 cm long object published from E sec. 30. □ (VÉRTES 1966. Fig.2.) It did not appear in the bone material investigated (KRETZOI 1964 a). In the excavation register, there were drawings of 8 animal bones and one tooth beside this object (VÉRTES HNM Archives V. 94. 1965)

III.63. E sec.

2. □ 100 cm "cultural layer"		
	Equus	2 d. corpus mandibulae fr., + M3, d. hum. dist. med. fr.,
	Alces	3 -s.-d. magnum (C2+3), s .unicatum (C4+5)
8. □	*Alces*	3 – corpus mandibulae fr., s. ang. mandibulae fr., s. scap. dist fr.
13–15. □	*Equus*	5 - 2 d. $P^{3/4}$ (juv., ad.), d. $M_{1/2}$), s. hum. prox. fr. (juv.), d. tib. dist. fr.
	Alces	2 - s. ram. mandibulae fr., scap. fr.
	Mammuthus	1 – d. m^2
24. □	*Alces*	1 - s. corpus mandibulae + P-M.
	Bison	1 - s. mc. dist.

III.63. E sec. "disturbed layer"

	Equus	4 - s. $M^{1/2}$, d. $M_{1/2}$, d. hum. dist. med. fr., d. os ph. II. post. (?)
	Alces	3 - s. os unicatum (C4+5), s. os lunatum (Ci), s. os triquetrum (Cu).
	Cervus	1 – end of antler tine (L. 57 mm)
	Bison	1 - s. astragalus

III.63. J sec. (Fig. 6)

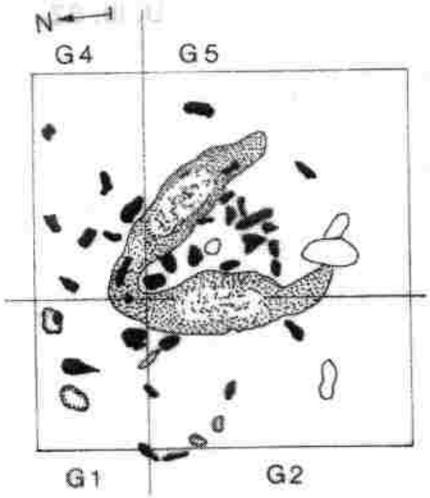
According to excavation register, there were "one-two, more or less and sometimes abundant" remains of animal bones in the following □-s:
4–5., 8–9., 10., 13., 17., 19–20., 24.

1. □	*Equus*	2 - s. M^3, d. astragalus fr.
26–29. □	*Alces*	5 - s dp_4 fr., d. P_4, 2 s. – 1 d. corpus mandibulae fr.
28. □	*Equus*	2 - d. hum.dist. med. fr., d. tib.dist. (juv.).
	Alces	13 - d. $M^{1/2}$, s. M^3, M sup. fr., s. $di_{2/3}$, dp_{2-3}, s. corpus mandibulae + dp_{2-4}, d. corpus mandibulae fr. + $M^{1/2}$, d. rad. prox., d. olecranon fr., 2 mt. diaph. fr., os ph. II. prox. fr. post.

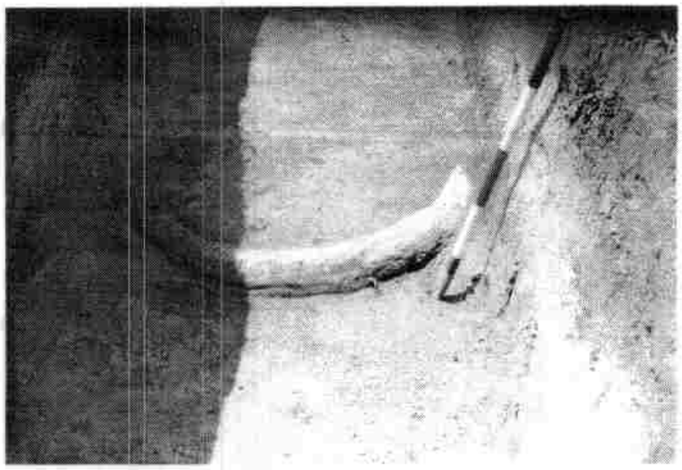
27–30. □	*Equus*	3 - d.rad.dist. fr. (juv.), patella fr., s. tib. dist. fr.
	Alces	18 - d. max. fr. + P^{3+4}, s. dp^{2-4}, d. dp^{2-3}, s. P^3, 3 d. $M^{1/2}$, d. corpus mandibulae + P+M., d. dp_{2-4}, s. $M_{1/2}$, tib. dist. fr., os ph. I. med. post., os sesamoideum prox.
	Cervus	1 - d. tib. dist.
	Bison	2 - d. os centrotarsale med. fr., mp. dist. trochlea fr.
30. □	*Alces*	1 -d. corpus mandibulae + P+M
III.63. J sec. ("disturbed layer")		
	Equus	3 - s. ram. mandibulae fr., M. sup. fr., d. tib. dist. fr.
	Alces	3 - s. corpus mandibulae + dp_{2-4} M_{1-2} (14-16 months old), d. ram mandibulae fr., d. astragalus
III.63. G sec. *(Fig. 6.)*		
2. □	*Mammuthus*	2 - fem. diaph. fr. (2 ps).
5. □	*Mammuthus*	3 - pair of mandibulae (Fig. 8.1.) fem. diaph. fr. (2 ps)
19. – 22. – 25. – 28. □		
	Equus	8 - s. $P^{3/4}$, d. $dp_{3/4}$, d. $P_{3/4}$, s.-d. $M_{1/2}$, s. hum.dist. fr., hum. dist. fr., s. os naviculare (Tc).
22. □	*Alces*	1 - d. corpus mandibulae + P+M.
21. – 24. – 27. – 30. □		
	Equus	9 - s.-d. I_1, s. I_{1-3}, d. I_3, s. mandibula oral fr., s. tib.dist. fr., tib. diaph. fr.
	Leo	1 - d. mt 3.

III.63. D sec. "during excavation" –50, –60 cm (Probably the area between the squares 28. – 19. – 21. –30. □, the Eastern part of the section)

	Equus	7 - right side brain skull fr., s. $P^{3/4}$ fr., d. $M_{1/2}$, M_3 fr., s.-d. rad. prox. fr., mp. dist.fr.
	Alces	8 - brain skull fr. (5 ps), $I_{1/2}$ (germ), $P_{3/4}$, d. mc. prox.fr.
III. 82. 1. tr *(Fig.7.)*		
5. □	*Equus*	6 – oral fr. of mandibula, s. astragalus fr., s. calc. fr., mt.prox. fr., mt. dist. fr., $mp_{2/4}$ prox. fr.
	Mammuthus	3 - s.-d. mandibula symph. fr., M inf. fr.
III. 82. 2. tr		
6. □	*Equus*	3 - d. tib. dist. fr. (3 ps).
	Mammuthus	2 – tusk fragment (L: 1800 mm, greatest diam.: 110 mm, (Fig. 8.2.), s. fem. diaph. fr.
III. 82. 3. tr		
4. □	*Equus*	7 - c. fem. fr., fem. diaph. (2 ps), tib. diaph. (4 ps).
	Alces	3 - costa fr. (3 ps).
	UnIB	20 ps.
7. □	*Equus*	13 - 6 costa fr s.scapula fr. (3 ps),., d. hum dist. (2 ps), d. rad. prox. fr., tib.diaph.
	Alces	3 - costa fr. (2 ps), os ph.I. dist. fr.
9. □	*Equus*	1 – sP_2
	Alces	2 – s.-d. corpus mandibulae
	Leo	1 – os ph. I. s. I. post.
	UnIB	10 ps.



1.



2.

Fig. 8 Bodrogkeresztúr-Henye, Unit III. 1. 63. G sec. anvil made of mammoth mandible (After Vértes 1966 Fig. 5., completed / corrected), 2. 82. 2. tr. mammoth tusk.

2.4.Unit IV. (Fig. 1.)

IV. 63. C. sec.

Equus	1 - astragalus fr.,
Mammuthus	1 - M sup. fr.

IV. 63. "stray finds" (=D. sec.)

Equus	10 - s. P^2 (juv.), 3 s. $P^{3/4}$, 2 d. $P_{3/4}$, 2 d. $M_{1/2}$, d. M_3 fr. rad. diaph. fr.
Alces	2 - 2 M inf. fr.
Cervus	1 - s. mc. dist. fr.
Mammuthus	8 - M fr., long bone fr. (7 ps)
Lepus	1 - ulna fr. (data from excavation register and KRETZOI 1964a, lost).
UnIB	10 ps.

3. Zoological and palaeontological characterisation of the animal species

3.1.Equus

Equus remagensis SKORKOWSKI 1933., Equus "germanicus" (NEHRING 1884)

483 remains - 50 individuals

3.1.1. Anatomical of the Equus remains

At the Palaeolithic campsite Bodrogkeresztúr–Henye, 483 pieces of *Equus* bones could be identified. The anatomical division of these are listed below:

Head region
3 brain skull fragments (basioccipitale),
2 facial skull fragments (praemaxilla fr., os zygomaticum),

Table 3. Bodrogkeresztúr-Henye. Anatomical distribution of the *Equus* remains on the hunting station (Number of specimens)

Unit					I.						II.							III.					IV.		To-tal
Section	D.	C.	F.	B.		A.								H.		E.	J.	G.					C.	D.	
Trench					2.		3.	7.	6.	1.	4.	2.	3.		A.				1.	2.	3.	4.			
barin skull		1		1														1							3
facial skull												1			1										2
I sup.		3	2	2			1					1			6										15
P sup.		3	1	1			3			1				1	3	2		2						4	21
M sup.		5		6	1		3				1	1	1	3	6	1	2								30
mandb.		5											1		2	1	1	1	1						12
I inf.		1													1			6							8
P inf.		5	1												2			2			1			2	13
M inf.		10												1	7	2		4				1		3	28
verteb.								1																	1
costa							1	3			2				1						6	8			21
scapula		11	1																		3				15
hum px												1				1						2			4
dph		7	2	1									1					1							12
dt		1														2	1	1			2	1			8
rad px		7		2							1				2			2			1				15
dph		5				2					8													1	16
dt											1						1								2
ulna				1							1														2
carpal		2				1						4			1										8
mc px		1																							1
dph		2																							2
dt		1								3		1		1	1										7
pelvis	2	18									1											1			22
fem px		5									1										1	1			8
dph		17	8																		2	3			30
dt		2										1			1										4
patella															1		1								2
tib px		3																							3
dph	1	39		11	7				2		6	2			2			1			5	5			81
dt		3													1	1	3	1		3					12
astg.			1	2					1								1		1				1		7
calc.		2		2					1										1						6
tarsal		1		2					1									1							5
mt px				1															1						2
dph		1		2																					3
dt		1										1							1						3
mc/mt dph		8	5						2									1	1						17
ph I.		7	3	1							1	1			1										14
II.		7	2								1	1				1									12
III.		2																							2
sesam.		3				1																			4
Total	3	189	26	35	8	4	8	4	7	4	24	15	3	6	39	11	10	24	6	2	21	22	1	10	483

Table 4. Bodrogkeresztúr-Henye, Dimensions of the upper cheek teeth of *Equus* (measured at the occusal surface; in mm)

	P^2		$P^{3/4}$								
1.	38,5	39,0	29,6	30,0	30,0	30,0	31,0	31,5	32,5	34,0	34,0+
2.	26,5	26,5			30,0	31,0	30,0	30,5		29,5	28,0
3.		75,0	45,0	75,0	54,0	64,0	58,0	60,0	83,0	85,0	
4.					14,50	14,0	15,5	14,0	17,0	11,5	15,0
5.					48,40	46,7	50,0	44,5	52,3	33,8	44,2
6.	10,2	10,4			9,0	9,3	9,7	9,6		10,0	9,2
7.	1,45	1,47			1,00	0,96	0,98	1,03		1,15	1,17
			mat		mat						

	$P^{3/4}$		$M^{1/2}$								
1.	35,0	35,0	26,0	28,0	28,0	28,5	31,0	32,0	32,0	32,0	33,0
2.		32,0	26,0	28,5	29,0	28,5	30,0	27,0	28,0	28,1	26,0
3.	75,0	96,0	76,0	65,0	65,0	85,0	86,0	80,0	98,0	88,0	90,0
4.		13,0	14,0	13,5	15,0	15,5	14,8	12,0		16,0	15,0
5.		37,1	53,8	48,2	53,5	54,3	47,7	37,5		50,0	45,4
6.		11,2	6,7	7,9	8,52	8,2	9,3	8,6	8,9	9,0	8,6
7.		1,09	1,00	0,98	0,96	1,00	1,04	1,18	1,14	1,13	1,27

	M^3				
1.	28,0	28,0	28,0	30,0	32,5
2.	24,0	25,0	26,0	23,0	27,1
3.	66,0	75,0	55,0	85,0	66,0
4.	16,0		15,0	13,0	11,1
5.	57,2		53,5	43,4	34,2
6.	6,7	7,0	7,3	6,9	8,8
7.	1,17	1,12	1,08	1,30	1,20
		sad	mat		

1. length, 2. breadth, 3. height, 4. length of Pc., 5. Index of Pc., 6. occlusal surface measure (cm^2), 7. proportion length to breadth + = embryyo (not yet erupting; the tooth crown was still sunk down in the alveolus

Lower teeth from Henye hill:

	NOBIS categories		
	A. I.	A. II.	A. III.
P_2		2	2
$P_{3/4}$	1	2	–
$M_{1/2}$	4	1	1
M_3	2	3	–

Lower teeth height (mm)

	juv				Subad			ad.			mat.		sen	
P_2									58				35	28
$P_{3/4}$			84					60				50	54	45
$M_{1/2}$	95	90		80		75					52			28
M_3					78		70	60	58	56				

Average height of the lower teeth in A. I. was 81,72 (n = 7), 95–70 mm; in A. II., 56,28 (n = 7) 60–50 mm.
Average height of lower teeth (in mm):
$M_{1/2}$ (n = 4) 85,00 95–75
M_3 (n = 2) 74,00 78–70

nomenon that the high tooth crown of horses is getting gradually narrow towards the neck of the root. Consequently, the length – width data of the chewing surface gradually decrease by the advance of age. The "macrodontous" dentition becomes "microdontous". The width data of the crown, especially on the lingual side, is also influenced by the thickness of tooth cement. 60–70 mm length decrease (tooth abrasion) can result in decreasing the chewing surface by 5–6 mm^2.

M1/2 between them. The decrease of breadth of P2 and M3 tooth column is more significant at the upper teeth than the lower ones.

Tooth finds of *Equus* at Henye are dominated by abrasion stage I. and II. Among the teeth with known height, only 2 sup. and 3 inf. were found belonging to abrasion stage III. It is characteristic of the construction of the dental columns that dimensions of different abrasion stage teeth can be similar, or slightly different from each other (*Tables 4.–5.*). Similar phe-

Table 6. Length and breadth measurement data measured at the occlusal (or grinding) surface. Statistics on the cheek teeth of *Equus* found at Henye (in mm)

	n	mean	min-max.	n	mean	min-max.	n	mean	min-max.
P^2	2		38,5–39,0	2	26,5				
$P^{3/4}$	12	31,95	29,5–35,0	8	30,43	29,0–32,0	9	14,45	11,5–17,0
$M^{1/2}$	10	30,25	26,0–33,0	10	27,91	26,0–30,0	9	14,26	12,0–16,0
M^3	5	29,3	28,0–32,5	5	25,02	24,0–27,0	4	13,78	11,1–16,0
P_2	4	35,47	33,4–38,0	4	17,05	15,0–18,2			
$dp_{3/4}$	2		33,0–35,0	2		15,0–16,5			
$P_{3/4}$	9	30,95	29,5–35,0	10	19,06	17,0–22,0			
$M_{1/2}$	13	29,08	36,5–35,0	16	17,28	15,5–19,0			
M_3	6	34,42	33,0–36,5	8	14,68	13,5–16,5			

The length – breadth and height values of the teeth are presented in *Table 4–5.*

It seems that in the dental set of the Upper Pleistocene horses the length – breadth dimensions of the lower P2 and M3 are more unified on individual and phylo- chronoevolutionary level than that of P3/4 and

nomenon could be observed in case of the horses found at Ságvár, where all teeth belonged to A.III., but apart from the normal "old age microdonts", there were also mesodont size teeth found as well *(Tables 7.–8.)*. On species evolutionary level, "prismatic" tooth with parallel walls and "truncated pyramidal"

Table 7. Comparison of measurements of *Equus* upper teeth from Bodrogkeresztúr and other UP sites (in mm)

Teeth/Site	length			breadth			Protocon length		
	n	x	min-max	n	X	min-max	n	x	min-max
P^2									
Bodrogkeresztúr	2	38,75	38,5–39,0	2	26,5				
Pilismarót-Bh[1]	1		41,0	1		28,0			
Kiskevély[3] ML	2	40,00	40,0	2		27,0–28			
LL	1		45,0	1		36,0			
Nadap[6]	7	37,85	34,0–41,5	4	25,38	23,0–28,5			
Ságvár[7]	4	36,5	34,0–38,0	4	24,55	20,0–26,2			
Combe Grenal[8]	25	39,08	36,0–41,5	33	26.48	24,0–29,0			
Solutré[8]	8	36,82	35,0–38,7	8	24,86	23,2–26,0			
Willendorf II.[9]	2		34,5–36,5	2		25,0–27,0			
Tilde[10]	9	39,18	36,5–41,2	8	27,67	25,8–29,8			
Sandalja II[11] E-F	1		39,1	1		26,8			
G-H	6	39,40		8	26,00				
Temnata[8] V.	8	39,06	38,1–40,3	8	25,74	22,5–28,1			

Table 7. cont. (4)

Teeth/Site	length			breadth			Protocon length		
	n	x	min-max	n	X	min-max	n	x	min-max
M^3									
Bodrogkeresztúr	5	29,30	28,0–32,5	5	25,02	23,0–27,0	4	13,78	11,1–16,0
Pilismarót-Bh[1]	3	29,70	28,5–31,5	2		24,0–28,0	3	15,30	14,5–16,0
Kiskevély[3] ML	2		28,0–29,0	2	25,0		2		15,0–16,0
Nadap[6]	3	25,67	25,0–26,0	3	22,67	22,0–23,5	1		12,0
Ságvár[7]	2		27,0–28,0	2		24,0–24,5	2	15,00	
Combe Grenal[8]	46	26,69	23,0–32,5	49	23,82	18,0–29,0	55	14,59	11,5–19,0
Solutré[8]	4	27,07	26,0–28,3	3	22,84	22,5–23,0	3	14,80	14,4–15,5
Willendorf II.[9]	2		30,0–30,5			24,5			
Tilde[10]	6	27,58	25,8–29,0	7	22,84	21,0–23,9	7	14,62	12,8–16,2
Sandalja II[11] E-F	3	28,20		3	22,20				
G-H	7	27,30		5	22,10				
Temnata[8] V.	2		26,0–30,0	2		23,0–24,6	2		14,5–15,7

1. VÖRÖS 1990a. Tabl. 1.; 2. VÖRÖS 1986b. 37; 3. VÖRÖS 1994. Tab. 3.; 4. VÖRÖS 1989. Tab. 2.; 5. VÖRÖS 1987c. 43.; 6. VÖRÖS 1988b. Tabl. 2.; 7. VÖRÖS 1982. Tabl. 1.; 8. DELPECH–GUADELLI 1992. Tabl. 28, 31–35.; 9. THENIUS 1959. 160.; 10. RIEDEL 1980. Tabl. I.; 11. FORSTEN 1990. Tabl. 2.; 12. FORSTEN 1982. Tabl. I.

Table 8. Comparison of measurements of *Equus* lower teeth from Bodrogkeresztúr and other UP sites (in mm)

Teeth/Site	length			breadth		
	n	x	min-max	n	X	min-max
P_2						
Bodrogkeresztúr	4	35,47	33,4–38,0	4	17,05	15,0–18,2
Kiskevély C. LL[2]	1	38,50	38,5	1	18,05	18,5
Nadap[4]	5	35,00	31,0–38,0	5	16,20	15,0–18,0
Ságvár[5]	11	34,09	30,5–36,0	11	17,02	15,0–19,0
Pilisszántó II. Rsh.[1]	1	34,00	34,0	1	16,0	16,0
Combe Grenal[6]	49	34,17	29,0–38,0	51	15,39	13,0–18,0
Solutré[6]	16	32,87	29,0–35,6	17	15,12	13,5–18,0
Tilde C T_1[7]	6	34,55	30,3–37,9	7	16,76	16,4–18,4
Sandalja II C. E-F[8]	4	35,5		2	15,00	
G-H	6	35,6		5	15,4	
Temnata C.[6]	6	34,64	33,3–35,5	6	16,8	16,0–18,0

Table 8. cont. (2)

Teeth/Site	length			breadth		
	n	x	min-max	n	X	min-max
$P_{3/4}$						
Bodrogkeresztúr	9	31,95	29,0–35,0	10	19,0	17,0–22,0
Pilisszántó II. Rsh.[1]	5	31,05	28,0–32,0	5	18,04	16,5–21,0
Kiskevély V. LL[2]	5	30,80	30,0–33,0	4	20,75	20,5–21,0
Madaras ML–LL[3]	5	29,50	28,0–32,0	5	17,04	16,0–19,0
Nadap[4]	7	28,84	27,2–30,0	7	17,56	16,5–19,0
Ságvár[5]	19	28,65	25,0–32,0	18	18,70	17,0–21,0
Combe Grenal[6]	120	29,97	25,5–34,0	112	17,54	15,0–21,0
Solutré[6]	32	28,65	26,0–30,7	32	16,55	14,3–18,3
Tilde C T_1[7]	24	31,50	26,8–35,2	24	18,2	15,5–21,2
Sandalja II C. E-F[8]	9	29,10		11	16,6	
G-H	6	29,10		6	15,9	
Temnata C.[6]	4	29,92	28,5–31,5	4	16,02	13,2–17,5
Bacho Kiro C.[9]	10	28,80	25,0–32,7	10	16,20	14,5–17,7

	n	mean	min-max.
Upper teeth			
P^2	2		10,2–10,4
$P^{3/4}$	7	9,72	9,0–11,2
$M^{1/2}$	10	8,43	6,7–9,3
$P^{3/4}$–$M^{1/2}$	17	8,96	6,7–11,2
M^3	5	7,34	6,7–8,8
Lower teeth			
P_2	4	5,73	5,1–6,6
$P_{3/4}$	9	5,98	5,4–6,7
$M_{1/2}$	13	5,07	4,4–6,1
$P_{3/4}$–$M_{1/2}$	22	5,44	4,4–6,7
M_3	6	5,08	4,4–5,4

In case of the "pyramidal" teeth, the great variation in the grinding surface can be attributed to different abrasion stages. In case of these teeth, by A. III., grinding surface can decrease almost to half of the original. In technical literature, the mean value of the sum of lower P3 and M2 teeth is also used for the characterisation of the *Equus* population of a region or a site. As there is significant difference within the same Abrasion stage between the praemolars and the molars as well as the grinding surfaces in different abrasion stages, the *Equus* tooth find of Hungarian sites were treated separately *(Tables 9.–10.)*

Table 9. Comparison of occlusal surface (in cm^2) of upper teeth of *Equus* from similar chronological period sites in Hungary

Pilismarót-Basaharc[1]			n	mean	min-max.
	A.I.	P^3-M^2	11	9,45	8,4–9,9
		$P^{3/4}$	5	10,30	9,9–11,0
		$M^{1/2}$	6	8,75	8,4–9,9
Madaras ML-LL[2]					
	A.I.-II.	P^3-M^2	4	9,30	7,3–10,4
		$P^{3/4}$	3	9,97	9,5–10,4
		$M^{1/2}$	1	7,30	7,3
	A.III.	$P^{3/4}$	1	6,80	6,8
		$M^{1/2}$	1	5,50	5,5
Kiskevély C. LL[3]					
	A.I.-II.	P^3-M^2	4	9,27	8,1–10,9
		$P^{3/4}$	2		9,2–10,9
		$M^{1/2}$	2		8,1–8,9
Pilisszántó II. Rsh.[4]					
	A.I.-II.	P^3-M^2	6	9,28	8,1–11,2
		$P^{3/4}$	5	9,28	8,1–11,2
		$M^{1/2}$	1	9,3	9,3
	A.III.	$M^{1/2}$	1	6,1	6,1
Bodrogkeresztúr-Henye			n	mean	min-max.
	A.I-III.	P^3-M^3	17	8,96	6,7–11,2
	A.I.-II.	$P^{3/4}$	6	9,85	9,3–11,2
	A.III.	$P^{3/4}$	1	9,0	9,0
	A.I-III.	$P^{3/4}$	7	9,72	9,0
	A.I.	$M^{1/2}$	1	6,7	6,7
	A.I.-II.	$M^{1/2}$	9	8,63	7,9–9,3
	A.I.-II.	$M^{1/2}$	10	8,43	6,7–9,3
Pilisszántó I. Rsh.[5]					
	A.I.-II.	$P^{3/4}$	4	8,32	7,9–8,7
	A.III.	$P^{3/4}$	1	7,2	7,2
		$M^{1/2}$	1	7,0	7,0
Kiskevély C. UL[3]					
	A.I.-II.	P^3-M^2	8	7,92	6,7–8,7
		$P^{3/4}$	4	8,52	8,1–8,7
		$M^{1/2}$	4	7,32	6,7–7,9
Nadap[6]					
	A.I.-II.	P^3-M^2	8	7,58	6,9–8,4
		$P^{3/4}$	3	7,48	7,0–8,4
		$M^{1/2}$	3	7,65	6,9–8,4
Ságvár[7]					
	A.III.	P^3-M^2	26	7,43	6,0–9,6
		$P^{3/4}$	11	8,24	6,6–9,6
		$M^{1/2}$	15	6,83	6,0–7,6

1. VÖRÖS 1990a Table 1.; 2. VÖRÖS 1989 Table 2.; 3. VÖRÖS 1994 Table 3.; 4. VÖRÖS 1986b 37.; 5. VÖRÖS 1987c 43.; 6. VÖRÖS 1988b Table 2.; 7. VÖRÖS 1982. Table 3.

In the Hungarian Upper Pleistocene *Equus* populations, the trend of changes in the grinding surface is the following (data in cm^2):

Upper teeth - P^3-M^2

	Site	mean	n
A.I-II.	Pilismarót-Basaharc	9,45	11
	Madaras Lower Level–Middle Level	9,30	4
	Pilisszántó II. Rockshelter	9,28	6
	Kiskevély Cave, Lower Level	9,27	4
	Bodrogkeresztúr–Henye	**8,96**	**17**
	Pilisszántó I. Rockshelter+	8,32	4
	Kiskevély Cave, Upper Level	7,92	8
	Nadap	7,58	8
A.III.	Ságvár	7,43	26
	Madaras Lower Level	6,15	2
	Pilisszántó I. Rockshelter	7,12	2
	Pilisszántó II. Rockshelter	6,10	1

+ only $P^{3/4}$

Lower teeth - P_3-M_2

	Site	mean	n
A.I-II.	Kiskevély Cave, Lower Level	6,17	6
	Bodrogkeresztúr–Henye	**5,44**	**22**
	Pilisszántó II. Rockshelter	5,43	8
	Madaras—Middle Level+	5,04	5
	Nadap	4,98	11
	Kiskevély Cave, Upper Level	4,96	2

Among the investigated Hungarian Upper Pleistocene populations, the average of P^3-M^2 Pc length values are given below, in decreasing order (mm):

A I.-II.	mean	n	min-max.
Madaras LL-ML	16,50	4	15,0–18,0
Pilisszántó II. Rockshelter	16,34	6	14,5–17,5
Pilismarót–Basaharc	14,62	11	12,4–18,5
Bodrogkeresztúr–Henye	**14,35**	**18**	**11,5–17,0**
Kiskevély Cave, UL	13,86	8	10,0–16,0
Nadap	13,72	8	12,1–15,0
Pilisszántó I. Rockshelter	12,17	3	11,0–13,0

A III.	mean	n	min-max.
Ságvár	13,52	25	11,3–17,0
Pilisszántó I. Rockshelter		1	16,5
Pilisszántó II. Rockshelter		1	12,0
Madaras LL	10,10	2	9,5–10,7

The higher values of Pc length (16–18 mm) occur dominantly at the $P^{3/4}$ teeth. Pc dimensions for this tooth do not change much with age: even in stage A.III., they remain about the same: see Ságvár or Pilisszántó I. Rockshelter.

The Pc length dimensions of the Henye horses again show the greatest similarity to the *Equus* horses at Tilde Cave T_1: mean 14,7, for n = 52, limit 11,5–17,2 (RIEDEL 1980. 42. Tabl. I., 6,.).

The *Equus* Pc length of Sandalja II.Cave. E-F. Level was found to be the following: mean 13,6, n - 14, G-H. Level mean 14,2, n - 33 (FORSTEN 1990. Tabl. 1.).

P^3 - M^2 Pc length of *Equus achenheimensis* was between 13,9–17,8 mm (NOBIS 1971. 36., 41).

Protoconus index (Pc length / length of the grinding surface)

	n	mean	min-max.
$P^{3/4}$	9	45,23	33,8–52,3
$M^{1/2}$	9	47,72	37,5–54,3
M^3	4	47,07	43,2–57,2

The P^3 - M^2 Pc Pc-Index average for the Henye hill horses was 46,47, large medium size. The Pc-Index average of P^3 - M^2 among the investigated Hungarian Upper Pleistocene populations are given below, in decreasing order (mm):

A I.-II.	mean	n	min-max.
Madaras LL-ML	53,12	4	44,8–59,4
Pilisszántó II. Rockshelter	51,40	6	48,4–53,8
Kiskevély Cave, UL	50,16	8	40,0–60,3
Nadap	48,85	8	44,4–53,7
Pilismarót–Basaharc	47,67	11	37,0–63,1
Bodrogkeresztúr–Henye	**46,47**	**18**	**33,8–54,3**
Pilisszántó I. Rockshelter	37,90	3	35,4–40,0

A III.	mean	n	min-max.
Ságvár	50,56	25	41,3–60,0
Pilisszántó I. Rockshelter		1	66,0
Pilisszántó II. Rockshelter		1	51,7
Madaras LL	41,0		35,1–46,9

LL: Lower Level, ML: Middle Level, UP: Upper Level

Values of the Pc-Index correlate quite well with Pc length values (e.g., Madaras 59,4; Ságvár 60,0; Kiskevély Cave UL 60,3; Pilismarót–Basaharc 63,1; Pilisszántó I. Rockshelter UL 66.0.)

By similar Pc length, the higher Pc-Index values appear at the shorter teeth.

The Pc-Index value of the Henye hill horses, 46,47 belong to the medium values, low values are found at the teeth with short Pc, high values are characteristic of the teeth with short crown.

The dentition of Upper Pleistocene horses studied so far in Hungary cannot be considered uniform because of the variation in dimensional parameters. In case of the horses with similar geological and individual age (same Abrasion stage), dimensions of Pm and M as well as the grinding surface size are basically similar, but tooth find occur in both higher and lower domains. The general trend of changes in tooth dimensions and mean values show a decreasing trend by the advance of geological age (FORSTEN 1988., 1991.)

The dentition of the Late Upper Pleistocene horses in Hungary can be classified, on the basis of size categories, as follows:

A I.-II.	Teeth	Protoconus		
Bodrogkeresztúr–Henye	L		M	L
Pilismarót–Basaharc	L		M	L
Madaras UL-LL	L	Sh		L
Pilisszántó II. Rockshelter LL	L		M	L
Kiskevély Cave, LL	L		M	
Kiskevély Cave, UL	L	Sh		L
Pilisszántó I. Rockshelter LL	L	Sh		L
Nadap	M	Sh	M	
A III.				
Ságvár	Sm | M	Sh	M	L
Pilisszántó I. Rockshelter UL	Sm			L
Pilisszántó II. Rockshelter UL	Sm		M	
Madaras LL	Sm	Sh		

L: Large/long, M: Medium, Sm: Small, Sh: Short
UL : Upper Level, LL: Lower Level

	1.	2.	3.	4.	5.	6.	7.
post.	48	61	51	57,5	34,5	25	–
	47	55	45	50	36	23,5	29
	–	63,5	–	–	38	25	–

	1.	8.	9.
Astragalus			
	–	68	60
	–	70	–
	–	–	63
Calcaneus			
	128	63	60
	–	54	–

1. length, 2. prox. epiph. breadth, 3. diaph. min. breadth, 4. dist. epiph. breadth, 5. prox. piph. diameter, 6. diaph. min. diameter, 7. dist. epiph. diameter, 8. breadth, 9. heigh

Measurements were made on breadth and diameter of prox. and/or dist. epiph. of long bones and length – breadth dimensions of os Ph. I.–II. Long bones belong typically to the large medium category with 5 exceptions.

These exceptions are the smallest within the assemblage. They are the following:
s. mc. dist (I. 82. C. sec. 5. ☐),
2 s. calc. (I. 82. C. sec. 5. ☐; I. 82. 6. tr.
os ph. I. s. post. (I. 82. B. sec. 9. ☐)
os ph. II. d. post. (I. 82. C. sec. 5. ☐)

Their dimensions belong to the small medium size category *(Table 11)*.

Comparing the *Equus* bone dimensions on some Upper Pleistocene sites we can observe the following *(Table 12)*:

Table 12. Comparison of measurement of postcranial bones of *Equus* (in mm) from other Upper Palaeolithic Sites

Radius prox. breadth	n	mean	min-max.	diameter	n	mean	min-max.
Bodrogkeresztúr-Henye	1	95,0	95,0		3	51,4	48,0–56,0
Kiskevély C.[1]	2		84,0–85,0		2		46,0–48,0
Pilisszántó II. Rsh.[3]					1	47,0	47,0
Achenheim[6]	14	87,8	80,0–95,0				
Tilde C. T_1[8]	3	92,8	88,5–97,0		5	49,0	47,4–53,2
Kúlna C.[7]			81,7–89,4				40,3–47,7
Metacarpus dist. breadth				**diameter**			
Bodrogkeresztúr-Henye	5	57,8	56,0–61,0		5	40,6	40,0–42,0
Kiskevély C[1]	6	54,5	53,0–56,0		6	40,2	37,0–42,5
Madaras LL[2]	1	55,0	55,0				
Pilisszántó II. Rsh.[3]	3	51,0	48,0–55,0		2	37,5	36,0–39,0
Achenheim[6]	27	55,1	49,0–60,0				
Tilde C. T_1[8]	10	55,3	52,4–58,9		11	40,1	38,2–42,5
Tibia dist. breadth				**diameter**			
Bodrogkeresztúr-Henye	4	86,2	80,0–90,0		8	53,0	50,0–56,0
Madaras LL[2]	2		79,0–82,0		2		52,0–54,0
Pilisszántó I. Rsh.[3]	1	77,0	77,0		1	47,5	47,5
Kiskevély C.[1]	3	76,7	70,0–80,0		3	48,0	46,0–50,0
Achenheim[6]	24	88,1	82,0–96,0				
Kúlna C.[7]			73,0–90,0				
Tilde C. T_1[8]	6	84,1	80,0–92,0		3	53,2	52,5–54,0
Metatarsus prox. breadth							
Bodrogkeresztúr-Henye	1	60,0	60,0				
Kiskevély C.[1]	4	56,0	53,0–58,0				
Achenheim[6]	44	58,1	46,0–68,0				
Tilde C. T_1[8]	15	55,7	52,5–62,3				
Kúlna C.[7]			53,2–62,3				
Pilismarót-Diós[5]	1	49,0	49,0				
Istállóskő C. UCI.	1	58,0	58,0				
Metatarsus dist. breadth				**diameter**			
Bodrogkeresztúr-Henye	1	53,0	53,0		1	40,0	40,0
Kiskevély C.[1]	6	56,2	55,0–58,0		6	42,6	40,0–44,0
Achenheim[6]	41	56,2	46,0–64,0				
Tilde C. T_1[8]	12	56,5	54,1–58,9		11	41,0	38,8–43,2

Table 12. cont.

prox. breadth	n	mean	min-max.	diameter	n	mean	min-max.
Pilisszántó I. Rsh.[4]	1	57,0	57,0				
Combe-Grenal[9]	2		56,5–58,0				
Solutré[9]	66	56,5	51,0–62,0				
Achenheim[6]	14	58,9	54,0–66,5				
Tilde C. T1[8]	14	57,6	50,0–64,7				
Kûlna C.[7]	2		60,8–64,7				
Temnata C.[9]	1	63,1	63,1				
diaph. breadth							
Bodrogkeresztúr-Henye	4	51,5	45,0–56,0				
Kiskevély C. UL[1]	8	48,4	43,0–51,0				
LL	7	52,2	50,0–55,0				
Pilisszántó II. Rsh.[3]	1	47,5	47,5				
Pilisszántó I. Rsh.[4]	1	45,0	45,0				
Combe-Grenal[9]	2		46,5–47,0				
Solutré[9]	70	46,7	43,0–54,0				
Tilde C. T1[8]	14	49,2	44,4–52,8				
Temnata C.[9]	1	48,2	48,2				
dist. breadth							
Bodrogkeresztúr-Henye	4	56,8	57,5–61,0				
Kiskevély C. UL[1]	8	53,3	47,0–56,5				
LL	7	55,3	54,0–59,0				
Pilisszántó II. Rsh.[3]	1	51,0	51,0				
Pilisszántó I. Rsh.[4]	1	50,0	50,0				
Combe-Grenal[9]	2		49,5–51,0				
Solutré[9]	67	50,3	47,0–54,2				
Tilde C. T1[8]	13	51,6	45,6–55,5				
Temnata C.[9]	1	54,2	54,2				

1. VÖRÖS 1994. Table 4.; 2. VÖRÖS 1989. Table 2.; 3. VÖRÖS 1986b. Table 2.; 4. VÖRÖS 1987c. Table.; 5. VÖRÖS 1981c. 22.; 6. NOBIS 1971. Tab. LXII., LXIX–LXIX.; 7. MUSIL 1990. 25–26.; 8. RIEDEL 1980. Table II.; 9. DELPECH–GUADELLI 1992. Table 48.

Dimensions of radius, metacarpus, tibia dist. epiph., metatarsus prox. and dist. epiph. as well as os ph I. from Henye horses agree most with those of Kiskevély Cave LL (VÖRÖS 1994.) and medium size Equus from Kûlna Cave (MUSIL 1990.), as well as the Achenheim form (NOBIS 1971.) and the big horses of Tilde Cave T1 (RIEDEL 1980.) Length of the os ph. II. agrees with those of the large horses in Kiskevély Cave LL and Achenheim horses. The same bone is longer in case of the medium large horses in Kûlna Cave and shorter on all other sites *(Table 12.)*

The postcranial bone dimensions of the Kniegrotte Cave VIII by the end of the Late Pleistocene with micro- and macrodontous teeth are smaller than the Henye finds (MUSIL 1974. Table 24).

It is an interesting phenomenon that while the dimensions of os ph. I. correlate well with the long bones, that is they change accordingly, that of os. ph. II. allow more differences: small and medium size forms but also phalangees with wide prox. epiphysis could equally appear.

Withers height

There were no complete long bones preserved at the Henye. We can estimate the length of the long bones adequately from the width of the prox. and dist. epiphyses. Thus, typical long bone data can be reconstructed accordingly:

radius	cca. 340–350 mm
metacarpus	cca. 240–250 mm
tibia	cca. 350–370 mm
metatarsus	cca. 280–290 mm

The withers height based on the calculations of the long bone values, elaborated on domestic horse material by Vitt (1952.) are given below in cm. This method is applied here for the sake of uniform comparison (in cm).

than 85 mm. An early appearance of E. "germanicus" is represented by the *Equus* found at Sveduv Stul in W II–III (identified as E. cf. gmelini MUSIL 1962.)

The small medium size *Equus* finds from Bodrogkeresztúr–Henye hill can be identified with the *E. "germanicus"* chronospecies.

At the Bodrogkeresztúr campsite, the joint occurrence of two horse species, *E. remagensis* and *E. "germanicus"* cannot be excluded. It cannot be disregarded, however that one of the horse bone sample submitted for C-14 dating from I.82. B sec. yielded an absolute date of 19–18 000 BP! Is it a casuality, or the site might have had a younger phase as well. Archaeological analysis of the existing find material seem to exlude the possibility.

Those Upper Pleistocene sites where the two caballoid horses (large – small, large – medium, medium – small) occurred together were collected last time by A. Forsten (FORSTEN 1988. 169–171). The presence of the small Equid can be defined well where teeth and long bones were found together.

It seems that a general trend of size decrease can be observed in Europe among the Upper Pleistocene caballoid horses (FORSTEN 1988. 171–173., 1991.) but this trend is manifested in the *Equus* material of some sites in a mosaic-like pattern. The joint effect of climate and nutrients, the deterioration of the habitat for *Equus* and its direct and indirect effect on dentition and body size cannot be felt directly on Hungarian Palaeolithic settlements of the Upper Pleistocene. It can be demonstrated, however, that at the beginning of Würm III (Madaras Lower Layer) around the cold maximum of the Würm period the *Equus* teeth, especially those of smaller size became abraded totally very fast. Such "worn out" teeth were only met for the *Coelodonta, Sus* and the *Crocotta*.

In the second half of the Upper Pleistocene (Würm II.–III.) the history of events for climate and sedimentation was faster and more varied than that of the preceding period. Such fast changes could not be followed by a "indigenous " horse population neither in pheno-, nor in genotype. It cannot be neglected, however that in these times large mammals, thus horses among other reacted with long migrations, drifted by "fauna waves" into other regions. This view is supported by the study of A. Forsten, on the basis of numerous find material collected from large area: apart from horses with long metapodia and phalanxes, horses of short mc appear in W II (time unit 6.), while with short os ph. I., they appear in W. III (time unit 7.) (FORSTEN 1991. 416., Fig. 2.–3.). The same phenomenon can be observed in case of the Hungarian Late Upper Pleistocene Equidae.

It cannot be decided that the large size *Equus* form at a given place was a local "archaic" or migrated element. Also, we have no details as yet on the chronomigration of the small size *Equus* forms.

These problems can be forwarded only by the regional study of *Equus* materials which are exactly dated and separated well in zoogeographical and chronological aspects.

In my opinion, the Late Upper Pleistocene decrease of dimension of *Equus* can be explained not only by cold and arid climate and deterioration of the environment, but also by the appearance of small *Equus* forms in Europe by migration.

3.2. Alces alces (L)

224 remains – 34 individuals

The relatively abundant occurrence of *Alces* finds was observed already in the first excavation (KRETZOI 1964 a.). The determination of the *Alces* remains was made easier by the high number of tooth finds, especially lower row of teeth (mandibulae). The build-up of the crown, the position of the ento- and hypoconids of the praemolars, the diagonal crest of the proto-entoconid of P_4 proved without doubt the presence of the *Alces* genus. Dimensions of teeth and bones correspond to, at the same time, the specific data of the species *Alces* alces.

3.2.1. Anatomical division of the Alces remains

At the Henye Upper Palaeolithic campsite, 224 pieces of *Alces* bones were determined. The anatomical distribution of these is given below:

Head-region

1 cast antler beam piece
5 brain skull fragments (refittable pieces)
3 facial skull fragments (3 dext. maxillae, 2 juv. 1 ad.)
19 isolated upper teeth
 11 P (of these, 6 dp)
 8 M ($M^{1/2}$ 1 sin - 5 dext., 1 M^3 sin., 1 M fr.)
14 isolated lower teeth
 3 I (1 di, 2 I juv.)
 7 P (1 P_4 dext., 2 dp_2, 2 dp_3, 2 dp_4)
 4 M (1 $M_{1/2}$ sin., 1 M_3 sin., 2 M inf. fr.)
24 mandibulae (14 sin. - 10 dext.)
 16 corpus mandib. 8 sin. - 8 dext. (1 inf., 2 juv., 13 ad).
 1 mandb. lower edge fr., sin.
 4 mandb. oral fr., 3 sin. - 1 dext.
 3 ram. mandb. 2 sin. - 1 dext.

Trunk-region

2 vert. lumbalis fr.
19 costa fr.
1 stenebra fr.

Table 13. con.

Unit	I.					II.				III.							IV.	Total
Section	D.	C.	E.	B.	A.					H.		E.	J.	G.			D.	
Trench						1.	4.	2.	3.		A.				4.	3.		
calc.								1										1
tarsal								2										2
mt px		8						2										10
dph		1		1				1					2					5
dt		2		2														4
mc/mt dph		1		2		6	3											12
ph I.		3											1			1		5
II.													1					1
sesam.													1					1
Total																		

3.2.2. Teeth, bones

For the characterisation of the Henye *Alces*, dimension of teeth *(Table 14.)* and some postcranial bones *(Table 15.)* can be used. The *Alces* remains, similar to other animal species found on the site are very fragmented. Bones exfoliated already in the soil due to physical effects and the wall of long bones were disassembled to small plates during excavations.

Table 14. Bodrogkeresztúr-Henye. Dimensions of the upper and lower check teeth of *Alces* (measured atz crown, in mm)

Upper teeth

	dp^2	dp^3	dp^4		P^3			$P^{3/4}$	P^4	$M^{1/2}$							
1.	19	22	22,0	26	23,0	24	24	24	24	24	25	27	28	28	30	30	31,0
2.	15	20	27,5	35	21,5	24	28	–	32	28	33	29	28	33	30	34	31,5 juv.

Lower teeth

	P_2		P_3		P_4		M_1		M_2		M_3	
	1.	2.	1.	2.	1.	2.	1.	2.	1.	2.	1.	2.
dp	14,0	9,5	18,0	13,0	28,0	17,5						
dp	14,5	10,0	19,0	14,0	31,0	18,0	28,0	20,0				
dp					30,0	17,0						
					27,0	16,5	27,0	21,0				
					28,0	21,0	25,0	21,0	26,0	21,5	40,0	23,5
					30,0	17,0			28,0	21,5		
	18,0	15,0	22,0	20,5	28,0	21,5	23,0	20,5	28,0	23,0		
			22,0	17,0	24,0	22,0	24,0	21,0	28,0	22,0	38,0	21,5
	19,0	13,0	22,0	15,0	25,0	18,5	26,0	21,0				
	19,0	14,5	22,0	18,0	26,0	–	24,0	21,5	27,0	22,0	40,0	23,5
	19,5	13,5	24,0	16,0	26,0	19,5	26,0	18,0	28,0	20,0	40,0	20,0
	19,0	14,0	24,0	18,0	26,0	21,0	27,0	21,0	28,0	22,0		
			23,0	17,0	26,0	20,5			28,0	21,5		
	18,0	13,0	25,0	18,0	29,0	22,0			30,0	22,0	40,0	23,0
			24,0	27,0					26,0	23,5		
									28,0	22,0		
											39,5	21,0

Table 16. Comparison with other teeth dimensions of *Alces* from the same chronological period (in mm)

	length			breadth		
	n	mean	min-max.	n	mean	min-max.
$P^{3/4}$						
Bodrogkeresztúr-Henye	5	23,8	23,0–24,0	4	26,4	21,5–32,0
Kiskevély C. LL	1	23,0	23,0	1	26,5	26,5
Betalov C.[1] sp.	2		23,1–23,5	2		22,0–26,5
Babja C.[2] j.	4	23,6	23,2–23,7	4	29,8	29,5–30,0
$M^{1/2}$						
Bodrogkeresztúr-Henye	8	27,9	24,0–31,0	8	30,8	28,0–34,0
Babja C.[2] j.	3	28,9	27,2–30,0	3	29,0	27,9–31,8
Veternica C. h.[3]	1	27,0	27,0	1	27,0	27,0
P_2						
Bodrogkeresztúr-Henye	6	18,7	18,0–19,5	6	13,8	13,0–15,0
Nagymaros[4]	1	19,0	19,0	1	14,0	14,0
Betalov C.[1] sp.	2		19,0–19,2	2		13,6–16,8
Babja C.[2] j.	1	18,8	18,8	1	13,4	13,4
P_3						
Bodrogkeresztúr-Henye	9	23,2	22,0–25,0	9	17,4	15,0–20,5
Nagymaros[4]	1	22,5	22,5	1	18,0	18,0
Betalov C.[1] sp.	3	24,5	23,9–25,0	3	16,7	16,5–16,8
Babja C.[2] j.	1	23,4	23,4	1	17,2	17,2
P_4						
Bodrogkeresztúr-Henye	11	26,8	24,0–30,0	10	19,9	16,5–22,0
Nagymaros[4]	1	29,0	29,0	1	19,8	19,8
Pilismarót-Öd.[4]	1	30,5	30,5	1	21,0	21,0
Betalov C.[1] sp.	5	27,9	27,3–28,5	5	18,8	17,5–20,4
Babja C.[2] j.	2		27,9–28,6	2		20,1–21,8
M_1						
Bodrogkeresztúr-Henye	9	25,6	23,0–28,0	9	20,6	18,0–21,5
Nagymaros[4]	1	28,6	28,6	1	22,0	22,0
Pilismarót-Öd.[4]	1	30,0	30,0	1	22,0	22,0
Pilisszántó II. Rsh.[5]	1	28,0	28,0	1	19,0	19,0
Babja C.[2] j.	2		24,8–28,3	2		20,6–21,7
Veternica C. h.[3]	1	25,2	25,2	1	20,1	20,1
M_1						
Bodrogkeresztúr-Henye	9	25,6	23,0–28,0	9	20,6	18,0–21,5
Nagymaros[4]	1	28,6	28,6	1	22,0	22,0
Pilismarót-Öd.[4]	1	30,0	30,0	1	22,0	22,0
Pilisszántó II. Rsh.[5]	1	28,0	28,0	1	19,0	19,0
Babja C.[2] j.	2		24,8–28,3	2		20,6–21,7
Veternica C. h.[3]	1	25,2	25,2	1	20,1	20,1
M_2						
Bodrogkeresztúr-Henye	11	27,8	26,0–30,0	11	21,9	20,0–23,5
Nagymaros[4]	1	31,0	31,0	1	23,0	23,0
Kiskevély C. LL	1	28,0	28,0	1	20,0	20,0
Babja C.[2] j.	2		28,6–29,2	2		22,1–22,5
M_3						
Bodrogkeresztúr-Henye	7	39,3	38,0–40,0	7	21,8	20,0–23,5
Nagymaros[4]	1	41,2	41,2	1	23,0	23,0
Kiskevély C. LL	1	43,0	43,0	1	23,0	23,0
Babja C.[2] j.	1	40,7	40,7	1	22,7	22,7

Fokoru, Tisza bed, (JÁNOSSY—VÖRÖS 1979. Nr. 494)
Kőtelek, Tisza bed (JÁNOSSY—VÖRÖS 1979. Nr. 493)
Lovas – grit quarry, Palaeolithic paint mine (DOBOSI—VÖRÖS 1979.)
Madaras-Brickyard, "Lower" loess under the Upper Palaeolithic site (VÖRÖS 1989.)
Mályi – gravel quarry (JÁNOSSY—VÖRÖS 1979. Nr. 374)
Nagybátony (JÁNOSSY—VÖRÖS 1979. Nr. 304)
Nagymaros-Ujvölgy, Fischer–Tóbiás's "soil quarry" (MOTTL 1942b. 47, – VÖRÖS 1998.)
Nagymaros – beside narrow-gauge railway (MOTTL 1942b. 48, – VÖRÖS 1998.)
Pilismarót-Öregek dülő (MOTTL 1942b. 53–54)
Polgár, Tisza bed (JÁNOSSY—VÖRÖS 1979. Nr. 482)
Romhány, in cavity of Triassic limestone (JÁNOSSY—VÖRÖS 1979. Nr. 278)
Szolnok-Sárnyak, Tisza bed (JÁNOSSY—VÖRÖS 1979. Nr. 503)
Szolnok-Sokorú, Tisza bed, (JÁNOSSY—VÖRÖS 1979. Nr. 508)
Tiszalök-Rázom puszta (JÁNOSSY—VÖRÖS 1979. Nr. 478)
Tószeg cliff, Tisza bed (JÁNOSSY—VÖRÖS 1979. Nr. 512)

***Slovakia** 3 localities*

Apart from data in older technical literature from Presov (Torysa river bed) and Tovarné (Ondava river bed) (KOCH 1900. 551), J. Bárta mentioned fossil *Alces* finds around Trenčin (BÁRTA 1964. 17). Their age is s.l. Upper Pleistocene.

***Roumania** 17 localities*

In Roumania, there are 17 Upper Pleistocene sites known with Alces (CZIER—JURCSÁK 1987., CHIRICA 1987., CZIER 1988.). In layer III. of the Mousterian site Ohaba Ponor, the "*Alces* machlis Og. f. diluvialis" I_1 and di_1 (GAÁL 1943 a. 21–22., Taf. II. 11) seem to be, on the basis of the photos published, not *Alces* but remains of a large *Cervus* (incisors published as *Saiga* are probably *Rupicapra*, ibid.). Thus the site should be cancelled from the list of *Alces* sites (CZIER—JURCSÁK 1987. Nr. 39). In the following, Romanian sites are numbered according to the above list.

With the exception of the Mountenian Late Upper Pleistocene (16) and the Sub-Carpathian Mousteroaurignacian (3a) as well as the Aurignaco-Gravettian site of Ripiceni-Izvor in the Prut valley, the bulk of the occurrences of *Alces* were registered from Transylvania. Most of the known occurrences are valleys or close to valleys:

Apa (2), Baia de Fier (3a, Sub-Carpathian), Bistrița (7), Borsec (9), Bratei (12), Cimpia Romana (16, Mountenia), Cuina Turcului (Danube valley, Epipalaeolithic, 20a)

Lespezi (30a), Mălini (32), Meziad (34), Nandru (36a), Noul Săsesc (37), Onca Sugatag mine (CZIER 1988.), Ormeniş (40), Ripa (44), Ripiceni-Izvor (Prut valley, CHIRICA 1987. 29–30), Scărişoara (46).

Alces alces occurred in Roumania during the Middle Würm (W II-II/III), the Upper Würm (W III), the end of the Ice Age and also in the Holocene (MACAROVICI 1962. 68).

***Yugoslavia** 3 localities*

Aradac (Voivodina) is known from old technical literature as a site with *Alces* (Koch 1900. 551). It was dated to s.l. Upper Pleistocene.

Vučedol, Danube valley in loess from W III (?)(MALEZ 1972., MALEZ 1986. 107).

One of the southernmost exposed sites with *Alces alces* is known from the Palaeolithic settlement of Crvena Stijena (Crna Gora, Mousterian-Tardigravettian; MALEZ 1972. 176, MALEZ 1986. 107, JURIĆ—BASLER 1979. 380. Nr. 116.).

***Croatia** 12 localities*

Croatian sites with *Alces* are well known from the work of M. MALEZ (MALEZ 1972., 1979., 1986.) The *Alces* remains were found both in Cave sediments and open air sites.

Localities with *Alces* include: Kanegra, Krapina C. (Mousterian, W I–II., MALEZ 1979. 236. Nr. 42.), Pećina in Brina near Drnis (with A. hydruntinus, in Aurignacian-Gravettian context, MALEZ 1979. 247. Nr. 78.), Pisana Stina in Opor Mountain (Dalmatia), Romualdo Pećina layer "c", W. III. (MALEZ 1979. 252. Nr. 58.), Samobor (Mousterian, W I., MALEZ 1979. 253. Nr. 45.), Sandalja II. Cave (Aurignacian-Tardigravettian, W II–III.), Veternica Cave layer "h" (W I/II., MALEZ 1963. 126–127, revised by MIRACLE—BRAJKOVIĆ 1992.), Vindija Cave (Aurignacian-Gravettian (?Mousterian, ? Mesolithic) Velika Pećina, Goranec, Ravna Gora (Mousterian-Gravettian, W. I–III., MALEZ 1979. 263. Nr. 35.), Vinkovci (KOCH 1900. 551.), Zarilac in Basin near Slavonska Požega.

***Slovenia** 7 localities*

The chronology of Slovenian *Alces* sites is relatively well known (RAKOVEC 1956., 1975., BRODAR—OSOLE 1979., POHAR 1983., 1997.).

Localities with *Alces* include: S.l. Würm: Tomažek Cave near Sezana (RAKOVEC 1956.),

Lower Würm – W I.–W I/II.: Betalov Spodmol, layers 3–4. (BRODAR—OSOLE 1979. 136. Nr. 16.), The site Maszyce Cave (46.) is an Upper Palaeolithic site from the Magdalenian period. All the others probably come from the s.l. W II.-II/III., late W III. period.

***Localities with Alces from the territories to the east of the Carpathes** 12 localities*

Alces occurrences of Late Upper Pleistocene age are known from the river valleys in the Western part of the Volhynian-Podolian table (GROMOV 1948., PIDOPLICHKO 1956., LUCIUS 1970., CZIER—JURCSÁK 1987., DAVID 1980.).

localities are the following:

***West-Ukraine** 3 localities:*

Sirec (PIDOPLICHKO 1956. 87.), Ternopol, Bug valley (PIDOPLICHKO 1956. 131.), Gura Putilei (CZIER-JURCSÁK 1987. 620., Nr. 27).

Prut-valley: 4 localities

Cernovici (Ukraine, with *Megaloceros*, PIDOPLICHKO 1956. 169.), Brinzeny Cave I. (Moldavia, with *Megaloceros*, DAVID 1980. 23. Tab. 8.) Stari Duruitory C.II.(Moldavia with *Megaloceros*, DAVID 1980.23.Tab.-3.), Ripiceni-Izvor (Romania, see there, CHIRICA 1987.).

Dniestr-valley:3 localities

Molodova V (Ukraine, PIDOPLICHKO 1956. 168., layer 7 – end of Solutrean, layer /.-1. end of Late Würm, CHERNISH 1961. 72–73., 7. W II/III. 6. beginning of W III, 5–2. second half of W III, LUCIUS 1970. 76–81., 6–1, last Valdai (W) interstadial, beginning of the Holocene, BORZIYAK 1993. 68. Tab.1.), Korman IV (Ukraine, CZIER—JURCSÁK 1987. 619., Nr. 18, 4–3 last Valdai (W) interstadial – beginning of the Holocene, BORZIYAK 1993. 68. Tab.1.), Raskov VII (Moldavia, Epigravettian, end of W III. DAVID 1980. Tab. 10).

Central Russian Plain 1 locality

Among the 29 Upper Palaeolithic settlements, O. SOFFER (1985. tab. 2.1.2.) mentioned no *Alces*. From Goncy in the Udai valley (SOFFER 1985. Nr. 7.) V. I. GROMOV published *Alces* remains (GROMOV 1948. 92.). In the publication of E. LUCIUS, (1970. 90.), *Alces* was also missing.

Dniepr valley 1 locality

Alces is mentioned from the site Kremenchug (Ukraine, with *Megaloceros*, PIDOPLICHKO 1956. 108).

Alces occurred in the W I. period, the Würm interstadials and the end of the Würm III / Holocene transition.

***Bulgaria** 2 localities*

Fossil occurrences of *Alces* are known from Northern Bulgaria, at the following sites:

Bacho Kiro Cave 8., cf. *Alces* sp. (KUBIAK—NADACHOWSKI 1982. 63., Tab. 1., Gravettian, Middle Würm, GINTER—KOZŁOWSKI 1982.)

Temnata Cave TD-I. 3d and TD-V. 3a-3d-3g, *Alces* alces and *Alces* seu *Megaloceros* was described, respectively (DELPECH—GUADELLI 1992. 154–155., 158–159., Tab. 1–2.). On the basis of the published dimension of os ph. III. from TD-V 3d (DELPECH—GUADELLI 1992. 155.), it can hardly be remains of *Alces* but much smaller game. Layers 3d-3g were of Middle Würm age, Gravettian, layer 3a of Late Upper Würm age, Epigravettian (GINTER—KOZŁOWSKI 1982.).

Megaloceros and *E. hydruntinus* were found at both sites and Rangifer was missing.

3.2.4. Late Pleistocene chronological distribution of Alces alces

The occurrence of elk turned out to be discontinuous after the Riss/Würm (Eem) interglacial – Early Würm I. period, both in space and time. To answer the question, where was the areal of elk in Europe during the Middle and Upper Würm, the study of known sites is necessary.

Altogether 132 so-called Upper Pleistocene localities were collected from the Carpathian Basin and the adjacent areas where elk used to live (s.l. W. I. W. I.–II., late W III; *Table 18*, Fig. 9.) Areas to the North-West and North of the Alps were not included in the survey. This area could be the western stripe of the Pleistocene / Holocene dispersion of elk. Upper Würm data were not obtained. W. v. Koenigswald published elk from 9 sites from the Northern Upper Rhine region, in fauna from the last interglacial. In the fauna list, *Alces* sp., in Tab. 1., *Alces alces* was mentioned as a climatically indifferent species similar to auroch (?) (KOENIGSWALD 1991.). In the Late Glacial fauna of Gamssulzenhöhle (Oberösterreich), dated cca. 14–10 000 BP., elk can be possibly considered as an expansional fauna element (FRANK et al. 1995., Tab.1.)

Distribution and frequency of Late Pleistocene elk sites *(Fig. 9.)* demonstrate clearly that *Alces* used to occur, dominantly, within the area bordered by the Western Alps – Southern France -Eastern Alps – Ore Mts. – Sudetes – Carpathes; to the south, in the northern foothill region area of the Po valley, further on, outside the Sudetes and the Carpathes on the Northern, North-Eastern marginal zone. Occurrences in Southern Romania and Northern Bulgaria can be considered marginal.

To answer the question: to what period(s) the elk sites can be dated, more exactly, when did elk turn up at a given region is more difficult.

Most of the sites have no exact geological, archaeological or radiometrical dating. In most cases, "only" the faunistical dating is available, resulting from the joint occurrence of chronologically important species. Individual finds make the correlation of the faunas more difficult, which is at the same time a self-evident vicious circle. Which is saying: species X belong to fauna Y because species X used to occur, so far, in Y fauna. This must be true, knowing the species evolutionary trends of a given region (e.g., in the Carpathian Basin: KRETZOI 1969 a., JÁNOSSY 1979.) In case of a chronologically discontinuous species, the exact faunistical-chronological assignment, i.e., which chronophase of a given occurrence the actual remains can be assigned to cannot be performed without other data like faunal assemblage, archaeological culture, geological, radiometrical dating or species evolutionary data.

For the chronological assignation of a part of the Upper Pleistocene elk sites, the author made use of, apart from the basic publications[1] the work of A. Păunescu (1984. Fig. 1.) and Paleolit SSSR (1984). Taking into consideration only the mentioned archaeological cultures, disregarding now locally different terminology cannot given "faunal assemblage" of a region in a concrete period of time, and their regional and chronological changes. Taking chronological level as priority, regionally it can comprise several archaeological cultures. Taking culture (cultural complex) as a priority, they can comprise a long period including several climatical phases. The similar character of economical-cultural heritage (e.g., way of life, use of tool types) can be spread in time, diffuse in space. For example in Europe there is a difference of about 4000 years between the Mesolithic cultures of Southern and Northern Europe.

The known Upper Pleistocene elk sites can be separated into three periods:

1. W I.–W I/II.	Mousterian
2. W II.–W II/III.	Aurignacian-Gravettian
3. Second half of W III., transition towards the Holocene	Magdalenian, Epigravettian, Epipalaeolithic, Tardigravettian etc.

Period 3. comprise also the sites classified by archaeologists to Late palaeolithic on the basis of archaeological heritage; on the basis of C-14 dates, however, they are obviously younger than 10000 years BC, that is, belonging to the Holocene period. The revision of these finds, however, already fall outside the present scope.

In spite of the scanty chronological data, the known distribution of elk can be used to reconstruct the Upper Pleistocene areal of *Alces*.

Upper Pleistocene occurrence of *Alces (Fig. 9.)* was dominant in two areas:

1st	72 localities	54,6%
Carpathian Basin	37 localities	28,8%
Transylvania	13 localities	9,8%
NE-Balkans	22 localities	16,8%
2nd	30 localities	22,7%
South Poland	18 localities	13,6%
West Ukraine, North Moldavia (Romania, N Moldavia)	12 localities	9,1%

The greatest frequency of *Alces* was encountered in the Carpathian Basin and the NW-Balkans.

Calculations can be made without the 13 Upper Pleistocene finds from the Tisza bed; in this case, the ratio of cave / open air sites will be 9 / 15. We may also add the 13 localities from the Sava bed, which were described by the authors (RAKOVEC 1956, MALEZ 1972.) as Holocene but in the opinion of the author, they are Pleistocene finds: in this case, the number of NW Balkan sites will be 35. The 13 Transylvanian (Romanian) *Alces* sites, mainly from river valleys, complete the picture nicely.

Localities with *Alces* in Silesia, outside the mountain range of the Sudetes and the Carpathes are less numerous (7 sites), more on the Kraków-Wielún Upland (11 sites). In Western Ukraine and the upper reach of the Prut valley 7, in the Dniestr valley 3, in the Dniepr valley and the Central Russian Plain 1-1 sites with *Alces* are known.

The total number of localities with *Alces* from the other regions – Northern Italy, Lower Austria, Bohemia, Slovakia, S Romania, N Bulgaria *(Fig. 9)*. is altogether 30–22,7% of all localities. Numerically, they agree well with the localities of the N-NW marginal region of the Sudetes and the Carpathes.

It is remarkable how much the areal of *Alces* got pinched within the area bordered by the Central European Eastern Alps and the Carpathes, its southern border formed by the Po valley, and the stripe of the marginal (outer) zone of the Sudetes and Carpathes.

It seems that the Carpathian range means no physical obstacle for Alces; neither today, nor in the Upper Pleistocene. Along the low-lying passes, valleys, elk could cross the mountain range without problem.

[1] see at the list of localities

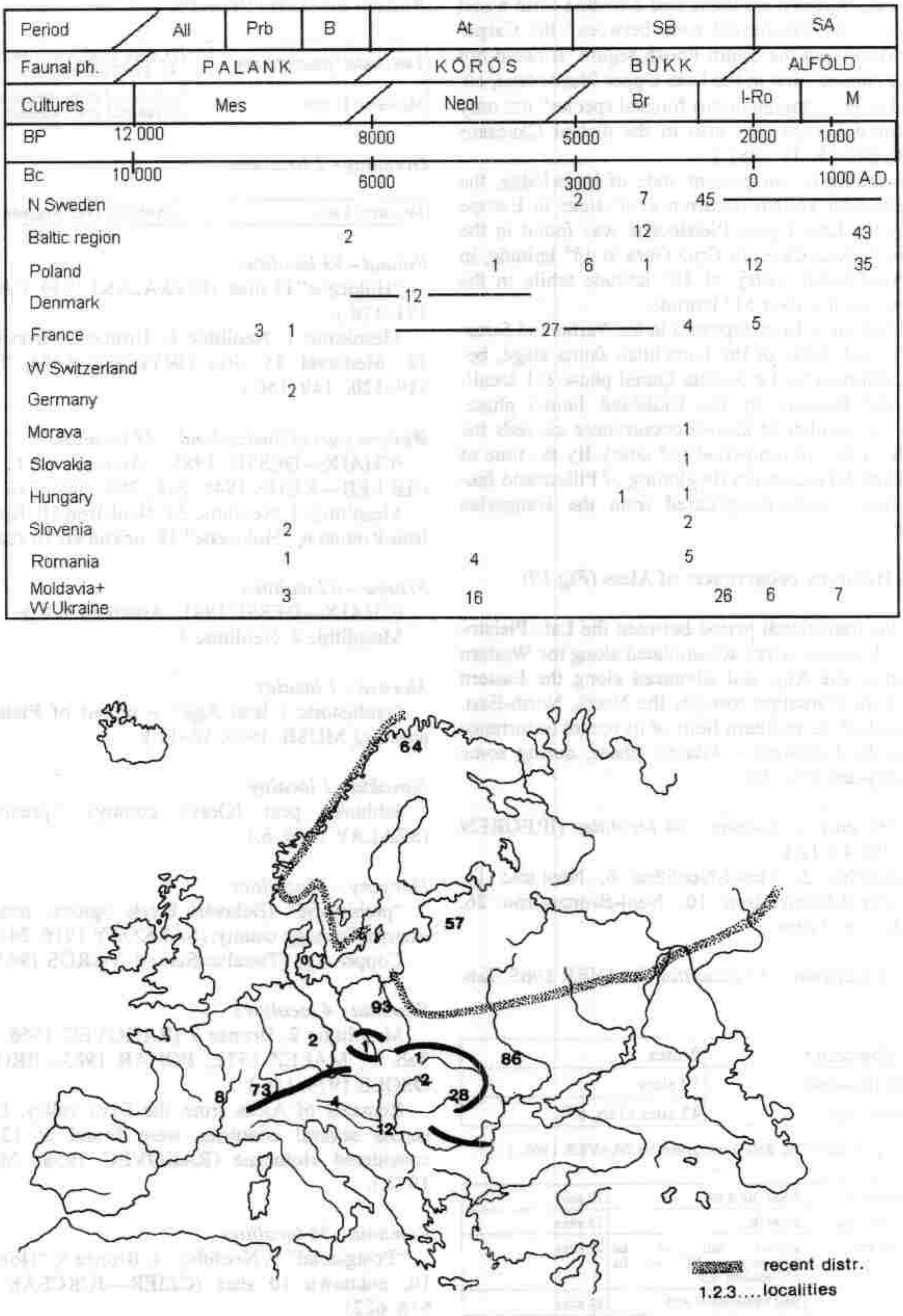


Fig. 10. Topographical and chronological distribution of *Alces alces* during the Holocene in Europe

The two distal tibiae were remains of stag.

Table 19. Dimensions of Cervus tibia dist. (in mm)

	dist. breadth	dist. diameter
Bodrogkeresztúr	**66,5**	**58**
	70,0	**–**
Kiskevély Cave 3–4	67	52
Svéduv stul[1]	63,6–67	
Veternica C[2]	52,3–56,4	
Aszód (Late Neol.)[3]		
– male n-34	57,0–67,0	
– female n-81	49,5–57,0	
Cervus maral (Neol. Georgia)[4]		
Recent (Hungary)[3]		
– male n-12	49,5–54,0	
– female n-21	42,5–49,0	

1. MUSIL 1962. 199., 2. MALEZ 1963. 121., 3. VÖRÖS 1975., 1983 a. Tabl. 1., 4. BURCHÁK—ABRAMOVICH 1972. Tabl. 42.

Red deer was the third most common species in the herbivore fauna of Upper Pleistocene sites in Hungary, following bison and horses (See Appendix, *Table II.*).

Among the finds of Hungarian Upper Pleistocene red deer, a larger form is constantly found though in smaller quantities. The differences, surpassing (?) sexual differences were observed by palaeontologists fairly early and marked in the fauna list under various names: e.g., *Cervus* ssp., *Cervus cf. elaphus, Cervus elaphus f. major, Cervus cf. maral, Cervus canadensis asiaticus* Lydekker, *Cervus maral* Ogilby etc.

The large form of *Cervus* was found on 25% of Hungarian sites (22 localities), "dominating" in roughly equal quantities (6 and 9 localities, respectively) in the Szeleta and Istállóskő faunal phases. Red deer was still present in the first phase of the Pilisszántó faunal phase, later – by the Würm III cold maximum – displaced by *Rangifer.*

In course of the chronological body size analysis of the Hungarian subfossil red deer it was observed that apart from a general decrease of size, differences could be observed also in the size differences due to sexual dimorphism. On a given place, e.g., the Carpathian Basin, the difference between the two sexes in the arid continental period was larger than during the humid Atlantic period (VÖRÖS 1975.) On a larger scale, e.g., Europe, proceeding from the Southern zones towards the North the sexual differences decrease.

Knowing this as well as the 8–10% difference in size between the male and female *Bisons* should put us on the guard. The possibility of having a large red deer form in the Upper Pleistocene however is corroborated by finding among the small deer male (small) and female (smallest) bones as well. To put it in different ways, the occurrence of large size bones on some sites would indicate the hunting on the biggest stags exclusively.

The faunal history of subfossil large mammals in the Carpathian Basin shows well that the deer form *maral* appeared in Hungary together with the Eastern European wild boar, the Caucasian *Bison, Capra aegarus* (this latter, however, needs further proofs: VÖRÖS 1996. 46–47), Eastern European wild horse "hemionus" (= "Asinus") and the Persian lion in a so-called second subfossil fauna wave (Late Neolithic – Copper Age: VÖRÖS 1981 a, 1983 b, 1986 a, 1987 b.) The more drastical changes in climate and environment during the Upper Pleistocene could reasonably even more drive in the "*maral*" deer into Central Europe, more specifically, the Carpathian Basin.

The red deer specimens at Bodrogkeresztúr belong also to this "forma major" and could be identified with Cervus elaphus maral (Ogilby)

The dimensions of the distal tibia *(Table 19)* show the large dimensions of this *Cervus* form very well. It is interesting to note that the red deer from Veternica C (Croatia, MALEZ 1963. 121.) was much smaller. It was possible to observe much smaller red deer during the subfossil Late Neolithic period on the Southern parts of Hungary than the Lowlands, especially the Northern parts of the Great Hungarian Plain (Alföld) (VÖRÖS 1975, 1983a.) Today we can already render probable that the red deer form living in the Illyricum was smaller during the Upper Pleistocene as well as the Holocene than the fore type in Central Europe. The large form of *Cervus*, appearing latest in the arid continental climatic phase of the Late Neolithic (4000–3500 BC) in the Carpathian Basin, did not proceed towards the South to NW Balkans and / or N Italy.

The forest red deer, maral deer could be found in the Upper Pleistocene universally, though in uneven frequency; with the exception of the Eastern European steppe region where their presence was confined to some river valleys e.g., Dniestr valley – Molodova V. (CHERNISH 1961.), Don valley – Kostenki I., VI., XIV., XV., XVI., (LUCIUS 1969–70. 41., 49., 57., 59.).

The red deer considerable withdrawal, decrease in Central Europe took place in the time of the Würm III cold maximum, when this form was driven back to submountainous – submediterranean regions towards the South.

Table 21. con.

	1.	2.	3.	4.	5.	6.	7.
Holocene							
Jásztelek I ? Mesolithic	262	82	55	–	50	–	–
Szarvas 1.[4] ? Neolithic	252	89	57	91,5	53	35	48
Ljubljansko b.[5] Prehistoric.	204	73	47	68	–	29	37
Kálmánréti pot-hole Celtic	220	67	37,5	64	39	24	38
Szabolcs[6] Medieval	230	85	53	80	50	30	46
Recent							
Bialowieza[7] (female)	204–216	66–73	37–43	63–69			
(male)	209–231	73–86	45–52	69–80			

1. MOTTL 1938a 34., 2. PHLEPS 1907. 40., 3. KROTOVA—BELAN 1993. Tabl. 3., 4. BÖKÖNYI 1987., 5. RAKOVEC 1953. 273–274., 6. VÖRÖS 1990b Tabl. 4., 7. EMPEL—ROSKOSZ 1963., Tabl. 13.

In the Upper Pleistocene, *Bison priscus* used to be a typical steppe species of the open landscape areas.

3.5. Mammuthus primigenius (Blumenbach 1799)

42 remains - 8 individuals

The topographical division of the mammoth remains is the following:

I.82. D. Sec. 7 ☐	Lamellae
I.82. C. Sec. 12 ☐	corpus mandibulae fr. (5 pieces)
"stray finds"	2 tusk aboral fr., praemaxilla fr. (5 pieces)
III.63. E. Sec. 13–15. ☐	d mM^2 (4–5 years old)
III.63. G. Sec. 2. ☐	femur diaph. fr. (2 pieces)
III.63. G. Sec. 5. ☐	pair of mandibles (Fig. 8.1. 20–25 years old), femur diaphysis fr. (2 pieces)
III.82. 1. tr. 5. ☐	M inf fr., s-d. symphysis mand. fr.
III.82. 2. tr. 6. ☐	tusk (slightly curved, juvenile Fig. 8.2. In situ dimensions: 1. 1800 mm, base diam. 110 mm), femur diaph. fr. (1. 265 mm, w. 70 mm)
III.63. A tr. 26–30. ☐	M fr., long bone diaph. fr. (3 pieces)
III.63. A tr. 36–40. ☐	2 costa (1. 190 mm, 360 mm)
III.63. A tr. 39–42. ☐	praemaxilla fr., 2 M sup. fr.
IV.63. C. Sec.	M sup. fr.
IV.63. D. Sec.	M fr. long bone diaph. fr. (7 pieces)

The anatomical distribution of Mammoth remains:

tusk fr.	3
praemaxilla fr.	6
mol. Sup. fr.	4
mandibula fr.	8
mol. fr.	4
costa fr.	2
femur diaph. fr.	5
long bone diaph. fr.	10
	42 pieces

Remains of mammoth have been registered so far from 410 sites in Hungary. On 71% of the 552 "stray-finds"/ open-air sites (392 localities) and 24% of the 75 Cave/Rockshelter sites (18 localities). It is even more striking that on Palaeolithic sites – both Cave sites and open-air settlements – the number of hunted mammoth is actually very low. Considering provisionally all the 18 Cave / Rockshelter mammoth remains as products of human hunting, we can only add 5 open-air settlements with mammoth in the fauna (Tata, Érd, Bodrogkeresztúr, Verseg and Csillaghegy). The tusk tip of the Csillaghegy baby-mammoth was formerly published as reindeer antler (GÁBORI—CSÁNK 1980. 238) and later corrected (GÁBORI—CSÁNK 1984. 7., 1986.4.). Its connection with the cultural layer is not clear.

On the territory of Northern Hungary where Bodrogkeresztúr is also located there were 146 localities with 513 pieces of mammoth bones found, presented in a former survey (VÖRÖS 1980. 33.).

Their anatomical distribution is the following:

skull fr.	8 pieces
mandible fr.	31
molar, molar fr.	203
tusk fr.	46
vertebrae	41
ribs	40
scapula fr.	5
humerus fr.	12
radius fr.	3
ulna fr.	10
pelvis fr.	6
femur fr.	15
patella	1
tibia fr.	13
fibula fr.	4
carpus / tarsus	32
metapodium	8
os phalangis	5
"long bone fr."	30
	513 pieces

Among the of all mammoth remains (203 pieces) 29% are most resistant teeth and its fragments.

In Northern Hungary, at 137 localities the mammoth died of natural causes and the remains stayed on the primary spot or were transported to secondary locations. There were 6 articulated skeletons or larger parts of the skeleton found (Apc, Hont, Hatvan, Miskolc "engine-house settlement", Sámsonháza and Zsujta.) At Jobbágyi in the valley of river Zagyva, there were remains of mammoth breccia found at an area of "25 x 50–60 feet in half meter depth, with weathered bones and molars" (HALAVÁTS 1899.)

3.6. Leo spelaeus Goldfuss 1810

2 remains - 2 individuals
Among the two large predators, *Leo* and *Crocotta*, only Leo's two bone remains of the feet were found:

d.mt. III	III.63. G. sec. 21-24-27-30 □
s. os ph. I.	III. 82. 3 tr. 9 □

Bone dimensions (in mm):

	1.	2.	3.	4.	5.	6.	7.
mt. III	–	15	14,5	–	–	16	–
os ph. I.	51	19,5	13,0	16	–	9	11

Both bones are small size.The medial length of ph.I. is 44 mm.

Cave lion and Cave hyena were constant representatives of the Hungarian Upper Pleistocene large mammal fauna. They were found on one third of the studied 180 sites (60 localities); at 27 localities, together (45%), on 22 localities (36,6%) only hyena, at 11 localities (18,4%) only lions were found (Appendix Table I). Both animals were typical large predators of clearings near scrubs or open spaces. Hyenas were more frequent (49 localities); their separate occurrences were double the amount of lions. It is all the more surprising that on open air sites, lions were more frequent: 16% (6 localities) contained lion and only 8% (4 sites) contained hyena. It seems hyena deserved more its attribute name "spelaeus".

The dominance of the two large predators was reached by the Szeleta and Istállóskő faunal phases, however, they were still occurring in Caves and rock shelters in the first phase of the Pilisszántó faunal phase. Due to climate deterioration, getting nearer to W III cold maximum, lion disappeared earlier from the fauna than the hyena. Hyena lasted longer and its site frequency was about double (7 localities) than that of lion (4 localities). They were occurring together only in the middle layer complex of Pilisszántó I. Rockshelter.

3.7. Lepus sp.

The only rabbit bone of the Upper Palaeolithic settlement was an ulna fragment (IV. 63. D. Sec.), lost (KRETZOI 1964 a).

4. Big game remains on the hunting campsite

4.1. Quantitative distribution

The estimated extent of the Palaeolithic settlement on the basis of the surface distribution of finds on the Henye was over 18–20 000 m^2. Some 2–2,5% of the total area was excavated, 423 m^2. The collected 1803 pieces of animal bones were found on less than half of the excavated surface, 154 m^2 (36,4 %) where the average density of bone finds was 12 ("11,7") pieces/ m^2. Calculated for the total excavated area, 423 m^2, the bone find density was 4 ("4,26") pieces/ m^2, one third of the above value.

60% of the 1803 bone pieces were found in Unit I (1083 pieces); bone find density here was 19 pieces/ m^2;

26,4% in Unit III (474 pieces), bone find density 8 ("7,8") pieces/ m^2;

11,8% in Unit II (212 pieces), bone find density 7 ("7,5") pieces/ m^2;

1,8% in Unit IV (34 pieces), bone find density 4 ("4,25") pieces/ m^2.

Number of unidentified bone (UnIB) fragments was 1036 (57,5 % of total bones found), mainly fragments of bone cortices from split long-bone diaphyses and fragments of "bone plates". Their size varied between 5 and 50 mm. Their physical frittering was forwarded, apart from intensive soil cultivation, extreme climatic conditions as well. 67,5% (699 pieces) of unidentified bone fragments were found in Unit I; 19,6% (202 pieces) in Unit III; 12,5% (125 pieces) in Unit II and 0,9% (10 pieces) in Unit IV.

Among the 1803 pieces of animal bones, 767 pieces (42,5%) could be determined anatomically and, consequently, taxonomically as well: half of them –

Table 23. Bodrogkeresztúr-Henye. Distribution of the animal species by units (Number of specimens, %)

Unit	I-57 m^2		II-28 m^2		III-61 m^2		IV-8 m^2		I–IV 154 m^2	
	pieces	%	pieces	%	pieces	%	pieces	%	pieces	%
Equus	284	58,0	46	9,5	142	29,5	11	2,2	483	100,0
Alces	85	38,0	46	17,8	97	43,3	2	0,9	224	100,0
Mammuthus	13				8		9		42	
Bison	2				3				10	
Cervus			1		2		1		5	
Leo									2	
Lepus									1	
Total identified	384	50,0	87	11,3	272	35,5	24	3,2	767	100,0
unidentified (UnIB)	699	67,5	125	12,0	202	19,6	10	0,9	1036	100,0
Total	1083	60,0	212	11,8	474	26,4	34	1,8	1803	100,0

tity of accessory games: 98,8% for Unit II., 96,1% for Unit I., 88,2% for Unit III.

Horse dominated all units: 74,0 – 52,8 – 52,8% in Units I–II–III; followed by *elk* 22,1 – 46,0 – 35,8% in Units I.–II.–III. Percentage was not calculated for Unit IV due to low number of occurrences. Most bone remains here (11 pieces) belonged to *horses*, followed by *mammoth* (9 pieces).

Among the accessory games, 4 species were found in Unit III., 3 species in Unit IV., 2 species in Unit I. and one in Unit II (Table 23.).

4.2.2. Distribution of bone remains according to anatomical regions

The anatomical distribution of animal remains found at Bodrogkeresztúr-Henye hill is heterogeneous. It means that the single bones, bone fragments are present in different number and ratio: some parts are missing.

The method for classifying animal bone remains found on archaeological sites – i.e., antropogeneously selected – into anatomical regions was elaborated by Miklós Kretzoi on the animal bone evidence of the Middle Palaeolithic site Érd (KRETZOI 1968 b. 230.).

The animal was grouped, according to anatomical build-up, muscles and meat cover into five body regions which were all different in respect of use or utilisation:

A. head region-skull and mandibles, teeth, lingual bone and perhaps the atlas
B. trunk region-vertebral column (cervical, dorsal, lumbar and sacral vertebrae), ribs and sternum
C. meaty limb region (limbs and shoulder region): scapula, humerus, radius-ulna prox. parts, pelvis, patella, femur, tibia-fibula prox. pieces
D. dry limb region-radius-ulna dist. pieces, carpus, metacarpus, tibia-fibula dist. parts., tarsus, metatarsus
E. terminal bones-phalanges, caudal vertebrae, penis bone.

The ratio of bones belonging to the anatomical body-regions, the dominance or absence of certain regions, separation of animals represented by all body regions from those which were represented deficiently can give information on the utilisation of the animals, in our case, hunting specialisation and methods.

Such primary data can be given for the activities performed on certain parts of the settlement by units and within them, by squares, analysing distribution of body-regions by excavation units.

Horse

The distribution of horse remains was more even than that of elk. Dominant occurrences of the individual body regions by Units are given below:

head region in U.I. 82.C. B. sec., in U. III. 63 A tr., G sec.

meaty limb region in U.I.82. C. sec., U.II.82. 4-2. tr., U. III.82. 3-4 tr., less in U. III. 63. E-J-G. sec and A tr.

dry limb region in U.I. 82. C-E-D. sec., U. III. 63. J. sec., U.III.82. 1 tr.

phalanges U.I.82. C-E. sec

From the trunk region, only in U.I. 82., 3., 7.tr, U.II. 82. 4 tr., U.III. 63. A. and 82 3-4 tr. yielded some pieces.

The anatomical units, body regions of *horse* remains found on each square meter were given in Table 25. Summarising data, i.e., where and in which combination the *horse* remains were found the followings could be concluded:

on the settlement, bone remains representing "*horse* meat" were:

scap-hum-rad and pelv-fem-tib, found in U.I. 82. D-C-E sec. and U. III. 82. 3-4 tr.,

hum-rad and pelv-fem-tib in U.II. 82. 4-2 tr.,

hum-rad and tib in U.I. 82. B sec. and U. III. 63. G. sec.

rad and fem-tib in U.III. 63 A tr.

hum in U. III. 63. E-J. sec.,

rad in U. II. 82. A sec. and U. IV 63 D. sec.

The shoulder and (scap-hum-rad) and ham (pelv-fem-tib) body-pelts cutting from the trunk region was seldom (in 9 cases) connected to the lower parts of the leg, carpus/tarsus-metapodium and sometimes phalanges. In most cases, the limb was truncated at the wrist/ankle joint: in case of U.I.82.E-B. sec., U.II.82.2-3-4 tr. U.III.63. E-J-G. sec. and U.III.82. 3-4 tr. the carpus/metacarpus bones, in case of U.I.82.D. sec. 2. tr. U.II. 82. 4. tr., U.III.63. A tr. and E sec., as well as U.III. 82. 3-4 tr., the tarsus/metatarsus bones were missing.

At four places, we could find only the dry limb bones, these were: metacarpus in U. II. 82. 1 tr. and U. III. 63. H. sec and tarsus/metatarsus/metapodium in U.III. 63. C sec and 82. 1. tr.

Os ph. I. was also found singly at two places, U.I.82.E. sec. 2 □, U.III. 63. A tr. 40–42 □, other proximal bones of the feet were missing. *(Table 25, Fig.11). (Table 25.)*

Table 25. cont.

Location	Head			Trunk		Fore leg				Hind leg				Terminal bones of feet	
Unit IV. '63															
C. sec.													t		
D. sec.			tooth					rad							

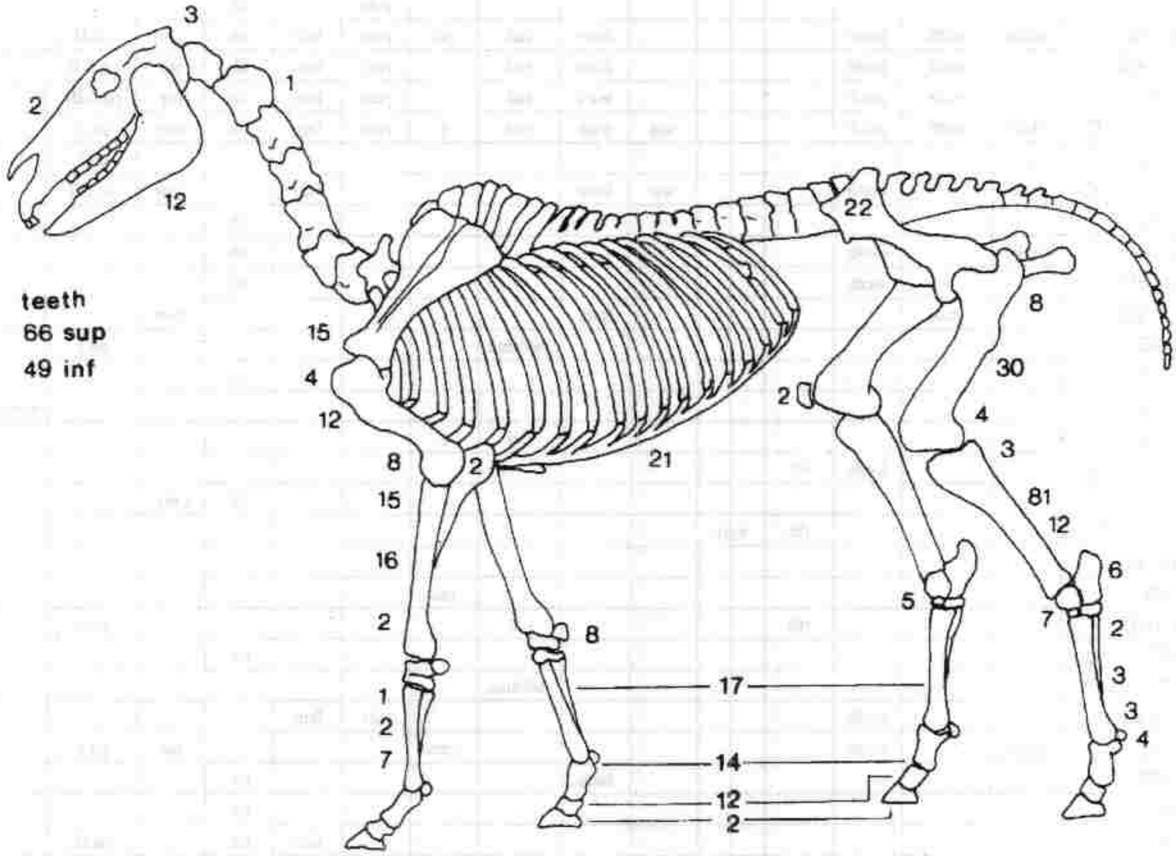


Fig. 11. Bodrogkeresztúr–Henye. Anatomical distribution of *horse* bones

Elk

The distribution of elk bones on the settlement was more differentiated than those of horse. Remains of the individual body regions were more separated topographically from each other (Table 26).

For example, 90% of finds belonging to the head region were found in sections U.III.63-82. In U.I.82., there was only one tooth more (E.sec.).

82% of meaty limb bones were concentrated in U.I.82. D-C., B-A sec.; 2-2 more pieces were also found in U.III.63.E and J sec.as well as 82 4. tr., 1 piece came forth from U.II.82. 4. tr.

Body-pelts cutting from the trunk region, shoulder (scap-hum-rad) and ham (fem-tib were generally connected to lower part of the leg (carpus/tarsus-metapodium, 11 instances). Basic difference compared to horse remains is the common presence of dry-limb bones occurring in themselves at 6 places: Unit II.82., 1-2-3 tr. and U.III. 63. H-G. sec., A tr.

At six places, carpus/metacarpus was occurring in itself – U.I.82. D. sec., U. II. 82. 4-2 tr., U.III. 63. E-G. sec.; at four instances, tarsus / metatarsus bone was found alone: U.I. 82. B. sec., U.II. 82. 2 tr., U. III. 63. J. sec., without higher proximal leg bones *(Fig.12)*.

Finger-bone was found at one place in the company of a rib bone (U.III.82. 3 tr. 7 ?).

It can be stated that on the Bodrogkersztúr settlement there were less shoulder-ham parts and more "dry limb" bones for elk than for horses. *(Table 31)*.

Table 26. cont.

Location	Head			Trunk		Fore leg				Hind leg				Terminal bones of feet	
Unit III. '63															
H. sec.	antler							rad	c						
A tr. 37.□			tooth									tib			
A tr. 39.□			tooth												
A tr. 40-42.□		max/mdb						rad	mc			tib			
E. sec. 2.□									c						
E. sec. 8.□		mdb				scap									
E. sec. 10-15.□		mdb				scap									
E. sec. 24.□		mdb													
J. sec. 28.□		mdb	tooth					rad/ulna					mt	ph.II.	
J. sec. 26-29.□		mdb	tooth												
J. sec. 27-30.□		max										tib		ph.I.	sesam.
J. sec. 30.□		mdb													
J. sec.		mdb											t		
G. sec. 22.□		mdb													
D. sec.□	skull		tooth						mc						
Unit III. '82															
4. tr. 3-4.□				rib		scap									
3. tr. 4.□				rib											
3. tr. 7.□				rib										ph.I.	
3. tr. 9.□		mdb													
Unit IV. '63			tooth												

Mammoth

Remains of mammoth were typically found in "patches" at all three excavated units within the settlement with the exception of U.II.82. Thus, a mandible fragment, tusk and praemaxilla fragment found in U.I.82. C.. sec., tooth, praemaxilla fragment, rib and long bone fragments in U.III. 63. A tr.,, pair of mandibles and 2 femur diaph. fragments in G. sec., mandible and tooth fragment in U.III.82. 1 tr., tusk and femur diaph. in 2 tr., tooth in U.IV. 63 C. sec. and tooth and long bone fragment in D. sec.

Real "meaty limb bones" of mammoth could possibly be the femur and femur and/or tibia long bone diaphysis fragments. The two ribs belonging to the trunk region could also represent meaty parts. Still the general impression on the type and distribution of the bones can be that the mammoth bones, especially the parts of the head region were not taken to the settlement as a part of the diet.

It could be proved for U.III.63.G. Sec and supposed for U.I.82.C. Sec and U.III.82.1. tr. that the mammoth mandible served as an "anvil" (flat, smooth bone plane) used for the production of the stone tools.(VÉRTES 1966.13) Similar role can be attributed to the femur ("long bone") fragments at U.III.63. G. sec., 82. 2. tr., U.IV. 63. D. sec.

Bison

Remains of bison were found only in two units: at U.I.82. C. and E sec., as well as U.III.63. A tr. and E-J-G.sec. Apart from one tooth (U.I.82. C. sec.) and one os ph. II. (U.III. 63. A tr.) all the *bison* bones found belong to the so-called dry limb region. No bones belonging to trunk- or meaty limb region were found in the excavated area. (*Table 30)* The meat of the bison was consumed by the Palaeolithic hunters but on the settlements it is more typical to find dry-limb bones and phalanges while trunk and meaty limb bones were accumulated mainly at the natural death places (potholes., clefts, waterfront etc. thanatocoenoses).

Red deer

Remains of red deer were found at 5 different places on the settlement. One antler tine each at U.III. 63.E. sec. 2. □ and at 82. 4. tr. 3–4 □; fragments of one tibia each at U.III. 63. J. sec. 27–30 □ and U.II. 82.3. tr., the fragment of a metacarpus at U. IV. 63. D. sec. Apart from the small antler tine fragments, the three bones belong to the dry-limb region *(Table 30).*

Cave lion

Both lion bones were typical for parts remaining in the flayed hide /mt/ of the dry limb region and a fin-altogether 14 individuals were found with only 1 red deer.

Most of the hunted mammals were killed in *adultus* (92,5%, 89 individuals) *or subadultus* (9 individuals) age. The ratio of developed individuals was 80% for both main big games, that is, 40 *horses* and 27 *elks*. *(Table 28)*

9 individuals represented subadultus age, all of them *horses*:

between 2,5–3 years	1 individual
cca. 3 years	1 individual
between 3,0–3,5 years	6 individuals
between 3,5–4,0 years	1 individual

On the basis of the individual number (108) hunted, calibrated by age group data *(Table 28)*, the theoretical useful meat quantity could be 20462 kg, with considerable amount of fat.

On the basis of the skeletal parts *(Table 29)* found on the four excavation surfaces, less than half of the potential meat quantity (6 902 kg, 34%) was present. Of this total weight, horse-meat could amount to 4750 kg, elk 1950 kg, bison 200 kg, rabbit 2 kg. In case the mammoth bones were obtained with and for meat, we could add 400 kg more.

None of the hunted mammals were taken totally to the site as demonstrated by the anatomical distribution of bones, only some parts of their body.

Table 29. Bodrogkeresztúr–Henye. Anatomical distribution of hunted animals (pieces)

Bone	Equus	Alces	Mammuthus	Bison	Cervus	Leo	Lepus
antler		1					
skull	5	8	6				
mandible	12	24	8				
tooth	115	33	11	1			
vertebra	1	2					
costa	21	19	2				
stenebra		1					
scapula	15	6					
humerus	24	4		1			
radius	33	12					
ulna	2	1					1
carpus	8	16					
metacarpus	10	15		1	1		
pelvis	22						
femur	42	5	5				
patella	2						
tibia	96	33		1	2		
tarsus	18	6		3			
metatarsus	8	19				1	
metapodium	17	12		2			
ph. I.	14	5				1	
ph. II.	12	1		1			
ph. III.	2						
sesamoideum	4	1					
bone fr.			10				
Total	**483**	**224**	**42**	**10**	**5**	**2**	**1**

On the basis of the dentition status, the abrasion of the chewing surface and the ossification of the epiphyses, the distribution of the young individuals can be given below:

Elk	7 individuals: 2 of them, 8–10 months old, 5 individuals 14–16 months old
Horse	1 individual: cca. 2 years old
Red deer	1 individual: cca. 2 years old
Mammoth	1 individual: 4–5 years old

In case of the two main big game, *horse* and *elk*, both the anatomical (*Table 29*) and the body region distribution show certain similarities and differences *(Table 30, Fig. 13)*.

For both species, the contribution of the head region – especially teeth – was relatively high: *horse* 27,3%, *elk* 29,5%. At the same time, presence of the trunk region (horse 4,6%, elk 9,8%) and phalanges (horse 6,6%, elk 3,1%) was negligible. The basic difference between the remains of the two main game langes, for the perissodactylous horse, 32 phalanges were found on the settlement. The feet and the phalanges were cut off from the fore and hind legs. Still, on the relatively less numerous *horse* feet more of phalanges were found than on the *elk* feet.

In the meaty limb remains of *horses* (222 pieces) there were more than two times more hind legs (150 pieces) than fore legs (72 pieces). In case of the *elk* remains, the difference in the same region is negligible: bones belonging to 21 fore legs and 18 hind legs.

On the basis of the two main big games hunted remain distribution (*Table 30, 31*) the meat can be stated that the meaty limb region as well as the head region of the *horse* was primarily accumulated on the settlement. That is, results and product of *horse*-hunting was transported to the excavated parts of the settlement and was consumed there.

In case of *elk*, the situation was different: bones of the dry limb region and the head region dominated the assemblage. Apart from "occasional" consumption of *elk* meat, signs for a meat depot or meaty bones were missing from the excavated parts of the settlement. It seems as if the place for *elk*-meat consumption were different from the parts excavated. Was the Bodrogkeresztúr settlement only a temporary stage in *elk* hunting? The frequency of the head region (29, 5%) seem to contradict this. *(Table 30)*

The archaeozoological evaluation of the material is made more difficult by the scanty evidence on horizontal and vertical periodicity of the site. We have no information on important circumstances: were the four units utilised at the same time or separately, for how long and which periods?

On the basis of the limb bones representing "food residuals" on the site, local stripping and / or consumption of meatcould be localised at the following micro-regions within the Bodrogkeresztúr site:

horse meat – Unit I. 82. C. sec. (dominant) and adjacent B and E Secs.
Unit II. 82. 2-4., Eastern half of 3 tr.
Unit III. 63. A tr., E-J-G sec.,
Unit III. 82. 3 and 4 tr., on the surface of each squares

elk meat – Unit I. 82. C-B-A sec.
Unit III. 63. E. sec.,
Unit 82. 4. tr. on the surface of each squares

rabbit meat – Unit IV. 63. D. sec.

Remains of feet detached from the limb (c/t, mp, ph) were observed independently at 6 places in case of the *horse*, at 11 places for *elk*, at 4 places for *bison*, at two places for cave *lion* and one case for red deer (see chapter 4.2.2. *Table 25, 26*). It is probable that these terminal dry bones were transported to the settlement in skinned hide, and were cut off from the end of foot at their spot of occurrence.

Table 31. Bodrogkeresztúr–Henye. Body regions of hunted animals according to body regions (individual cases)

Parts of the body	Head		Trunk	Fore limb						Hind limb					Fingers
Bone	Sk.	mdb	Vert/rib	Sp	H	R	U	c	Mc	Pv	F	T	t	Mt/mp	Ph
Equus	28	11	7	3	15	16		4	5	9	10	25	8	12	14
Alces	9	13	8	4	2	6		5	9		2	13	2	10	5
Mammuthus	6	3	1								3				
Bison		1			1				1			1	3	2	1
Cervus									1			2			
Leo														1	1
Lepus							1								

Sk.-skull; mdb-mandible; Vert-vertebra; Sp-scapula; H-humerus; R-radius; U-ulna; c-carpus; Mc-metacarpus; Pv-pelvis; F-femur; T-tibia; t-tarsus; Mt-metatarsus; mp-metapodium; Ph-phalangis.

5.2. Environment - hunting strategies

The slubbered Upper Pleistocene vegetation history of the Carpathian Basin has recently started to formulate chronologically as well as regionally as a result of the activity of P. Sümegi and his team (KERTÉSZ—SÜMEGI 1999. with further references).

The faunistical examination of large mammals, similar to the study of birds seem to exclude completely the previous old static view on the exclusive dominance of "tundra" and "steppe" vegetation zones in Hungary. Vegetation zones determined by surface morphology and river valleys were mixed in patches, the individual components appeared in a mosaic-like pattern.

Large herbivores – in our case, hunted big game – were living in the *environmental boxes* suitable for their requirements. The natural caducity of the animals moving along river valleys or to drinking places was seemingly most different, depending on the size of the animal and taxonal characteristics.

For example: in the current bed of the river Tisza, remains of *horse* were found only at two places (Po-

Table 32. Distribution of body regions of *Equus* on Hungarian Upper Palaeolithic campsites (pieces, %)

Region/Site	Ságvár[1]		Nadap[2]		Bodrogkeresztúr	
	Pieces	%	Pieces	%	Pieces	%
Head	185	75,82	85	55,56	132	27,3
Trunk	1	0,41	9	5,88	22	4,6
meaty limb	6	2,45	11	7,18	222	43,0
Dry limb	42	17,22	41	26,80	75	15,5
Phalanges	10	4,0	7	4,58	32	6,6
	244	100,0	153	100,0	483	100,0

1. Vörös 1982., 2. Vörös 1988b.

Table 33. Distribution of body regions of *Rangifer* and *Alces* on Hungarian Upper Palaeolithic campsites (pieces, %)

	Rangifer						Alces	
Region/Site	Ságvár[1]		Pilismarót-Pálrét[3]		Pilisszántó I. Rsh.[4]		Bodrogkeresztúr	
	Pieces	%	Pieces	%	Pieces	%	Pieces	%
Head	1094	73,52	47	12,06	223	15,82	66	29,5
Trunk	48	3,32	120	30,70	50	3,54	22	9,8
meaty limb	56	3,76	116	29,75	396	28,08	39	17,4
Dry limb	232	15,61	58	14,87	333	23,62	90	40,2
Phalanges	58	3,98	49	12,56	408	28,94	7	3,1
	1488	100,0	390	100,0	1410	100,0	224	100,0

1. Vörös 1982., 3. Vörös 1983d., 4. Vörös 187c.

Pilisszántó I. rock-shelter was a reindeer meat depot (Table 33.).

The mammoth femur (and femur or tibia) belong to the category of meaty bones but it is not very likely that the whole cut-off limb could have been transported to the settlement. The meat of the "mega herbivore" mammoth was probably cut off from the bones. The large bones or parts of their diaphysis were probably collected from the kill site or other places. Palaeolithic hunters hunted not only mammoth calves but also full-grown males as well: this was proved by the mammoth skeletons from Dunaföldvár and Mátraderecske, where stone tools (weapons?) were found associated with the bones (CSALOGOVITS 1936., VÉRTES 1954., VÖRÖS 1975., BIRÓ 1984.) Dunaföldvár was a kill-site where two juvenile mammoths and a *bison* were captured from the animals which used to go there for drinking. The prey was butchered on spot and parts carried away. For example, only the vertebral column of the bison were left behind. At Mátraderecske, a died (?) mammoth was hunted on the site, proved by the existence of the complete skeleton. The head, leaning on the tusks, was found in vertical position at the left side of the body. The carcass was not disassembled. A large stone tool was found 6–7 m far from the head of the animal in the same level.

Mammoth tusk was used for the production of thin spear-heads, "tusk sticks" – this was specially characteristic of the Aurignacian culture. At the site Verseg, from habitation surface Nr. 1. (C section 4 block, –120 cm) an arched triangular "spoon" was found, made of mammoth tusk (VÖRÖS 1991c. 88. Figs. 4–5). Similar but hafted specimen, pierced and ornamented with rows of dots described as "amulet" was published from Brinzeni cave, Moldavia (DAVID 1980. 47–48 Fig. 15.).

We can calculate the hunting season on the transit campsite Bodrogkeresztúr, based on the age of some young animals:
among the *elk* calves, 2 individuals were hunted in spring (U.III.63. A. tr., U.III.82. 2 tr.), 5 individuals were captures by the end of summer-beginning of autumn (U.III.63. J-G. sec., U.I.82. E sec.);
among the young *horses*, 6 individuals were taken by the end of summer-beginning of autumn (U.I.82. E-C-D. sec., U.III. 63. E-J.1-2), one individual was killed in spring (U.III.63. G.sec.) and two in winter (U.I.82. 3. Tr., U.II. 82. 3 tr.)

The total amount of useful meat which could be, theoretically utilised was 20 462 kg *(Table 28.)*, of which 34%, 6 902 kg meat was actually documented by the bones found on the excavated parts of the settlement. This was a considerable amount of food in itself.

result of climatic as well as antropogeneous factors; they may migrate to the south to considerable distances from their permanent areal.

4. *Cervus* (occurrence frequency 0,6%) belong to "forma major" (*Cervus s. maral*). In Central Europe, the red deer was driven back before the cold maximum of Würm III towards the south to the submountainous-submediterranean region.

5. *Bison* (occurrence frequency 1,4%). The postcranial bone dimensions agree best with the short-horn Eastern European *Bison priscus* mediator form.

6. *Mammuthus* (occurrence frequency 5,5%): compared to the frequency of faunistical finds, the number of mammoth remains found on Upper Palaeolithic sites as hunted is surprisingly low. On the Upper Palaeolithic settlements younger than 18–20 ka BP., mammoth bones were probably transported not as a result of hunting but much rather, collecting of bones.

7. The top-predator *Leo* and the *Lepus* were rare elements in the fauna.

8. At Bodrogkeresztúr, the frequency of animal remains was unevenly distributed among the settlement units. The two main big game were *horse* and *elk*; frequency of accessory game was low. *Horse* remains dominated in Unit I., *elk* remains dominated in Unit III.

9. The anatomical distribution of the bones proved that none of the animals had been taken to the settlement in whole. The total amount of useable meat calculated on the basis of individual number of hunted animals (108) was 20462 kg, the amount of meat associated with the bones actually found on the settlement was 6902 kg. The accumulation of the meaty vs. dry limbs of the two main big game show complementary tendencies: *horse* remains were dominated by meaty limb bones, elk remains were dominated by dry limb bones. *Bison* and red deer were mainly occurring as dry limb bones. Remains of mammoth were probably not for the purpose of eating. The remains of the cave lion found were typical for terminal bones left in the stripped skin.

10. The Bodrogkeresztúr hunters used to go after their prey along the southern margin of the Tokaj-Eperjes Mts., the gallery forests of the floodplain of the rivers Bodrog and Tisza. Herbivore large mammals used to live in these ecological niches. *Elk*, red deer, bison and the large *horse* could be of forestal area, the small medium horse from the steppean region. With the exception of the resident red deer, the other animal species were migratory types. On the basis of the mortality of the hunted animals, the hunting season could be hypothesed for spring, late spring-autumn and winter.

11. The fauna of the Bodrogkeresztúr-Henye Upper Palaeolithic settlement could be dated to the **second half of the Istállóskő faunal phase.**

DESBROSSE—PRAT 1974 R. Desbrosse—F. Prat: L' Elan magdalénien de Poerre-Chatel (Ain). Quartär 25 1974 Bonn 144–157.

DRIESCH 1976 A. Driesch von den: A guide to the measurement of animal bones from archaeological sites. Peabody Mus. Bull.1. Cambridge 1976.

DOBOSI—VÖRÖS 1979 V. Dobosi—I. Vörös: Data to an evaluation of the finds assamblage of the Palaeolithic Paint Mine at Lovas. Fol.Arch. 30. 1979 7–26.

DUERST 1926 J. U. Duerst: Vergleichende Untersuchungsmethoden am Skelett bei säugern. In.: E. Abderhalden: Handbuch der biologischen Arbeitsmethoden. Abt. VII. Heft 2. 1926. 125–530.

EMPEL—ROSKOSZ 1963 W. Empel—T. Roskosz: Das Skelett der Gliedmassen des Wiesents, Bison bonasus (Linnaeus, 1758). Kosciec konczyn zubra, Bison bonasus (Linnaeus, 1785). Acta Theriologica 7, 13. 1963. Bialowieza. 259–320.

ÉHIK 1916 Éhik, Gy.: A Herman Ottó-barlang ásatásainak faunisztikai eredményei. Barlangkut. 4. Budapest 1916 24–29.

FISCHER 1993 A. Fischer: The Late Palaeolithic. In.: S. Hvass–B. Storgaard : Digging into the Past. 25 Years of Archaeology in Denmark. Copenhagen 1993. 51–57.

FODOR—VÖRÖS 1990 Fodor, L.—Vörös, I.: Pleisztocén ősemlősmaradványok Visontáról. Diluviale Ursäugetier-Reste aus Visonta. Agria 24. Eger 1990. 5–20.

FORSTEN 1982 A. Forsten: Equidae. In.: J. K. Kozłowski ed.: Excavation in the Bacho Kiro Cave (Bulgaria) Final Report. Warszawa 1982 56–64.

FORSTEN 1988 A. Forsten: The small caballoid horse of the upper Pleistocene and Holocene. P. J. Anim. Breed. Genet. 105. 1988. Hamburg–Berlin. 161–176.

FORSTEN 1990 A. Forsten: Dental size trend in an equid sample from the Sandalja II cave of northwestern Yugoslavia. Paläont. Z. 64. 1–2. Stuttgard 1990 153–160.

FORSTEN 1991 A. Forsten: Size decrease in Pleistocene-Hohocene true or caballoid horses of Europe. Mammalia 55,3. 1991. 407–419.

FRANK et al. 1995 Ch. Frank–G., K. Kunst–J. Mlikovsky–D. Nagel–G. Rabeder –K. Rauscher–G. Reiner: Liste der fossilen Faunen der Gamssulzenhöhle im Toten Gebirge (OÖ). Mitt. Komm. Quartärforsch. 9. Wien 1995 51–52.

FRAYER 1981 D. W. Frayer: Body size, weapon use, and natural selection in the European Upper Paleolithic and Mesolithic. Am. Anthropologist 83, 1. 1981 57–73.

GAMBLE 1986 C. Gamble: The palaeolithic settlement of Europa. Cambridge 1986 471.

GAÁL 1933a Gaál, I.: A jávorszarvas legrégibb csontmaradványa Magyarországon. Pótfüz. A Term. Tud. Közl. 65. Kötetéhez 1933. 189. Füz. 19–22.

GAÁL 1935 Gaál, I.: A bánhidai Szelim-barlang ásatása. Pótfüzet a Term. Tud. Közl. 67. Kötetéhez 1935. Füz. 49–63.

GAÁL 1943a Gaál, I.: Újabb ember- és emlőscsontleletek Erdély moustérijéből. Neuere Menschen- und Säugetierknochen aus dem Moustérien Siebenbürgens. Közl. az Erdélyi Nemzeti Múz. Érem- és Régiségtárából 3,1. 1943. Kolozsvár 1–46.

GÁBORI 1969 M. Gábori: Paläolithische Schnecken-Depots von Szob. Acta ArchHung 21. 1969 3–11.

GÁBORINÉ-CSÁNK 1980 Gáboriné-Csánk, V.: Az ősember Magyarországon. Budapest 1980 265.

GÁBORI-CSÁNK 1984 Gábori-Csánk V.: A felső paleolitikum nyoma Budapesten. Spuren des oberen Paläolithikum in Budapest. Bud.Rég. 25. 7–14.

GÁBORI-CSÁNK 1986 Gábori-V. Csánk: Spuren des Jungpalaolithikums in Budapest. ActaArchHung 38 .1986 3–12.

GINTER—KOZŁOWSKI 1982 B. Ginter—J. K. Kozłowski: Conclusions. In.: J. K. Kozłowski ed.: Excavation in the Bacho Kiro Cave (Bulgária) Final Report. Warszawa 1982 169–172.

GINTER—KOZŁOWSKI 1992 B. Ginter—J. K. Kozłowski: The archaeological sequence. In.: J. K. Kozłowski et al. ed.: Temnata Cave Excavations in Karlukovo Karst Area Bulgaria Vol.1. Part 1. Kraków 1992 289–293.

GROMOV 1948 V. I. Gromov: Paleontologicheskoe i arkheologicheskoe obosnovanie stratigrafii kontinentalnih otlozenij chetvertichnogo perioda ha territorii SSSR. AN.SSSR. Tr.Inst. Geol. N.64., Geol. Ser. 17. Moskva 1948 521.

KERTÉSZ—SÜMEGI 1999 Kertész, R.—Sümegi, P.: Az Északi-középhegység negyedidőszak végi őstörténete. Emder és környezet kapcsolata 30.00 és 5.000 BP évek között a szubkárpáti régióban. Nógrád MM Évk. 23. 1999. 66–93.

KORDOS—RINGER 1991 Kordos, L.—Ringer, Á.: A magyarországi felső-pleisztocén Arvicolidae-sztratigráfiájának klimato – és archeosztratigráfiai korelációja. MÁFI. Évi Jel. 19189. Évről (1991) Budapest 523–534.

KOCH 1900 Koch, A.: A magyar korona országai kövült gerinczesállat maradványai rendszeres átnézete. Magy. Orv. És Term. Vizsg. 30. Vándorgy. Munk. Szabadka. 1900. Budapest 526–560.

KOENIGSWALD 1991 W. v. Koenigswald: Exoten in der Grossäuger-Fauna des letzten Interglazials von Mitteleuropa. Eiszeitalter u. Gegenwart 41 Hannover 1991 70–84.

KOWALSKI 1959 K. Kowalski: Katalog ssaków plejstocenu Polski. A cataloque of the pleistocene mammals of Poland. PAN. Inst.Zoo.Oddzial w Krakowie. 1959. Warszawa – Wroclaw. 267.

KRETZOI 1946a M. Kretzoi: Die Wirbeltierfauna aus dem älteren Pleistozän von Solymár (Manuscript). 1946.

KRETZOI 1946b M. Kretzoi: On Bison bonasus hungarorum n. ssp. Ann.Hist.-nat. Mus. Nat. Hung. 39–. 5–6. Budapest 1946 105–107.

KRETZOI 1964a Kretzoi, M.: A Bodrogkeresztúr Henye hegyi keleti gravetti telep faunája. In.: Vértes, L.: Bodrogkeresztur Henye hegy keleti gravetti telep ásatása. Jelentés. MNM At. V. 94. 1965.

KRETZOI 1954b M. Kretzoi: Marmota-maradványok – Debrecenből. Marmot – remains from Debrecen. Földt.Közl. 84. 1–2. 1954 75–77.

KRETZOI 1968a M. Kretzoi: Étude Paléontologique. In.: Gábori-V. Csánk: La station du paléolithique moyen d' Érd-Hongrie. Mon. Hist. Budapestinensia 3. 1968. Budapest 59–103.

KRETZOI 1969a M. Kretzoi: A magyarországi quarter és pliocén szárazföldi biosztratigráfiájának vázlata. Sketch of the Late Cenozoic (Pliocene and Quaternary) terrestrial stratigraphy of Hungary. Földr. Közl. 17 (93) 3 1969 179–204.

KRETZOI 1969b M. Kretzoi: Erganzende Angaben zur Kenntnis der jungpaläolothischen Reststelle Bodrogkeresztur-Henye (NO-Ungarn). Manuscript. 1969.

KRETZOI et al. 1982 M. Kretzoi—P. Márton—M. Pécsi—F. Schweitzer—I. Vörös: Pliocene-pleistocene piedmont correlative sediments in Hungary (Based on lithological, geomorphological, paleontological and paleomagnetic analyses of the exposures in the open-cast mine at Gyöngyösvisonta). Quaternary Studies in Hungary 1982. Budapest 43–73.

KUBACSKA 1927 Kubacska, A.: A solymári sziklaüreg pleisztocén csontlelete. Barlangvilág 1 1926 1–4. (1927) 17–26.

KUBIAK 1965 H. Kubiak: Slonie kopalne Polski poludniowej. The Fossil Elephants of South Poland. Fol. Quaternaria 19. 1965 Kraków. 1–43.

KUBIAK—NADACHOWSKI 1982 H. Kubiak—A. Nadachowski: Artiodactyla. In.: J., K. Kozłowski ed.: Excavation in the Bacho Kiro Cave /Bulgaria/ Final Report. Warszawa 1982 61–66.

KROTOVA—BELAN 1993 A, A. Krotova—N, G. Belan: Amvrosievka. A Unique Upper Paleolithic Site in Eastern Europe. In.: O. Soffer – N. D. Praslov ed.. From Kostenki to Clovis. Upper Paleolithic-Paleo-Indian Adaptations. New York–London 1993 125–142.

LUCIUS 1970 E, Lucius: Das Problem der Chronologie jungpaläolithischer Stationen im Bereiche der europäischen UdSSR. Mitt.Prahist.Komm.Öst.Akad.Wiss. 13–14. Wien 1969–1970 130.

MACAROVICI 1962 N. Macarovici: Contribution á la connaissance de Alces palmatus Ham. Smith dans le Quaternaire de la Roumanie. Eiszeitalter u. Gegenwart 12 Ohringen/Württ. 1962 66–72.

MALEZ 1963 M. Malez: Kvartarna fauna pecine Veternice u Medvednici. Die Quartäre Fauna der Höhle Veternica (Medvednica – Kroatien). Palaeont. Jug. 5. Zagreb. 1963 193.

PHLEPS 1907 — O. Phleps: Ueber das Skelett eines weiblichen Bison priscus Boj. sowie andere Bison und Bosreste aus dem Diluvium Siebenbürgens. Verhandl. Mitt. Siebenb. Vereins.f. Naturw. 56. Hermannstadt. (1906) 1907 1–44.

PIDOPLICHKO 1956 — I. G. Pidoplichko: Materiali do vivchenya minulih fauna URSR 2. AN. URSR. 1956 Kiev 234.

POHAR 1983 — V. Pohar: Poznoglacialna favna iz Lukenjske jame. La faune tardiglaciaire de la grotte de Lukenjska jama. Geologija 26. 1983. Ljubljana 71–107.

POHAR 1985 — V. Pohar: Kvartarni sesalci iz Babje jame pri Dobu. Les mammiféres quaternaires de la grotte de Babja jama (Dob). Razprave 4. Razreda SAZU 26. Ljubljana 1985 97–130.

POHAR 1997 — V. Pohar: Late Glacial mammal macrofauna in Slovenia. Quartär 47/48 1997. 149–158.

PRAT 1968 — F. Prat: Recherches sur les équidés pleistocénes en France. Thése Sci. nat. Bordeaux. 226. 1968. Bordeaux 662.

RAKOVEC 1953 — I. Rakovec: Bizon iz mostiscarske dobe na Ljubljanskem barju. On Bison of the Lacusstrine Age from the Ljubljansko barje in Slovenia (NW Yugoslavia). Ar. h. vestnik 3. 1953. Ljubljana 257–287.

RAKOVEC 1956 — I. Rakovec: O ostankih evropskega losa v Jugoslaviji. The remnants of the Elk (Alces alces L.) in Yugoslavia. Geol. Anali Balkan. poluostrva 24 Beograd 1956 1–14.

RAKOVEC 1965 — I. Rakovec: Pleistocenska sesalska favna iz Risovace pri Arandjelovcu. Pleistocene mammalian fauna from Risovaca near Arandjelovac (Serbia). Razpr. 4. razr. 8. Ljubljana 1965 225–317.

RAKOVEC 1975 — I. Rakovec: Razvoj kvartarne sesalske favne Slovenije. Über Quartäre Säugetierfaunen Sloweniens (NW Jugoslawien). Arh. Vestnik 24 (1973) 1975. Ljubljana 225–270.

REICHENAU 1915 — W. Reinchenau: Beiträge zur näheren Kenntis fossiler Pferde aus deutschem Pleistozän, insbesondere über die Entwicklung und die Abkaustadien des Gebisses vom Hochterrassenpferd (Equus mosbachensis v.R.). Abh. hess. Geol. Landesanstalt 7. 1 1915. Darmstadt 155.

RIEDEL 1980 — A. Riedel. Il cavallo della grotta Tilde. The horse of the Tilde Cave. Atti Mus.Civ. St. Nat., 32. (1) 2. 1980. Trieste 19–110.

RUFFO 1995 — M. Ruffo: Origine degli insiemi faunistici nei vari livelli deposizionali della Grotta delle Capre – S. Felice Circeo (LT) – 1993. In.: Archeozoologia. 1 Convegno Nazionale. Padusa Quaderni 1. 1995. Rovigo 109–123.

SÁRKÖZY 1916 — Sárközy, Gy.: Vadászlap 1916. júl. 25. 247–248.

SKORKOWSKI 1938 — E. Skorkowski: Badania nad systematyka konia. Studien über die Systematik des Pferdes. Prace Rolniczo-Lesne 32. 1938. Kraków 125.

SOFFER 1985 — O. Soffer: The Upper Paleolithic of the Central Russian Plain. Orlando 1985 539.

STURDY—WEBLEY 1988 — D. A. Sturdy—D. P. Webley: Palaeolithic geography: or where are the deer? World Arch. 19.3. 1988 262–280.

SZALAY 1916 — Szalay, B.: Jávorszarvasunk. A magyarországi Alces palmatus története. Különlenyomat a Vadászlap 1916. évi 37. évf.-ból 1–11.

TELEGIN 1985 — D. Ya.Telegin: Pamjatniki epokhi mezolita na territorii Ukrainskoj SSR. ANU SSR. 1985 Kiev 183.

THENIUS 1959 — E. Thenius: Die jungpleistozäne Wirbeltierfauna von Willendorf i. d. Wachau, N. Ö. In.: Felgenhauer, Fr. ed.: Willendorf in der Wachau. Mitt. Prähist. Komm., 8–9. 1. 1956–1959. Wien 128–170.

TOPÁL—VÖRÖS 1984 — Gy. Topál—I. Vörös: Notes on history and recent records of elk (Alces alces /L./) in Hungary. Vert. Hung. 22. 1984 83–94.

TRINGHAM 1969 — R. Tringham: Animal domestication in the Neolithic cultures of the south-west part of European USSR. In.: P. J. Ucko–G. W. Dimbleby ed.: The domestication and exploitation of plains and animals. London 1969 381–392.

VÖRÖS 1990b I. Vörös: Szabolcs ispánsági székhely Árpád-kori állatcsontleletei. Árpád Age animal bones from Szabolcs. JAM Évk. 27–29 (1984–1986) 1990. Nyíregyháza 165–188.

VÖRÖS 1991a Vörös, I.: Magyarországi Elephantidae-k biosztratigráfiája. 1991. Kézirat.

VÖRÖS 1991b I. Vörös: Large mammal remains from the Upper Paleolithic site at Esztergom-Gyurgyalag. Acta. Arch. Hung. 43. 1991 261–264.

VÖRÖS 1991c I. Vörös: A versegi paleolit telep emlősfaunája. Die Säugetierfauna der Paleolithsiedlung von Verseg. Stud.Com. 21. 1991. Szentendre 85–96.

VÖRÖS 1994 I. Vörös: Bird and Mammal faunal revision of Kiskevély Cave. In.: V. T. Dobosi–I. Vörös: Material and chronological revision of the Kiskevély Cave. Fol.Arch. 43. 1994 21–36.

VÖRÖS 1996 Vörös, I.: A balácai neolitikus telep állatcsont-maradványai. Com.Arch Hung. 1996 45–51.

VÖRÖS 1998 Vörös, I.: A Duna-kanyar bal partjának pleisztocén nagyemlős leletei. Kézirat.

WYROST 1994 P. Wyrost: Dawna fauna Polski w świetle badan kostnych materialów archeologicznych rozmieszczenie w czasie i przestrzeni The fauna of ancient Poland in the light of archaeological bone materials research. Rocz.ar. Pozn. 259 1994 Poznan 75–176.

ŽELIZKO 1923 J. V. Želizko: Diluviálni fauna od Volyné. Zpráva o vyzkumu za rok 1918–1919. Fauna pléistocene de Volyné. Sborn. Stát. geol. u. Ceskoslovensko 1923. II.2. Praha 237–275.

APPENDIX

Macro-mammal remains on Hungarian Upper Pleistocene sites

István VÖRÖS

Hungarian vertebrate palaeontological research published 100 years ago the large-scale catalogue site list known as the "Koch-catalogue". Its exact reference is the following: Koch, A.: A Magyar korona országai kövült gerinczes állat maradványainak rendszeres átnézete" [A systematic list of the vertebrate fossil remains of the land under the auspices of the Hungarian Crown] (Magy. Orv. és Term.-Vizsg. Szabadkai Vándorgyűlés Munk., 30. Bp. 1900. 526–560). In this work – without references to technical literature due to lack of space – 73 species from the Quaternary period were enumerated. Apart from localities with cave bear, hyena and lion, sites with 20 herbivorous macro-mammals were listed.

The publication of the next, dominantly macro-mammal lists can be attributed to the renewal of Hungarian spelaeological research from the turn of the twenties, thirties of the 20th century, which became increasingly more intensive. At first, only the "species" of the individual cave layers (KADIĆ 1934.), later "faunas"of layers (MOTTL 1938b, 1940.), later "faunas" of the established Palaeolithic cultures were published (Solutréan: MOTTL 1938b., Aurignacian: MOTTL 1942a.). Later on, the faunistical results of the open-air sites along the Danubebend (MOTTL 1942b.) and that of the Bükk caves became know (MOTTL 1944, 1945.), though with some delay.

The first virtually complete list of the new Mammalian faunas extending over the whole Pleistocene, following chronological order – but unfortunately without references - was published by M. Mottl, under the title "Az interglaciálisok és interstadiálisok a magyarországi emlősfauna tükrében" [Interstadials and interglacials as reflected by the Hungarian Mammalian fauna] (Földt.Int. Évk. 35.2., 1941 75–112).

In the monograph "A Magyar Régészet Kézikönyve I." [Handbook of Hungarian Archaeology I] (VÉRTES 1965.) L. Vértes published fauna lists in chapters 26. "Barlangi lelőhelyeink…" [Cave sites in Hungary] and 27. "Külszíni (lösz és terasz) telepeink természettudományos és régészeti adatai "[Archaeological and scientific data on Hungarian open-air (loess and terrace) sites]. Former fauna lists were

3. yellowish red layer: *Crocotta*, *Cervus*, *Bos*, *Equus*, *Coelodonta*.

5. dark brown layer: *Crocotta*, *Sus*, *Cervus*, *Bos*, *Equus*. (MOTTL 1938c. 215, 221–225).

II. VARBÓ FAUNAL PHASE

/1./ Csákvár cave, Vértes Mts.

Side branch – upper part of yellow layer (mixed) Leading fossil: *(Hystrix)*, *Megaloceros*, *Asinus*.

Other taxa: *Crocotta*, *Sus*, *Cervus*, *Capreolus*, *Bison sp.*, *Equus*, *Coelodonta* (KRETZOI 1954a. 43–44).

4. Diósgyőr-Tapolca cave, Bükk Mts., Castle hill

Brown / Dark brown layer, marked "b": (*Hystrix* p.c. by M. KRETZOI), *Crocotta*, *Sus*, *Cervus*, *Megaloceros*, *Bos*, *Bison*, *Equus*, *Coelodonta*, *Mammuthus* (SAÁD—GAÁL 1935. 60–62).

5. Kiskevély cave, Pilis Mts.

Yellow layer nr. 5. "with hyena": *(Hystrix)*, *Crocotta* (VÖRÖS 1994. Fig. 8. Table 1.).

6. Kiskőhát pot-hole, Bükk Mts.

Reddish brown layer: *(Hystrix)*, *Cervus*, *Rangifer*, *Bison*, *Equus*, *Coelodonta* (JÁNOSSY 1979. 129).

7. Lambrecht cave, Bükk Mts.

Layer IV: dark grey: *(Hystrix)*. *Crocotta*, *Sus*, *Capreolus*, *Cervus f. major*, *Alces*, *Megaloceros*, *Rangifer*, *Bison*, *Asinus*, *Equus*, *Coelodonta*, *Mammuthus*

Layer complex V: from black to reddish brown: *(Hystrix)*, *Leo*, *Crocotta*, *Sus*, *Capreolus*, *Cervus f. major*, *Alces*, *Megaloceros*, *Rangifer*, *Bison*, *Asinus*, *Equus*, *Coelodonta*, *Mammuthus*

Layer V/a (=lower part of Layer V.): *(Hystrix)*, *Bison* (JÁNOSSY 1963. 294, 298).

8. Porlyuk cave, Aggtelek Karst area

"Flat room" – lower 1st reddish brown layer (JÁNOSSY 1979. 121 = layer 4. In JÁNOSSY et al. 1973. Fig. 5.): *Capreolus*, *Cervus*, *Equus* (JÁNOSSY et al. 1973. 34).

9. Poroslyuk, Bükk Mts.

Red/brown -reddish brown layer: *(Hystrix)*, *Sus*, *Capreolus*, *Cervus*, *Bison*, *Equus* (JÁNOSSY 1979. 128).

10. Pörgölhegy (Szárazgerence) cave, Bakony Mts.

V. "terra rossa" layer: *Cervus* (VARRÓK 1955. 494).

11. Solymár-Ördöglyuk cave, Budai Mts.

Denevér (Bat) room A/5. yellowish brown layer: *(Hystrix)*, *Leo*, *Crocotta*, *Capreolus*, *Cervus*, *Equus*, *Coelodonta* (VÖRÖS 1988a. 44 Table 4).

12. Süttő-Calcareous tuff,

(Hystrix), *Sus*, *Cervus*, *Megaloceros*, *Bovidae* (KORMOS 1925. 162–163).

13. Tarkő rock shelter, Bükk Mts.

Block IIIa, lower brownish layer marked "5": *(Hystrix)*, *Leo*,

Block VI. Terra rossa, layer "8": *(Hystrix)*, *Cervus*, *Rangifer*, *Bison* (JÁNOSSY 1976. Tabl. II/B-C)

III. SUBALYUK FAUNAL PHASE

/4./ Diósgyőr-Tapolca cave, Bükk Mts., Castle Hill

I/4. brownish grey layer: *Sus*, *Bos* seu *Bison*.

I/3. yellowish-reddish brown layer: *Megaloceros*, *Rangifer*, *Bison*, *Equus*, *Coelodonta*, *Mammuthus*

II/5. light grey layer: *Crocotta*, *Bos* seu *Bison*, *Asinus*, *Equus*, *Mammuthus*

II/4. reddish grey layer: *Megaloceros*

II/3. reddish brown layer: *Leo*, *Crocotta*, *Cervus*, *Megaloceros*, *Rangifer*, *Bos*, *Bison*, *Coelodonta*, *Mammuthus* (HELLEBRANDT—KORDOS—TÓTH 1976. 31). In the grey-dark grey layer "c" of the old excavation there were no *Crocotta* and *Mammuthus* (SAÁD—GAÁL 1934. 18), it is erroneously published in HELLEBRANDT et al. 1976. 31).

/5./ Kiskevély cave, Pilis Mts.

Layer 4. dark brown /reddish brown , *Leo*, *Crocotta*, *Sus*, *Cervus*, *Alces*, *Megaloceros*, *Bos*, *Bison*, *Asinus*, *Equus* *Coelodonta*, *Mammuthus*, (MOTTL 1938b. 40-41, 1941. 13,) *Bos*=*Bison*, *Megaceros* =*Alces* (VÖRÖS 1994, Tabl.1. Fig. 8).

In her earlier publications M.Mottl did not mention *Hystrix* from this layer (1938b. 40–41.). Later this species has occured in the faunal list (MOTTL 1941. 13) probably from the 5th layer.

/7./ Lambrecht cave, Bükk Mts.

III. yellow layer, *Capreolus*, *Alces*, *Megaloceros*, *Equus* (JÁNOSSY 1964. 145, 148).

14. Lengyel cave, Gerecse Mts.

Leo, *Capreolus*, *Cervus*, *Megaloceros*, *cf. Bison*, *Asinus*, *Equus*, *Coelodonta*, *Mammuthus* (JÁNOSSY 1979. 135).

Light grey layer: *Leo*, *Crocotta*, *Cervus* sp, *Megaloceros*, *Rangifer*, *Bison*, *Equus*, *Coelodonta* (MOTTL 1938b. 42, 1941. 14, KRETZOI 1954a. 42–43).

24. Görömbölytapolca cave, Bükk Mts., Szentkereszt Mt.

Niche III., 3. brown-brownish yellow layer: *Crocotta*, *Cervus*, *Megaloceros*, *Rangifer* (VÉRTES—KRETZOI—BERTALAN 1965. 82).

25. Herman Ottó cave, Bükk Mts.

Main branch – entrance hall

5. yellow layer: *Megaloceros*.

3. yellow / limestone breccious layer: *Alces*.

2. yellow layer with limestone grit: *Crocotta*, *Cervus* (2 pieces of pierced "pearl tooth" canines), *Alces*, *Megaloceros*, *Bos sp.* ? (KADIĆ 1916. 10–11, Fig. 9, ÉHIK 1916. 25, MOTTL 1938b. 41–42, 1941. 11) *Bos* (MOTTL 1942 a. 101).

26. Jankovich cave, Gerecse Mts.

Side branch – Dome room, reddish-yellow layer: *Leo*, *Crocotta*, *Rangifer*, *Equus*, *Coelodonta* (HILLEBRAND 1915. 133, MOTTL 1938b. 45, 1941. 14), Without layer assignation: *Megaloceros*, *Bos* seu – *Bison* – data by M. KRETZOI (VÉRTES 1965. 305).

27. Kecskésgalya cave, Bükk Mts.

Main hall – 3. Light brown layer (erroneously published as dark brown in VÉRTES 1965. 310): *Crocotta*, *Megaloceros*, *Rangifer*, *Bos* ?, *Bison*, *Equus*, *Coelodonta* (KADIĆ 1940. 219, MOTTL 1940. 1903, 1945. 1526).

4. dark grey layer (erroneously published as greenish grey by KADIĆ 1940. III. map, adopted by VÉRTES 1965. Fig. 18.): *Leo*, *Crocotta*, *Cervus*, *Megaloceros*, *Rangifer*, *Bison*, *Equus* (KADIĆ 1940. 220–221, MOTTL 1940. 1902–1903). In the publication of Kadić, *Cervus canadensis asiaticus* or *Cervus maral* was missing from the fauna list though, it was included in the description of species (KADIĆ 1940. 219–221).

In the contracted fauna list of 4. dark grey + 3. light brown layers contains *Cervus elaphus* f. *major* (MOTTL 1941. 10) as well.

Rear part of the cave (results of the 1937 excavation):

3. light brown layer: *Crocotta*, *Megaloceros*, *Rangifer*, *Bison*, *Equus*, *Coelodonta*.

4. dark grey layer: *Leo*, *Crocotta*, *Cervus* (*maral* ?), *Megaloceros*, *Rangifer*, *Bison*, *Equus*, *Coelodonta* (MOTTL 1945. 1526–1527).

28. Megyefa rock shelter, Mecsek Mts.

Leo, *Crocotta*, *Cervus elaphus* sp., *Megaloceros*, *Bison*, *Equus*, *Coelodonta*, *Mammuthus* (KRETZOI 1942a. 364).

29. Mexikóvölgy cave, Bükk Mts.

4. brown layer: *Crocotta*, *Megaloceros*, (MOTTL 1938b. 41).

Leo, *Cervus elaphus* sp., *Megaloceros* (KRETZOI 1942b. 268).

30. Miskolc-Tapolca rock shelter, Bükk Mts.

Megaloceros, *Bison*, *Equus*, *Coelodonta*, *Mammuthus* (JÁNOSSY—VÖRÖS 1979. Nr. 379).

31. Remete Upper cave, Buda Mts.

I. Small hall

4. yellow layer: *Leo*, *Cervus*, *Megaloceros* sp., *Rangifer*, *"Ovibos"* (= small Bison VI.), *Bos* seu *Bison*, *Equus*, *Coelodonta*, *Mammuthus*.

II. Large hall

4. yellowish brown layer, upper level: *Leo*, *Crocotta*, *Cervus*, *Megaloceros* sp., *Rangifer*, *"Ovibos"* (= small Bison VI.), *Bos* seu *Bison*, *Equus*, *Coelodonta*, *Mammuthus*.

– lower level: *Leo*, *Crocotta*, *Cervus*, *Megaloceros sp.*, (data by M. KRETZOI in GÁBORI-CSÁNK 1983, 1993. 61–63).

32. Szeleta cave, Bükk Mts.

6. (upper) light grey + red culture layer: *Leo*, *Crocotta*, *Megaloceros*, *Rangifer*, *Equus*, (KADIĆ 1934. 35, MOTTL 1938b. 45, 1941. 14).

4. dark grey layer: *Crocotta*, (KADIĆ 1934. 35).

3. light brown layer: *Leo*, *Crocotta*, *Megaloceros*, (KADIĆ 1934. 35).

2 (lower) brown /dark brown layer (erroneously published as light brown by MOTTL 1941. 14, 1945. 1521): *Leo*, *Crocotta*, *Cervus* (*elaphus*), *Megaloceros*, *Rangifer*, *Bison*, *Coelodonta*, *Mammuthus* (KADIĆ 1934. Fig. 4. 34, MOTTL 1938b. 36, 1941. 14, 1945. 1521).

33. Szelim cave, Gerecse Mts.

3. brown/dark brown "C" layer (with hyena): *Leo*, *Crocotta*, *Cervus canadensis asiaticus*, *Alces*, *Megaloceros*, *Rangifer*, *Equus*, *Coelodonta*, *Mammuthus* (MOTTL 1938b. 43, 1941. 13, GAÁL 1943b. 435).

1. yellow (GAÁL 1935.), light yellow (GAÁL 1941. fig. 7), brownish yellow (GAÁL 1943b., 434) "E" layer: *Leo*, *Crocotta*, *Megaloceros*, *Rangifer*, *Bison*, *Mammuthus* (data by D. JÁNOSSY in VÉRTES 1965. 344–346).

59. Szolnok - Tisza river bed
Cervus, Alces, Megaloceros, Rangifer, Bos, Bison, Equus, Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 501).

60. Szolnok - Pusztavarsány, Tisza river bed
Megaloceros, Bison, Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 492).

61. Szolnok-Zagyva fork
Megaloceros, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 502).

62. Tiszadada - Tisza river bed
Megaloceros, Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 479).

63. Tiszafüred - Tisza river bed
Cervus, Megaloceros, Bison, Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 485).

64. Tiszakécske - Tisza river bed
Alces, Megaloceros, Bison (JÁNOSSY—VÖRÖS 1979. Nr. 521).

65. Tiszasüly - Tisza river bed
Cervus, Alces, Megaloceros, Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 491).

66. Tiszaszőlős - Tisza river bed
Megaloceros, Bison, Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 487).

67. Tiszaug - Tisza river bed
Megaloceros, Bos, Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 524).

68. Tiszaug - Kecskeméti szikra, **Tisza river bed**
Cervus, Megaloceros, Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 525).

69. Vác-Csipkés - Upper Palaeolithic site, underlying loess
Megaloceros, Coelodonta (VÖRÖS 1998.).

70. Vezseny - Tisza river bed
Alces, Megaloceros, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 515).

71. Zalaegerszeg - II. Brickyard, 10–15 m deep
Megaloceros, Bison, Equus, Coelodonta, Mammuthus (VÉRTES 1954. 17, JÁNOSSY—VÖRÖS 1979. Nr. 56).

V. ISTÁLLÓSKŐ FAUNAL PHASE

72. Aggtelek - Baradla cave, Aggtelek Karst Mts.

Main branch and Denevér (Bat)-branch, yellow-red layer: *(Ursus spelaeus, Vulpes vulpes), Sus scrofa, Cervus elaphus, Rangifer tarandus, Equus sp., Coelodonta antiquitatis, Mammuthus primigenius* (VÉRTES 1954. 18, VÖRÖS 1974., 1980. 17, JÁNOSSY—VÖRÖS 1979. Nr. 406).

/24./ Görömbölytapolca rock shelter Bükk Mts., Szentkereszt Mt.

Yellowish brown layer: *Crocotta, Cervus, Rangifer* (HILLEBRAND 1935. 24, MOTTL 1941. 12). *Bos* seu *Bison*, without layer assignment, data by D. JÁNOSSY in VÉRTES 1965. 294).

Niche III. yellow layer: 3 pieces of pierced *Cervus* teeth (incisivus) (VÉRTES—KRETZOI—BERTALAN 1965. 81–82, Taf. I. 1–3).

73. Háromkúti cave, Bükk Mts.
First room - greenish layer: *Crocotta, Capreolus, Cervus* (KADIĆ 1914. 189, MOTTL 1941. 20).

74. Istállóskő cave, Bükk Mts.
V. yellow layer: *Leo, Crocotta* (VÖRÖS 1984. Tabl.1.).

IV. yellowish brown layer "in situ" large hearth: *Leo, Crocotta, Sus, Cervus* f. *major, Rangifer, Bison, Equus (Mammuthus* in the form of a tusk artefact), (MOTTL 1942a. 91, 1944. 44–45, JÁNOSSY 1955. 159–163, VÖRÖS 1984. Tabl 1.).

III. (dark brown, reddish brown, light brown, greyish brown, grey) layer complex, three different cultural layers: *Leo, Crocotta, Cervus f. major, Alces, Rangifer, Bison, Equus (Mammuthus* in the form of a tusk artefact), (VÉRTES 1955. 119, 129–130, JÁNOSSY 1955. 159–163).

II.dark brown, "lower layer with microfauna"

I. layer complex(light brown, dark brown layers) with two cultural layers: *Leo, Crocotta, Cervus f. major, Rangifer, Bison (Mammuthus* in the form of a tusk artefact) (VÉRTES 1955, 119, 129–130, JÁNOSSY 1955. 159–163).

/26./ Jankovich cave, Gerecse Mts.
"Uppermost" yellow layer: *Rangifer, Equus, Coelodonta* (KORMOS-LAMBRECHT 1914. 78–79, MOTTL 1941. 16).

In the front part of the cave, "Magdalenian age", in "microfauna-rich" part of yellow ? layer, polished butt-head bone awl made of *Alces* metapodium (HILLEBRAND 1919. 9, fig. 3.).

86. Badacsony, in sand
Bison, Equus, Coelodonta, Mammuthus (JUGOVICS—KRETZOI—CSÁNK 1954. 92).

87. Dunaföldvár - Göböljárás, Mammoth skeletons, **Upper Palaeolithic butchering site**
Bison, Mammuthus (CSALOGOVITS 1936., VÖRÖS 1981b.).

88. Dunaszekcső, loess
Alces (JÁNOSSY—VÖRÖS 1979. Nr. 261).

89. Esztergom environs
Rangifer, Bison, Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 161).

90. Füzesabony - gravel quarry
Alces, Bison, Equus, (JÁNOSSY—VÖRÖS 1979. Nr. 342).

91. Füzesabony - sand quarry,
Alces (JÁNOSSY—VÖRÖS 1979. Nr. 343).

92. Fokoru, Tisza river bed
Alces, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 494).

93. Galgahévíz
Bos seu *Bison, Equus, Coelodonta, Mammuthus* (JÁNOSSY—VÖRÖS 1979. Nr. 298).

94. Hatvan
Cervus, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 321).

95. Jászkarajenő
Bison, Mammuthus (STANCZIK 1975., JÁNOSSY—VÖRÖS 1979. Nr. 514).

96. Kaposvár, loess
Cervus, Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 112).

97. Kaposvár - Pécsi road., in depth of 15 m
Rangifer, Coelodonta (JÁNOSSY—VÖRÖS 1979. Nr. 111).

98. Kölesd
Cervus, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 110).

99. Kőtelek, Tisza river bed
Cervus, Alces, Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 493).

100. Lábatlan
Leo, (Ursus), Coelodonta, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 154).

101. Lovas, dolomite quarry, Upper Palaeolithic paint mine
Sus, Cervus, Alces, Rangifer, Equus (DOBOSI—VÖRÖS 1979.).

102. Madaras-Brickyard, "Lower" loess under the Upper Palaeolithic site
Alces, Bison, Equus, Mammuthus (VÖRÖS 1989. Table 1).

103. Mályi - gravel quarry,
Alces (JÁNOSSY—VÖRÖS 1979. Nr. 374).

104. Mátraballa - sand quarry
Bison, Coelodonta, (JÁNOSSY—VÖRÖS 1979. Nr. 376).

105. Mérk - Kraszna channel
Crocotta, Cervus sp., Bison, Coelodonta, Mammuthus (HALAVÁTS 1898.).

106. Miskolc
Crocotta, Bison, Equus (JÁNOSSY—VÖRÖS 1979. Nr. 389).

107. Miskolc-Quarry
Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 391).

108. Monor, Mammoth skeleton
Cervus, Equus, Mammuthus (GAÁL 1928.).

109. Nagybátony
Alces, Bison, Equus, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 304).

110. Nagykörü, Tisza river bed
Bison, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 496).

111. Nagymaros - Újvölgy, Fischer Tobiás's "soil quarry"
Cervus f. *major, Alces, Rangifer, Bison, Coelodonta,* (MOTTL 1942b. 47., VÖRÖS 1998.).

112. Nagymaros - beside narrow-gauge ("small") railway-station.
Alces (MOTTL 1942b. 47, – VÖRÖS 1998.).

113. Padragkút - Sand quarry,
Rangifer, Equus, Mammuthus (JÁNOSSY—VÖRÖS 1979. Nr. 27).

114. Pécsbányatelep - Káposztás valley, Mammoth skeleton
Cervus, Mammuthus (RIHMER 1935. 28).

3. (yellowish grey) layer: *Crocotta, Rangifer, Bison sp., Equus*

Pleistocene lower 4. (grey) layer: *Sus, Cervus*, (large form, formerly "*Megaloceros*", JÁNOSSY 1979. 144) *Rangifer* (KRETZOI—VARRÓK 1957. 22–23).

/23./ Büdöspest cave, Bükk Mts.

7. reddish brown layer: *Cervus* (formerly "*Megaloceros*" KRETZOI 1927, KADIĆ 1934. 64), *Rangifer, Bison, Equus* (KRETZOI 1927, KADIĆ 1934. 64).

/74./ Istállóskő cave, Bükk Mts.

VI. light yellow layer marked as "upper microfauna-rich layer": *Rangifer* (VÖRÖS 1984. Tabl. 1.).

/26./ Jankovich cave, Gerecse Mts.

II. Block 4. (between 90–110 cm) *Rangifer*, (BÁCSKAY—KORDOS 1984. Table 1.).

139. Királykút pot-hole, Bükk Mts.

Crocotta, (SEBŐS 1934. 14).

/5./ Kiskevély cave, Pilis Mts.

2. yellowish grey layer: *Rangifer, Equus* (HILLEBRAND 1913. 20–21, VÖRÖS 1994.).

140. Kőrös cave, Bükk Mts.

Dome hall, grey layer: *Leo* (KADIĆ 1944. 76).

141. Lillafüred rock shelter, Bükk Mts.

Yellow layer: *Sus, Cervus* (KORMOS 1914a. 202).

142. Óhuta (Bükkszentlászló) - Csengős teber, Bükk Mts.

Rangifer, Bison (VÉRTES 1954. 21).

143. Orfű - Sárkánykút, Mecsek Mts.

Crocotta, Bison, (KOCH 1900, 542, 552).

144. Ölyveskő rock shelter, Bükk Mts.

2. light brown layer (entrance): *Rangifer, Equus*.

3. greenish grey layer: *Leo, Rangifer* (MOTTL 1944. 63, 66).

/78./ Peskő cave, Bükk Mts.

2. light yellow / yellow layer: *Rangifer, Bison, Equus, Ovibos* (MOTTL 1944. 19).

/80./ Pilisszántó I. rock shelter, Pilis Mts.

Upper layer complex:

D_1 light yellow + D_2 darker yellow layer: (*Leo, Crocotta*), *Cervus canadensis asiat., Rangifer, Bison, Equus* (KORMOS 1915. 324–325, VÖRÖS 1987c. Tabl. 1–2). According to the opinion of the author, *Leo* and *Crocotta* are older fauna elements occurring in a secondary position.

Middle layer complex:

D_3 greenish grey + D_4 greyish yellow + D_5 rusty red layer: *Leo, Sus, Cervus maral, Rangifer, Bison, Equus* (KORMOS 1915. 326–327, VÖRÖS 1987c. Tabl. 1–2).

145. Rejtek I. rock shelter, Bükk Mts.

Trial pit "3": *Crocotta sp.*

Block III. 140–160 cm. "9": *Sus* (? *domestica*, JÁNOSSY 1962. 57), *Cervus, Rangifer*.

180–200 cm "11": *Bison* (JÁNOSSY—KORDOS 1976. Tabl. II.).

/82./ Remete Lower cave, Budai Mts.

11. yellow /b/ layer: *Cervus, Bison* (JÁNOSSY 1953. 420, 1979. 152).

146. Remetehegy rock shelter, Budai Mts.

Upper yellow layer ("with rodents"): *Bos* seu *Bison*.

Lower reddish brown layer: *Crocotta* ?, *Rangifer, Equus* (KORMOS 1914b. 357, 360–361).

/32./ Szeleta cave, Bükk Mts.

Entrance, light yellow layer: *Rangifer, Equus* (KADIĆ 1934. 35).

147. Vaskapu cave, Bükk Mts.

2. light brown layer: *Rangifer, Bison*,

3. greenish grey layer: *Rangifer* (KADIĆ-MOTTL 1938. 60–61).

148. Arka - Herzsarét, Upper Palaeolithic settlement

Rangifer, Bison, Equus (VÖRÖS 1987b. 89–90, Tabl. 1.).

149. Esztergom-Gyurgyalag, Upper Palaeolithic settlement

Rangifer, Equus (artefact made of *Mammuthus* bone) (VÖRÖS 1991b.).

150. Nadap - Stone quarry, Upper Palaeolithic settlement

Rangifer, Bison, Equus (VÖRÖS 1988b. 34–35, Tabl. 1.).

151. Pilismarót - Diós, Upper Palaeolithic settlement

Rangifer, Equus (VÖRÖS 1981c. 22).

152. Pilismarót - Pálrét, Upper Palaeolithic settlement

Sus, Rangifer, Bison, (VÖRÖS 1983d. 299).

VARBÓ FAUNAL PHASE 11 sites (con.)

8.	Porlyuk c I.					Cp	Cv						E		
9.	Poroslyuk c	Hx			Sus	Co	Cv			Rg	Bi		E		
10.	Pörgölhegy c V.						Cv								
11.	Solymár c A/5	Hx	L	C		Cp	Cv						E	Coel	
12.	Süttő calc.tuff	Hx					Cv		Mg		Bov.				
13.	Tarkő Rs. IIIa, VI.	Hx	L				Cv			Rg	Bi				

SUBALYUK FAUNAL PHASE 9 sites

/4./	Diósgyőr-Tapolca c c. I–II		L	C	Sus		Cv		Mg	Rg	BsBi	As	E	Coel	Mamm
/5./	Kiskevély c 4.		L	C	Sus		Cv	A			Bi	As	E	Coel	Mamm
/7./	Lambrecht c III					Cp		A	Mg				E		
14.	Lengyel c		L			Cp	Cv		Mg		Bi	As	E	Coel	Mamm
/10./	Pörgölhegy c IV–III				Sus	Cp	Cv/m		Mg	Rg	Bi	As	E	Coel	Mamm
/3./	Subalyuk c U.		L	C			Cv/m		Mg	Rg	BsBi	As	E	Coel	Mamm
15.	Érd I–II.		L	C	Sus		Cv		Mg	Rg	Bi	As	E	Coel	Mamm
16.	Poroszló							A	Mg		Bi	As	E	Coel	Mamm
17.	Tata loess		L	C	Sus		Cv		Mg		BsBi	As	E	Coel	Mamm
/17./	Tata travertino			C					Mg			As	E	Coel	Mamm

SZELETA FAUNAL PHASE 17 caves + 38 open air site = 55 sites

18.	Arnóckő c 2.		L				Cm		Mg		Bi		E		
19.	Balla c		L	C	Sus	Cp			Mg	Rg	Bi		E		
20.	Ballavölgy Rs.			C			Cv		Mg	Rg	Bi				
21.	Berva c			C			Cm		Mg		Bi		E		Mamm
22.	Bervavölgy Rs.			C	Sus	Cp	Cv		Mg	Rg	Bi		E	Coel	
23.	Büdöspest c 6-3		L	C			Cv/m	A	Mg	Rg	BsBi		E	Coel	Mamm
/1./	Csákvár c		L	C			Cv		Mg	Rg	Bi		E	Coel	
24.	Görömbölytapolca c III/3			C			Cv		Mg	Rg					
25.	Herman O. c 5-2			C			Cv	A	Mg		Bs				
26.	Jankovich c		L	C					Mg	Rg	BsBi		E	Coel	
27.	Kecskésgalya c 3-4		L	C			Cm		Mg	Rg	BsBi		E	Coel	
28.	Megyefa Rs.		L	C			Cv		Mg		Bi		E	Coel	Mamm
29.	Mexikóvölgy c		L	C			Cv		Mg						
30.	Miskolc-Tapolca								Mg		Bi		E	Coel	Mamm
31.	Remete Upper c 4.		L	C			Cv		Mg	Rg	Bi		E	Coel	Mamm
32.	Szeleta c 6-2		L	C			Cm		Mg	Rg	Bi		E	Coel	Mamm
33.	Szelim c C-E		L	C			Cv/m	A	Mg	Rg	Bi		E	Coel	Mamm
34.	Balatonszabadi								Mg		Bi		E	Coel	Mamm
35.	Barcs								Mg					Coel	
36.	Csepel-gravel-quarry								Mg						Mamm
37.	Csongrád c. Tisza b.						Cv		Mg		Bs			Coel	Mamm
38.	Csongrád-Szegvár				Sus		Cv		Mg		Bs				
39.	Danube river bed								Mg		BsBi				Mamm
40.	Endrőd								Mg						Mamm
41.	Eger								Mg		Bi				
42.	Ercsi								Mg					Coel	Mamm
43.	Fegyvernek Tb						Cv	A	Mg		Bi				Mamm
44.	Gyoma								Mg						
45.	Hatvan								Mg		Bi		E	Coel	Mamm

ISTÁLLÓSKŐ FAUNAL PHASE 18 caves + 52 open air sites = 70 sites (con.)

90.	Füzesabony grav. quarry							A			Bi		E		
91.	Füzesabony sand quarry							A							
92.	Fokoru Tb							A							Mamm
93.	Galgahéviz										BsBi		E	Coel	Mamm
94.	Hatvan						Cv								Mamm
95.	Jászkarajenő										Bi				Mamm
96.	Kaposvár						Cv								Mamm
97.	Kaposvár–P.road									Rg				Coel	
98.	Kölesd						Cv								Mamm
99.	Kötelek Tb						Cv	A			Bi				Mamm
100.	Lábatlan		L											Coel	Mamm
101.	Lovas				Sus		Cv	A		Rg			E		
102.	Madaras-By.							A			Bi		E		Mamm
103.	Mályi-gravel quarry							A							
104.	Mátraballa										Bi			Coel	
105.	Mérk-Kraszna b.			C			Cv				Bi			Coel	Mamm
106.	Miskolc			C							Bi		E		
107.	Miskolc-quarry										Bi				Mamm
108.	Monor						Cv						E		Mamm
109.	Nagybátony							A			Bi		E		Mamm
110.	Nagykörű Tb										Bi				Mamm
111.	Nagymaros-Újvölgy						Cm	A		Rg	Bi			Coel	
112.	Nagymaros-srst.							A							
113.	Padragkút									Rg			E		Mamm
114.	Pécsbányatelep						Cv								Mamm
115.	Pilismarót (+Marmota)						Cv			Rg			E		Mamm
116.	Pilismarót-Öd							A		Rg			E		Mamm
117.	Polgár							A							Mamm
118.	Rákóczifalva Tb										Bi				Mamm
119.	Romhány						Cv	A							
120.	Sirok										Bi		E	Coel	
121.	Szajol Tb										Bi				Mamm
122.	Szendehely		L				Cv						E	Coel	
123.	Szob-Kálvária						Cm			Rg					Mamm
124.	Sződliget										Bi				Mamm
125.	Szolnok-Sny Tb							A							Mamm
126.	Szolnok-Sk. Tb							A							
127.	Tiszalök-Rázom							A							
128.	Tiszalök-Dam Tb										Bi			Coel	Mamm
129.	Tószeg cliff Tb							A							Mamm
130.	Vác-DCM										Bi		E		Mamm
131.	Verseg									Rg	Bi		E		Mamm
132.	Visegrád-H						Cv								Mamm
133.	Zebegény						Cv			Rg			E	Coel	
134.	Zebegény-Kálvária						Cm				Bi		E		Mamm
135.	Zirc-Cuha strem.										Bi				Mamm

PILISSZÁNTÓ-BAJÓT FAUNAL PHASES 22 caves + 10 open air sites = 32 sites

136.	Alsószinva c						Cv								
137.	Baits c		L				Cm			Rg					
/19./	Balla c					Cp				Rg	Bi		E		
/22./	Bervavölgyi Rs 2.			C		Cp	Cm						E		
138.	Bivak c 1, 3–4.			C	Sus		Cm			Rg	Bi		E		

Table III. Species frequency of the Upper Pleistocene faunal phases according to site types (180 sites with carnivore and herbivore macro-mammals – number os sites)

Faunal phase	Sites total	Species analysed															
		L	C	Sus	Dm	Cp	Ce	Cm	A	Mg	Rg	As	E	B	O	Cl	Mm
SÜTTŐ	**3**	2	3	2	2	2	3						3	3		2	
Cave site	3	2	3	3	2	2	3						3	3		2	
VARBÓ	**11**	3	5	5		5	9	1	1	4	3	2	7	7		5	2
Cave site	11	3	5	5		5	9	1	1	4	3	2	7	7		5	2
SUBALYUK	**9**	6	5	5		3	7	2	3	8	4	8	9	8		8	8
Cave site	6	4	3	3		3	5	2	2	5	3	5	6	5		5	5
Open air site	3	2	2	2			2		1	3	1	3	3	3		3	3
SZELETA	**55**	12	15	4		2	19	6	11	54	13		23	35		24	34
Cave site	17	11	15	2		2	10	6	3	17	11		13	15		10	7
Open air site	38	1		2			9		8	37	2		10	20		14	27
ISTÁLLÓSKŐ	**70**	11	14	4		4	23	9	27		21		31	35		24	40
Cave site	18	8	12	4		4	10	5	8		10		12	10		10	4
Open air site	52	3	2				13	4	19		11		19	25		14	36
PILISSZÁNTÓ–BAJÓT	**32**	4	7	5		2	5	4			25		19	15	2		
Cave site	22	4	7	4		2	5	4			15		10	11	1		
Open air site	10			1							10		9	4	1		
TOTAL	**180**	**38**	**49**	**26**	**2**	**18**	**66**	**22**	**42**	**66**	**66**	**10**	**92**	**103**	**2**	**63**	**84**

Abbreviations:
L Leo, C Crocotta, S Sus, Dm Dama, Cp Capreolus, Ce Cervus elaphus, Cm Cervus "maral", A Alces, Mg Megaloceros, Rg Rangifer, As Asinus, B Bovidae (Bos, Bison), E Equus, O Ovibos, Cl Coelodonta, Mm Mammuthus.

A SHORT CHARACTERISATION OF THE FAUNAL PHASES (Table IV, Fig. 1.)

Most characteristic of the VARBÓ faunal phase is the presence of *Hystrix*; this is the main feature distinguishing it from the SUBALYUK level. *Cervus* dominates this faunal phase (17,%); *Equus* (11,8%) and *Bovid* (11,9%) are significant. *Capreolus*, *Sus* and *Coelodonta* are present. Also appearing: *Rangifer*, *Mammuthus*, *Megaloceros*, *Alces* and *Asinus* (Provided there is no mixture in the layers and finds of Csákvár /1./ and Lambrecht /7./ caves.

SUBALYUK faunal phase, the species *Cervus*, *Equus* as well as *Megaloceros*, *Asinus*, *Bovid*, *Coelodonta and Mammuthus* are represented evenly (between 9,5–10,8% each). Also present: *Sus*, *Capreolus*, *Alces* and *Rangifer*.

SZELETA faunal phase is dominated by *Megaloceros* (21,4%) with less *Bovid* (13,9%) and *Mammuthus* (13,5%). *Cervus* (10,0%), *Equus* (9,1%) and *Coelodonta* (9,5) are significant. About half this quantity is present of *Rangifer* (5,2%) and *Alces* (4,3%). *Sus* and *Capreolus* are present, *Asinus* missing.

ISTÁLLÓSKŐ faunal phase is dominated by and *Mammuthus* (16,5%), followed by *Bovid* (14,5%), *Cervus* (13,2%) and *Equus* (12,2%). *Alces* (11,2%) *Coelodonta* (9,8) and *Rangifer* (8,6%) are significant. *Sus* and *Capreolus* are present, *Megaloceros* missing.

PILISSZÁNTÓ–BAJÓT faunal phase is dominated by *Rangifer* (28,4%), *Equus* (21,6%), and less *Bovid* (17,0%). *Ovibos* appears. Missing from the fauna spectrum are: *Alces, Coelodonta, Mammuthus*.

In the Upper Pleistocene Würm period, 7 species are occurring in all faunal phases (*Sus, Leo, Crocotta, Capreolus, Cervus, Equus, Bovid*). *2-2 species are present in five (Coelodonta, Rangifer) and four (Mammuthus, Alces) faunal phases*. *Megaloceros* is present in three, *Asinus* in two, *Dama* and *Ovibos* in one faunal phase only.

The frequency of occurrence of the 15 species analysed in the six faunal phases of the Upper Pleistocene is demonstrated on Table IV., (*Fig. 1*).

The most striking features are the occurrences of *Dama, Asinus* and *Ovibos* connected to special periods as well as the chronological changes in the species dominance of *Cervidae*. Cave lion and hyena were present constantly. Ratio of mammoth increased con-

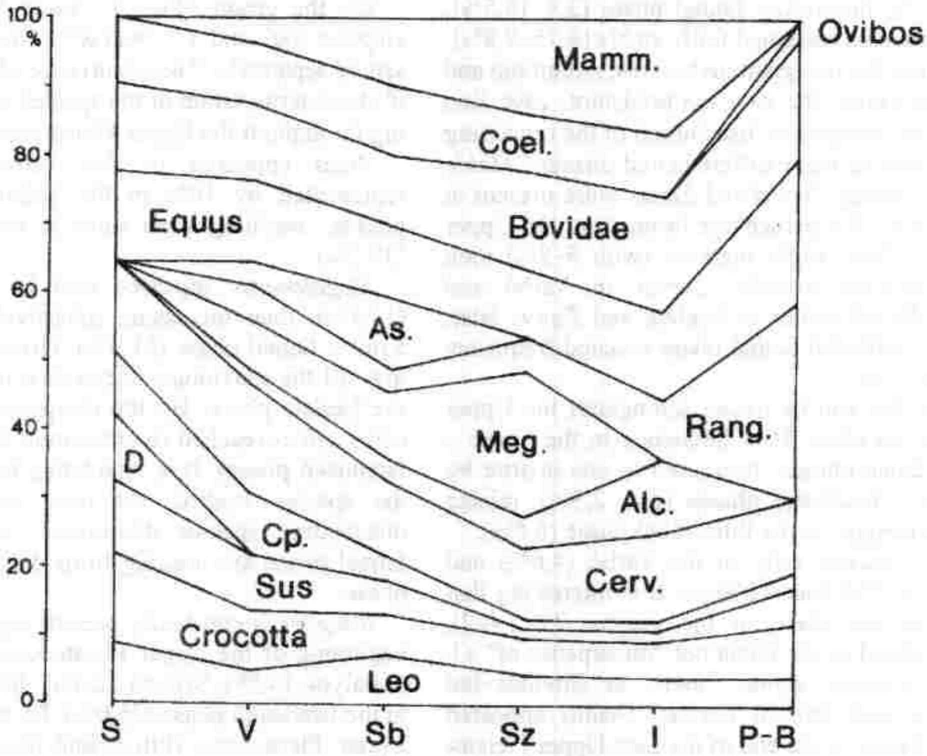


Fig. 1. S: Süttő, V: Varbó, SB: Subalyuk, Sz: Szeleta, I: Istállóskő, P-B: Pilisszántó-Bajót phaunal phases
Mamm.: Mammuthus, Coel.: Coelodonta, As.: Asinus, Rang.: Rangifer, Meg.: Megaloceros, Alc.: Alces, Cp.: Capreolus, D.: Dama, Cerv: Cervus

Table IV. Species frequency of the Upper Pleistocene faunal phases in percentages (180 sites with carnivore and herbivore macro-mammals, 15 species)

Faunal phase	Species analysed														
	L	C	Sus	Dm	Cp	Ce/m	A	Mg	Rg	As	E	B	O	Cl	Mm
SÜTTŐ															
Sites	2	3	3	2	2	3					3	3		2	
%	8,75	13,0	13,0	8,75	8,75	13,0					13,0	13,0		8,75	
VARBÓ															
Sites	3	5	5		5	10	1	4	3	2	7	7		5	2
%	5,0	8,5	8,5		8,5	17,0	1,8	6,8	5,0	3,4	11,8	11,8		8,5	3,4
SUBALYUK															
Sites	6	5	5		3	9	3	8	4	8	9	8		8	8
%	7,0	6,0	6,0		3,6	10,8	3,6	9,5	4,0	9,5	10,8	9,5		9,5	9,5
SZELETA															
Sites	12	15	4		2	25	11	54	13		23	35		24	34
%	4,7	6,0	1,6		0,8	10,0	4,3	21,4	5,2		9,1	13,9		9,5	13,5
ISTÁLLÓSKŐ															
Sites	11	14	4		4	32	27		21		31	35		24	40
%	4,5	5,8	1,6		1,6	13,2	11,2		8,6		12,7	14,5		9,8	16,5
PILISSZÁNTÓ–BAJÓT															
Sites	4	7	5		2	9			25		19	15	2		
%	4,5	8,0	5,7		2,3	10,2			28,4		21,6	17,0	2,3		

Abbreviations:
L Leo, C Crocotta, S Sus, Dm Dama, Cp Capreolus, Ce/m Cervus elaphus / "maral", A Alces, Mg Megaloceros, Rg Rangifer, As Asinus, B Bovidae (Bos, Bison), E Equus, O Ovibos, Cl Coelodonta, Mm Mammuthus

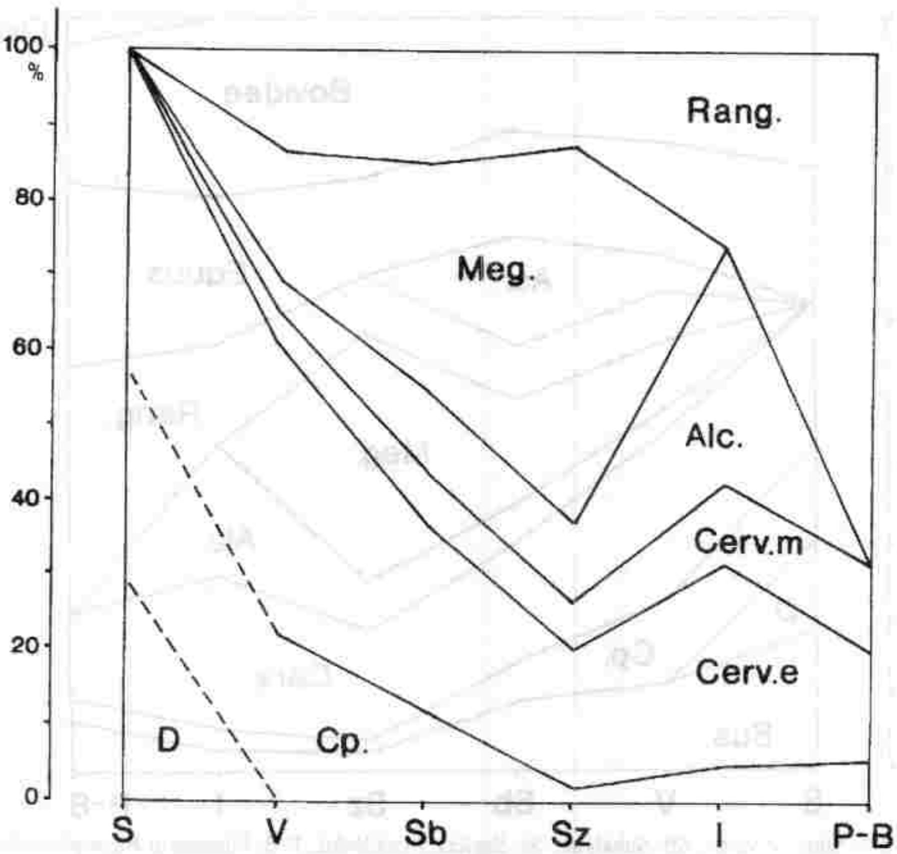


Fig.3. S: Süttő, V: Varbó, SB: Subalyuk, Sz: Szeleta, I: Istállóskő, P-B: Pilisszántó-Bajót phaunal phases
Mamm.: Mammuthus, Coel.: Coelodonta, As.: Asinus, Rang.: Rangifer, Meg.: Megaloceros, Alc.: Alces, Cp.: Capreolus, D.: Dama, Cerv: Cervus

Table VI. Cervidae species frequency of the Upper Pleistocene faunal phases in percentages (180 sites)

Faunal phase	Species analysed						
	Dm	Cp	Ce	Cm	A	Mg	Rg
SÜTTŐ							
Sites	2	2	3				
%	28,6	28,6	42,8				
VARBÓ							
Sites		5	9	1	1	4	3
%		21,8	39,2	4,3	4,3	17,4	13,0
SUBALYUK							
Sites		3	7	2	3	8	4
%		11,1	26,0	7,4	11,1	29,6	14,8
SZELETA							
Sites		2	19	6	11	54	13
%		2,0	18,0	5,8	10,4	51,4	12,4
ISTÁLLÓSKŐ							
Sites		4	23	9	27		21
%		4,7	27,4	10,7	32,2		25,0
PILISSZÁNTÓ–BAJÓT							
Sites		2	5	4			25
%		5,6	13,8	11,2			69,4

Abbreviations:
Dm Dama, Cp Capreolus, Ce Cervus elaphus, Cm Cervus "maral", A Alces, Mg Megaloceros, Rg Rangifer

REFERENCES

BÁCSKAY—KORDOS 1984	E. Bácskay—L. Kordos: Fontosabb szórványleletek a MÁFI gerinces-gyüjteményében /9. Közlemény/. Major finds scattered fossils in the Palaeovertebrate Collection of the Hungarian Geological Institute /Communication No 9/. MÁFI Évi Jelentése 1982. évről /1984/ 355–361.
BENDA 1929	Benda, L.: A magyar Alföld őstörténete. II. Acta Sabariensia 3. Kaposvár 1929. 352.
CSALOGOVITS 1936	Csalogovits, J.: Őskori leletek Dunaföldváron. Tolna Vármegye Multjából 2. 1936. 7–14.
DOBOSI—VÖRÖS 1979	V. Dobosi—I. Vörös: Data to an evaluation of the finds assamblage of the Palaeolithic Paint Mine at Lovas. Fol.Arch. 30. 1979 7–26.
ÉHIK 1916	Éhik, Gy.: A Herman Ottó-barlang ásatásainak faunisztikai eredményei. Barlangkut. 4. Budapest 1916 24–29.
GAÁL 1928	Gaál, I.: A legújabb monori mammut-lelet. Pótfüzet. a Term tud. Közl. 60. Kötetéhez 1928. Füz. 182.
GAÁL 1929	I. Gaál: Diluviális emlősmaradványok Bajót eddig ismeretlen barlangjából. Les restes mammiféres diluviennes de la caverne de Bajót jusqu'á present inconnue. Ann.Mus.Nat.Hung.26. 1929. 1–21.
GAÁL 1933b	Gaál, I.: A pézsmatulok Magyarország diluviális földjén. Pótfüz. a Term. Tud. Közl. 65. Kötetéhez 189. Füz. 129–131.
GAÁL 1935	Gaál, I.: A bánhidai Szelim-barlang ásatása. Pótfüzet a Term. Tud. Közl. 67. Kötetéhez 1935. Füg. 49–63.
GAÁL 1941	Gaál, I.: Csillagászati számitásokat igazoló földtani megfigyelések. Term. Tud. Közl.73. köt. 5. Sz 1119. Füz. 1941. 190–205.
GAÁL 1943b	Gaál, I.: Abánhidai Szelim-barlang "hiénás réteg"-e. Földt. Közl. 73. 1943. 430–448.
GASPARIK 1993	M. Gasparik: Late Pleistocene gastropod and vertebrate fauna from Tokod /NE Transdanubia. Hungary/.Fragm. Min. et Palaeont. 16 Budapest 1993. 89–116.
GASPARIK 1998	Gasparik, M.: A tokodi édesvizi mészkő összlethez kapcsolódó felső pleisztocén koru gerinces fauna vizsgálatának új eredményei. Előadás kivonat. In.. 1. Magyar Őslénytani Vándorgyülés 1998. május 8–9. Tata. 5.
GÁBORI-CSÁNK 1983	V. Gábori-Csánk: La Grotte Remete "Felső" /Supérieure/ et le "Szeletien de Transdanibie". Acta Arch. Hung. 5 1983. 249–285.
GÁBORI-CSÁNK 1993	V. Gábori-Csánk: La Jankovichien. Une civilisation paléolithique en Hongrie. ERAUL 53. 1993 Liége. 198.
HALAVÁTS 1898	Halaváts, Gy.: A Domahidi és Mérki ősemlős leletek. Földt. Közl. 28. 1898. 207–209.
HELLEBRANDT ET AL 1976	M. Hellebrandt—L. Kordos—L. Tóth: A Diósgyőr-Tapolca-barlang ásatásának eredményei. Ergebnisse der Ausgrabungen in der Diósgyőr-Tapolca-Höhle. Herman O.Múz.Évk. 15. 1976. Miskolc 7–36.
HILLEBRAND 1912	Hillebrand, J.: A Balla-barlangban 1911. évben végzett ásatások eredményei . A Magyarhoni Földt. Közl. 42. 1912. 763–772.
HILLEBRAND 1913	Hillebrand, J.: A Kiskevélyi barlang próbaásatásának eredményei. Barlangkutatás. 1. 1913. 20–21.
HILLEBRAND 1915	Hillebrand, J.: A bajóti Jankovich-barlangban 1914. és 1915. években végzett kutatások eredményei. Barlangkutatás. 3. 3–4. 1915. 129–141.
HILLEBRAND 1919	Hillebrand, J.: Az 1917. évben végzett ásatásaim eredményei. Barlangkut. 7. Budapest 1919 6–13.
HILLEBRAND 1935	J. Hillebrand: Magyarország őskőkora. Die ältere Steinzeit Ungarns. Arc.Hung,17. 1935. 42.
HIR 1990	Hir, J.: Rétegazonosító ásatás a Peskő-barlangban. Layer identifying excavation in the Peskő Cave. Karszt és Barlang 1990. 2. Budapest, 97–100.
JÁNOSSY 1953	Jánossy, D.: Ritkább emlősök /Sicista, Apodemus, Asinus/ a dorogi és a máriaremetei késői pleisztocénből. Földt. Közl. 83 1953. 419–436.

KORMOS 1914a — Kormos, T.: A Lillafüredi sziklaüreg faunája. Barlangkutatás. 2.4. 1914. 202–203.

KORMOS 1914b — Kormos, T.: A remetehegyi sziklafülke és faunája. In.: Kormos,T.–Lambrecht, K.: A remetehegyi sziklafülke és postglaciális faunája. MKFI. Évk. 22. 6. 1914. 351–365.

KORMOS 1915 — Kormos, L.: A pilisszántói kőfülke, rétegei és faunája. In.: Kormos, I.: A pilisszántói kőfülke. Tanulmányok a postglaciális kor geológiája, ősipara és faunája köréből. MKFI. Évk. 23, 6. 1915. 310–431.

KORMOS 1925 — Kormos, T.: A süttői forrásmészkő-komplexus faunája. Állattani Közl. 22. 3–4. 159–175.

KORMOS—LAMBRECHT 1914 — Kormos, T.—Lambrecht, K.: A bajóti Öregkő nagy barlangjának faunája. Barlangkutatás. 2, 2. 1914. 77–80.

KRETZOI 1927 — Kretzoi, M.: Előzetes jelentés a Büdöspest faunájáról. Kézirat 1927.

KRETZOI 1942a — M. Kretzoi: Spelaeus-Fauna aus dem Mecsek-Gebirge ohne Höhlenbären. Földt. Közl. 72. 1942. 364.

KRETZOI 1942b — M. Kretzoi: Die Fauna der Mexico-Höhle bei Diósgyőr im Bükkgebirge /Ungarn/. Földt. Közl. 72. 1942. 267–268.

KRETZOI 1954a — M. Kretzoi: Befejező jelentés a Csákvári barlang őslénytani feltárásáról. Rapport final des fouilles paléontologiques dans la Grotte de Csákvár. MÁFI. Évi Jel. 1952. évről /1954/ 37–69.

KRETZOI 1964b — M. Kretzoi: Die Wirbeltierfauna des Travertin-Komplexes von Tata. In.: L. Vértes ed.: Tata. Eine mittelpaläolithische Travertin-Siedlung in Ungarn. Arch.Hung. 43. 1964. 105–126.

KRETZOI 1968a — M. Kretzoi: Étude Paléontologiqe. In.: V. Gábori–Csánk: La station du paléolithique moyen d' Érd-Hongrie. Mon. Hist. Budapestinensia 3. 1968. Budapest 59–103.

KRETZOI—VARRÓK 1957 — Kretzoi—S. Varrók: Holozäne und Pleistozäne Fauna der Höhlensediment. In.: D. Jánosy et al .: Forschungen in der Bivakhöhle, Ungarn. Eiszeitalter u. Gegenwart 8 1957. 21–25.

KUBACSKA 1927 — Kubacska, A.: A solymári sziklaüreg pleisztocén csontlelete. Barlangvilág 1. 1926 1–4. (1927) 17–26.

MOTTL 1936 — M. Mottl: A bervavölgyi-sziklaüreg állatvilága, különös tekintettel a hazai magdaléníenre. Die Fauna der Bervavölgyer Höhlung mit besonderer Berücksichtigung des ungarischen Magdalenien. Földt. Közl. 46. 1–3. 1936. 148–157.

MOTTL 1938a — Mottl, M.: A Bervavölgyi sziklaüreg. Őslénytani eredmények. In.: Kadić, O.–Mottl, M.: Felsőtárkány vidékének barlangjai. Barlangkutatás 16. 1. 1938 25–34.

MOTTL 1938b — M. Mottl: Faunen, Flora und Kultur des ungarischen Solutréen. Quartär 1. 1938. Berlin 36–54.

MOTTL 1938c — Mottl, M.: A lerakódások állatvilága. In.: Bartucz, L. et al.: A cserépfalusi Mussolini-barlang /Subalyuk/. Geol.Hung. Ser. Palaeont. 14. 1938. 207–308.

MOTTL 1940 — Mottl, M.: Jelentés az 1932-35 évi barlangkutatásról és az ősgerinces-osztály müködéséről. MKFI. Évi jelentése az 1933–35. évről 4. /1940/ 1899–1972.

MOTTL 1941 — Mottl, M.: Az interglaciálisok és interstadiálisok a magyarországi emlősfauna tükrében. Függelék a MKFI 1941. Évi jelentésének. 1941 5–42.

MOTTL 1942a — M. Mottl: Das Aurignacien in Ungarn . Quartär 4. Freiburg 1942. 82–108.

MOTTL 1942b — M. Mottl: Adatok a hazai ó- és újpleisztocén folyóterraszok emlősfaunájához Beiträge zur Säugetierfauna der ungarischen Alt- und Jungpleistozänen Flussterrassen. MKFI. Évk. 36. 2. 1942 1–70.

MOTTL 1944 — Mottl, M.: Őslénytani eredmények. In.: Kadić, O.: Az északnyugati Bükk barlangjai. Barlangkutatás. 17 1. 1944. Peskő 9–22, Istállóskö 41–50, Ölyveskő 62–67.

MOTTL 1945 — Mottl, M.: Jelentés az 1936/38. évi ásatások eredményeiről és az ősgerinces osztály müködéséről. MÁFI. Évi jelentései az 1936–38. évekről 4. Köt. /1945/ 1513–1585.

oberen Pleistozän von Pilismarót-Basaharc. Dunai Régészeti Közl. 3. /1989/ 1990. 5–10.

VÖRÖS 1991b — I. Vörös: Large mammal remains from the Upper Paleolithic site at Esztergom-Gyurgyalag. Acta. Arch. Hung. 43. 1991. 261–264.

VÖRÖS 1991c — I. Vörös: A versegi paleolit telep emlősfaunája. Die Säugetierfauna der Paleolithsiedlung von Verseg. Stud.Com. 21. 1991. Szentendre 85–96.

VÖRÖS 1994 — I. Vörös: Bird and Mammal faunal revision of Kiskevély Cave. In.: V. T. Dobosi—I. Vörös: Material and chronological revision of the Kiskevély Cave. Fol.Arch. 43. 1994. 21–36.

VÖRÖS 1998 — Vörös, I.: A Duna-kanyar bal partjának pleisztocén nagyemlős leletei. *Kézirat.*

cultural layer as well, formed on a loess containing more clay than the recent soil (A=34,16%) and less sand than its cover (H=10,11%). Under this layer, over the volcanic bedrock and partly in its fissures, remains of a darker grey and a reddish brown soil could be observed.

In the past few years, a more or less concordant palaeopedostratigraphy was elaborated for North-Eastern Hungary in respect of the Upper Pleistocene (RINGER, 1993). This palaeopedostratigraphy is supported by archaeological and palaeontological correlation at several points, paralleled also by the Pleistocene cave sediments of the Bükk Mts. *(Fig. 2.)* In the upper third of the palaeopedostratigraphical sequence there is a palaeopedocomplex comprising three soil horizons. These soils are marked accordingly: MS3 brown soil with pseudogley(?), MS2 grey forestl soil and MS1 steppe soil. This sequence was worked out at Sajószentpéter-Margit kapu site.

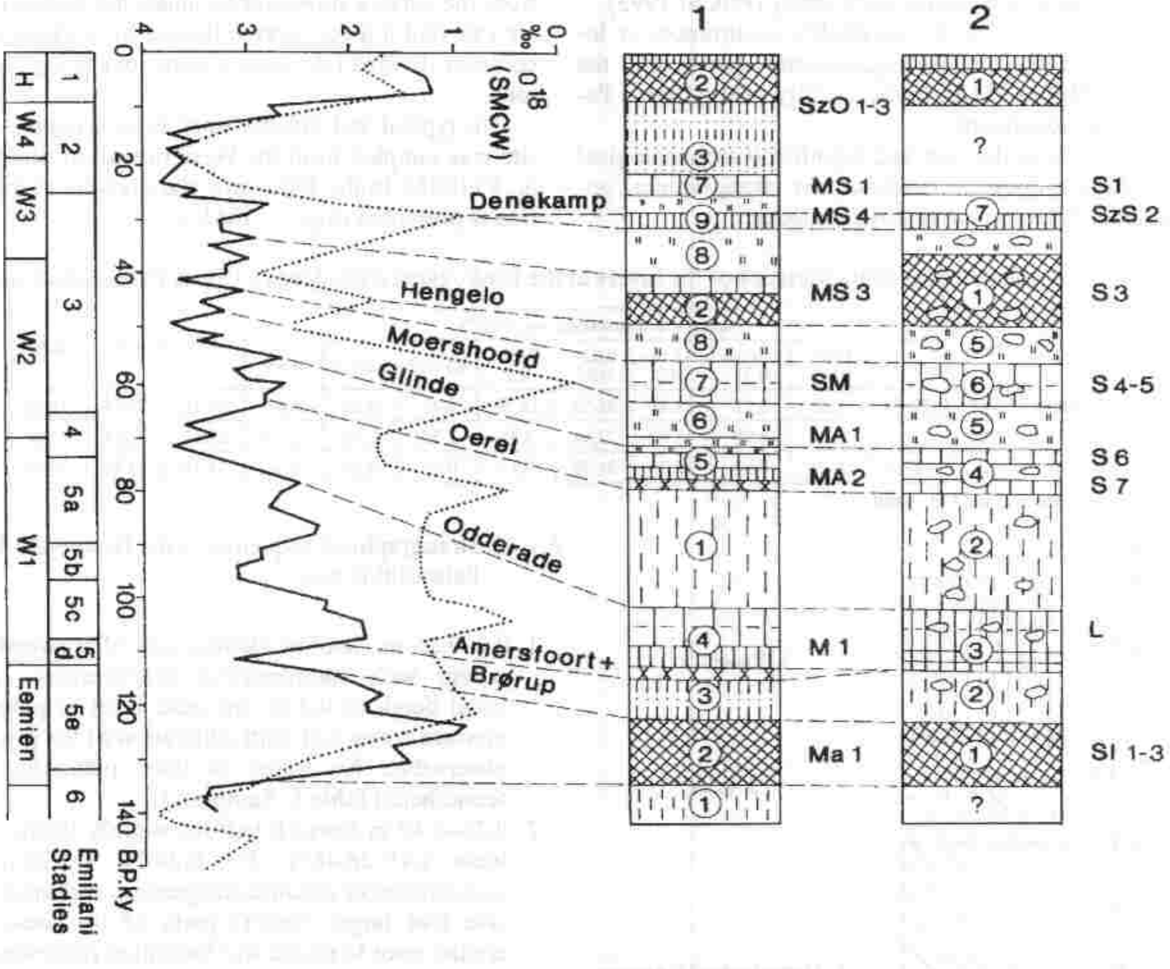


Fig. 2. Chronostratigraphical system of Northern Hungarian Upper Pleistocene loess and cave sediments

Key of symbols:

Subaeric sediments 1:
Ma1Mályi clay extraction pits, soil 1;
M1 Miskolc, 1. Palaeopedocomplex;
MA1 + MA2 Miskolc-Avas 1 – Avas 2 palaeosoil;
SM4 Sajószentpéter- Margit kapu site, palaeosoil 4;
SM3 Sajószentpéter- Margit kapu site, palaeosoil 3;
MS2 Miskolc-Sajószentpéter, palaeosoil 2;
MS1 Miskolc-Sajószentpéter, palaeosoil 1;
SzO 1,2, 3 Szirmabesenyő-Ónod, palaeosoils 1–3.

Cave sediments 2:
Sl 1–3 cave soil of Subalyuk 1–3 layers;
L soil complex of layers 4–5 of Lambrecht Kálmán cave;
S6+S7 double cave soil complex of layers 10 and 12 of Subalyuk cave;
S4 double (grey) cave soil of the "pipe" in Subalyuk cave (layers 8 and 10)
S3 brown cave soil of the "pipe" in Subalyuk cave (layer 6)
SzS2 dark grey cave soils of the caves Szeleta (layer 4 according to KADIC 1916 stratigraphical section) and Subalyuk (layer 4 of the "pipe")
S1 cave soil of layer 3 "pipe" in the Subalyuk cave and layer 5 in Szeleta cave (according to KADIČ 1916 stratigraphical section)

dried at room temperature. This was necessary to assure minimal fracture. Wet charcoal disintegrates easily an by this we loose information. Small pieces do not necessarily contain all diagnostic elements and also the relation of the pieces belonging to one twig or more will be lost. After drying, the weight of the charcoal was measured and compared it to the total amount of the soil sample from the fossil soil. This datum can give a hint on the density of former arboreal vegetation coverage. According to the pedological-anthracotomical studies by CARCAILLET and THINON (1996), made in the French Alps, 5 g charcoal in 100 g sediment means not a closed forest, but a rather open, forestal steppe vegetation with groups of trees.

Analysis results

Rough rock silt (0.02–0,06 mm diameter grains) fraction in the grain size composition of the fossil soil is about 40–50%. Fine rock silt (0.0–35%. At the same time, clay fraction was also considerable, between 10–14%, denoting a more intensive weathering in connection with soil formation. In the loess layer basement of fossil soil sections around Bodrogkeresztúr, Tokaj and Tarcal, which could be related to Bodrogkeresztúr-Henye plateau fossil soil level, clay content never surpassed 10%; on average, values of 5–6% could be demonstrated. These values indicate that the fossil soil of Henye plateau, though overlying rhyolite rock basement, was formed on loess, thus the formation of the fossil soil was preceded by that of a loess layer which turned to soil later. Soil formation took place on a more humid and milder climate than the formation of loess (sedimentation and diagenesis).

Result of radiocarbon analysis (from the 5 kg sample collected originally for malacological analysis, proved sterile for Molluscs but containing great amount of charcoal instead) gave a date of 26318±365 BP (deb-2555). Stereomicroscopic analysis of all charcoal samples indicated pine wood *(Fig. 1.)* which could be assigned to the *Larix-Picea* group (STIEBER 1967, 1968). At the same time, scanning electron microscopy could demonstrate the narrow annual rings, the sharp, undulate boundaries among the rings, the largely thick walled tracheids and the lack of twin bordered pits, the bordered pits arranged in one row and the presence of resin canals (GREGUSS 1972, Schweingruber, 1978, 1990) indicate the presence of some *Picea* species (*Picea* sp., *Figs. 2., 3., 4., 5., 6. and 7.)*. Considerable part of the samples showed traces of burning. These pieces, however, were found not in one concentration in the section but dispersed (features indicating forest-fire rather than fireplace embedded in the sediments). The mass of the charcoal calculated for 100 g sediments (1-2 wt %) showed that the territory must have been populated not by a closed

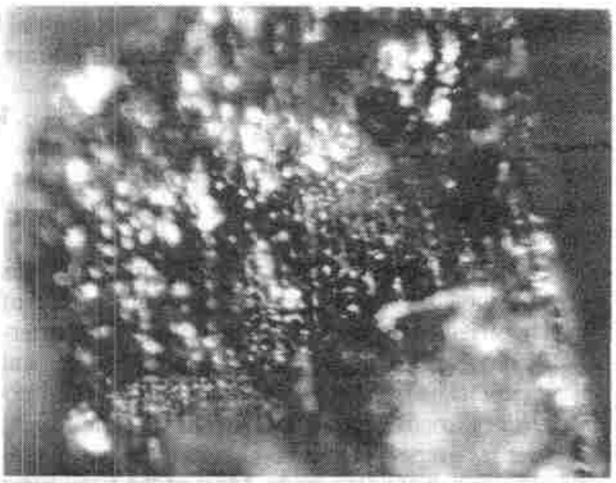


Fig. 1. Stereomicrograph of pine-wood charcoal from the Bodrogkeresztúr fossil soil (Magnification: 62.5x)

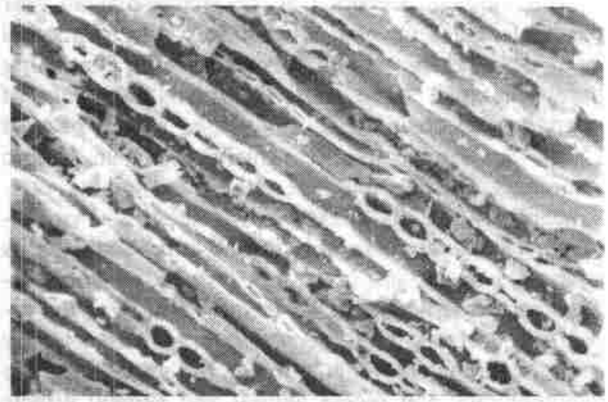


Fig. 2. Scanning electron micrograph tangential fracture surface of *Picea* sp. charcoal from the Bodrogkeresztúr fossil soil (Magnification: 344x)

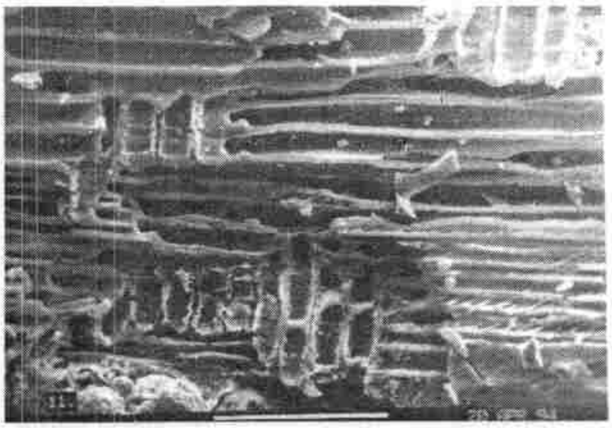


Fig. 3. Scanning electron micrograph radial fracture surface of *Picea* sp. charcoal from the Bodrogkeresztúr fossil soil (Magnificsation: 344x)

described by PÉCSI (1975, 1993), the so-called MF_1 horizon (radiocarbon dates of the type locality: 29.800 ± 600 BP, 27.200 ± 1400 BP, 27.855 ± 1589 BP). It should be noted, however, that the steppean (PÉCSI 1992) or chernozem (PÉCSI et al., 1979) type soil described for the Mende Upper Soil complex should be revised on the basis of the arboreal vegetation opened from it. This view is supported by anthracotomical results of Stieber (STIEBER 1968) on the Mende type locality, who found charcoal originating from wood belonging to the *Picea-Larix* group in the younge levels of the Mende Upper Soil Complex (MF_1). Chronologically, the formation of the fossil soil level at Henye Plateau can be placed to a more temperate and humid period of Würm2–3 interstadial or, in other names, the interpleniglacial phase.

REFERENCES

BARTHOLIN 1979 — T. Bartholin:The *Picea-Larix* problem, IAWA Bulletin 1979/1, 7–10.

CARCAILLET—THINON 1996 — C. Carcaillet—M. Thinon:Pedoanthracological contribution to the study of the evolution of the upper treeline in the Maurienne Valley (North French Alps): methodology and preliminary data. Rev. Palaeobot. Palyn. 91, 399–416.

GEYH et al 1969 — M. A. Geyh—F. Schweitzer—L. Vértes—I. C. Vogel:, A magyarországi würmi eljegesedés új kronológiai adatai. Földrajzi Közlemények 18, 5–18.

GREGUSS 1972 — P. Greguss: Xylotomy of Living Conifers. Akadémia Kiadó, Budapest.

HERTELENDI et al. 1989 — E. Hertelendi—É. Csongor—L. Záborszky—J. Molnár—J. Gál—M. Győrffy—S. Nagy: Counting system for high precision C-14 dating. Radiocarbon 31, 399–408.

NIKOLOV—HELMISAARI 1992 — N. Nikolov—H. Helmissari: Silvics of the circumpolar boreal forest tree species. Pages 12–84. in: Shugart H. H., Leemans R., Bonan G.B., (eds.) A system analysis of the global boreal forest. Cambridge University Press, Cambridge, UK.

PÉCSI 1975 — M. Pécsi: Lithostratigraphical subdivision of the loess sequences in Hungary. Földrajzi Közlemények 23, 228–239.

PÉCSI 1993 — Pécsi M.: Negyedkor és löszkutatás. Akadémiai Kiadó, Budapest.

RUDNER 1994 — Rudner E. Z.: Felső pleisztocén vegetáció rekonstrukciója Magyarországon faszénelemzések alapján. (Upper pleistocene vegetation reconstruction in Hungary on the basis of anthracological investigations.) Thesis for Msc, Ásvány- és Földtani Tanszék, Kossuth Lajos University, Debrecen.

SCHWEINGRUBER 1978 — F. H. Schweingruber: Microscopic Wood Anatomy. Zürcher AG, CH-6301 Zug.

SCHWEINGRUBER 1990 — F. H. Schweingruber: Anatomy of European i Woods.Zürcher AG, CH-6301 Zug.

STIEBER 1967 — Stieber J.: A magyarországi felsőpleisztocén vegetáció-története az anthrakotómiai eredmények tükrében. (Vegetation history of the Upper Pleistocene in Hungary on the basis of anthracotomical data.) Földtani Közlöny 97, 306–317.

STIEBER 1968 — Stieber J.: Anthrakotómia, kvarter kronológia és a hazai pleisztocén vegetáció. (Athracotomy, quarterchronology and the Hungarian pleistocene vegetation) Thesis for Acad. Doct. Department of Plant Anatomy, Eötvös Lóránd University, Budapest.

VENDEL 1959 — Vendel M.: A kőzethatározás módszertana. Akadémia Kiadó, Budapest.

VÉRTES 1966 — L. Vértes: The Upper Palaeolithic Site on Mount Henye at Bodrogkeresztúr. Acta ArchHung.18, 3–14.

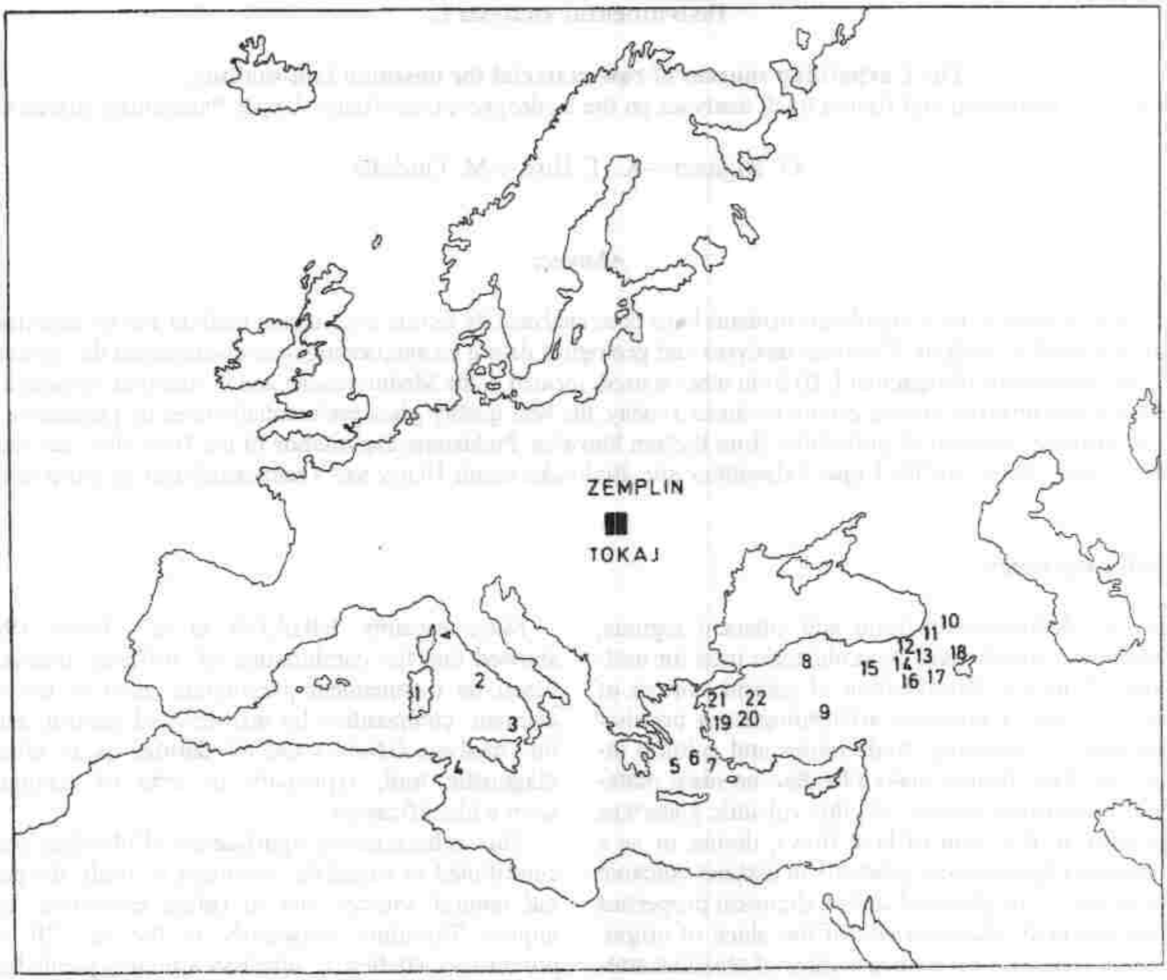


Fig. 1. Location of volcanics bearing obsidians in the Mediterranean and adjacent regions. 1-4: Monte Arcí, Palmarola, Lipari, Pantelleria; 5-7: Melos, Antiparos, Giali; 8: the Galatean massif; 9: the Central Anatolian volcanic district; 10-16: Kars, Sarikamis, Pasinler, Erzurum, Erzincan, Bingöl; 17: Mus; 18: Lake Van sources; 19: Foça; 20: Gördes; 21: Çanakkale; 22: Kalabak. Full square represents the area shown in Fig. 2.

given for the less known Anatolian obsidians and for the Carpathian obsidians, which are the subject of this work.

THE MEDITERRANEAN SOURCES.

In the Italian sector, obsidian sources are located in the Monte Arci volcanic complex, in Sardinia Island, in Palmarola Island, in Lipari Island and in Pantelleria Island (CORNAGGIA et al., 1962, 1963; CANN and RENFREW, 1964). In the Aegean, classical names are Milos (Adhamas and Demenegaki), Giali and Antiparos (RENFREW et al., 1965).

THE ANATOLIAN SOURCES

Since the pioneering studies by RENFREW et al. (1966, 1968), several authors contributed to document location, characteristics and prehistoric use of the Anatolian obsidians (WRIGHT and GORDUS, 1969; FORNASERI et al., 1977; BLACKMAN, 1984). An exhaustive outline on the present status of knowledge on these obsidians is given in the recent book edited by CAUVIN et al. (1998). Nevertheless, several factors indicate that more detailed field work and analytical investigations are needed in this region to register all existing sources or to detect the exhausted ones. These factors are:

- fragmentary volcanological surveying,
- inadequate information on exact locations and
- varieties of nomenclatures adopted and toponomastic uncertainties which make it difficult to compare data by different authors.

Obsidian occurrences are known from several areas:

Northern Anatolia. In the Galatean massif KELLER et al. (1976) recognised two hitherto unknown obsidian sources, the Yaglar group and Sakaeli, in the Miocene volcanic region between the towns of Bolu

Foça (W of Izmir). Another obsidian occurrence was recognised recently E of Gördes village. The material of these three occurrences seems to be not suitable for tool-making. Another potential source was found near Çanakkale (p.c. by Mehmet Özdogan, Univ. Istanbul). WAGNER—WEINER (1987) quote another source, Kalabak, located few kms W of Eskisehir.

THE CARPATHIAN SOURCES

The prehistoric exploitation of Carpathian obsidian sources is well documented. They are (or, more properly, were) located in a volcanic district covering a relatively wide area (~ 2000 km^2) across the Hungarian–Slovakian border within the Tokaj-Prešov mountain range. In the Hungarian side, volcanic activity started in the Late Badenian and continued through the whole Sarmatian till Upper Miocene times. Several eruptions from different centres produced large amounts of rhyodacite ash flow tuff and a wide variety of volcanic rocks of acid and intermediate composition (GYARMATI 1977, PERLAKY 1972).

In the adjacent Slovakian area, the acid volcanism lasted some million years, from Middle-Late Badenian up to Middle-Late Sarmatian times. Available K-Ar ages are shown in Fig. 2.

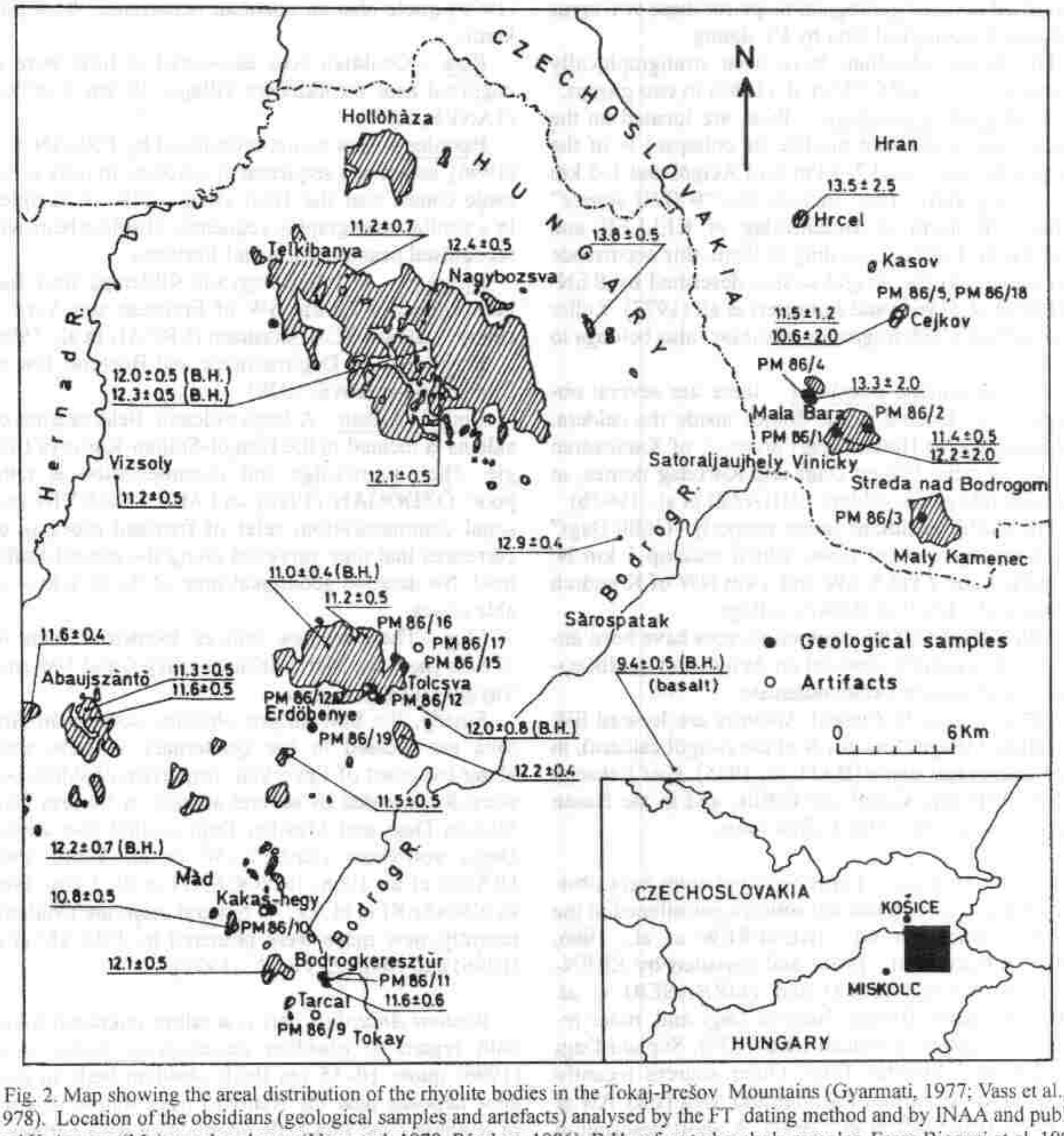


Fig. 2. Map showing the areal distribution of the rhyolite bodies in the Tokaj-Prešov Mountains (Gyarmati, 1977; Vass et al., 1978). Location of the obsidians (geological samples and artefacts) analysed by the FT dating method and by INAA and published K-Ar ages (Ma) are also shown (Vass et al. 1978; Pécskay, 1986). B.H. refers to borehole samples. From Bigazzi et al. 1990.

The plateau method consists in re-establishing by laboratory thermal treatments an identical etching efficiency of spontaneous and induced tracks.

Experimental evidence indicates that these techniques produce equivalent results and that corrected FT ages on glass are commonly reliable formation ages (ARIAS et al., 1981; NAESER et al., 1981; STORZER and WAGNER, 1982; WESTGATE, 1989).

As mentioned above, the FT method proved to be an efficient tool for correlation of prehistoric artefacts with natural sources. Results from pluriennual application of this technique can be summarised as follows:

(1) usually artefacts are replicas of geological samples from the sources where they originated from.

(2) as artefacts experienced a different thermal history during the last few thousand years, sometimes they show larger spontaneous track partial annealing amounts than their mother-rocks. Application of correction techniques produces again the formation ages and allows source identification

(3) few artefacts (~ 5%) suffered intense thermal events which erased pre-existing tracks. Track accumulation started again after FT clock reset: if this accident can be related with the human activity which produced the artefact, its FT age corresponds to its use and is called "archaeological age".

FT analysis of obsidians in the Carpathian region

The FT analysis of Carpathian obsidians was performed using the techniques described in BIGAZZI et al. (1990); see this paper for technical details. Results are shown in Tables 1 (geological samples) and 2 (artefacts). The distribution of the size-corrected ages shown in Fig. 3. indicates that the FT ages of geological samples from the Slovakian (Carpathian I.) sources are systematically older (by ~ 5 Ma) than those of samples from the Southern part of the Tokaj Mts. This evidence does not corroborate the geochronological framework inferred from K-Ar dating which does not detect a substantial difference of age between the two rhyolite body groups in Slovakia and Hungary, respectively (PÉCSKAY et al. 1986, VASS et al. 1978). Corrected FT ages (Table 1) appear generally older and younger than K-Ar ages, suggesting a larger time span for the volcanic activity of the region.

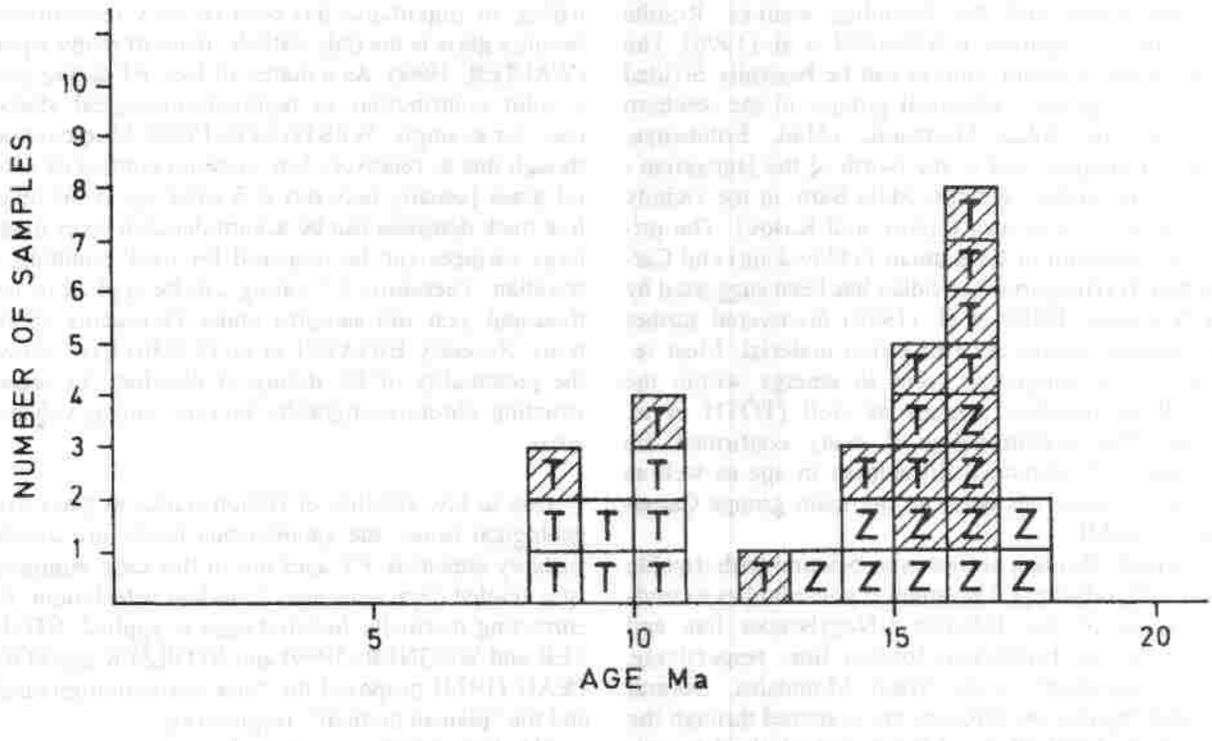


Fig. 3. Distribution of corrected FT ages of the Carpathian obsidians, geological samples and artefacts (shaded), shown in Tables 1 and 2. T (Z) indicates samples collected in the Tokaj Mountains. Age values distribute in two distinct peaks. Most artefacts belong to Carpathian I (Slovakian) obsidian peak. From Bigazzi et al. 1990.

Table 2. (con.)

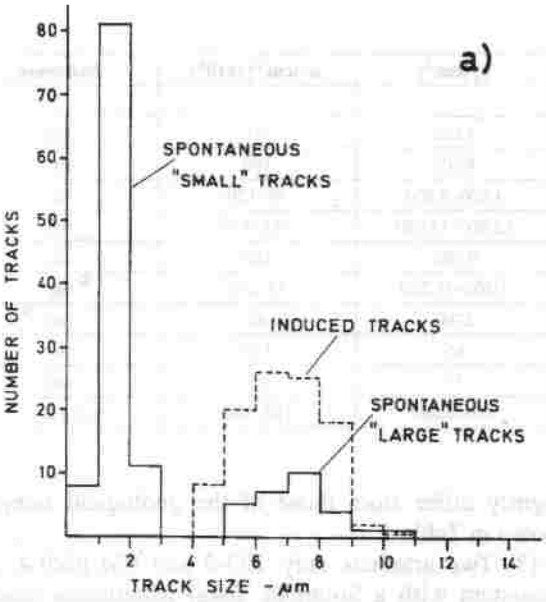
Sample	ρ_s	N_s	ρ_I	N_I	Φ	D_s/D_I	C.F.	App. Age	Age (+/– 1σ)
Tolcsva									
PM 86/12a-I	38,500	1,336	951,000	1,032	5.63	0.91	0.86	13.98	16.25 !simbol o 1.48
PM 86/17-1	38,900	1,352	978,000	2,157	5.63	0.92	0.87	13.75	15.81 !simbol o 1.22
2h 250 °C	34,500	1,199	780,000	1,133	5.63	–	–	–	15.29 +/– 0.63
PM 86/17-2	31,400	819	1,037,000	743	5.63	0.77	0.63	10.48	16.63 +/– 1.35
2h 250 °C	31,200	1,086	691,000	1,506	5.63	–	–	–	15.65 +/– 0.62
PM 86/17-3	18	4	972,000	338	5.44	–	–	–	0.0062 +/– 0.0031
PM 86/17-4	22,000	955	840,000	1,198	5.44	0.83	0.72	8.75	12.15 +/– 0.73
2h 250 °C	19,800	1,031	544,000	1,568	5.44	–	–	–	12.15 +/– 0.49
PM 86/17-5	21,100	1,100	945,000	1,343	5.44	0.83	0.72	7.47	10.22 +/– 0.94
2h 250 °C	20,300	1,236	681,000	1,707	5.44	–	–	–	9.97 +/– 0.37
8h 250 °C	16,500	715	586,000	1,047	5.44	–	–	–	9.39 +/– 0.46

The reason of this contradiction is not clear: FT ages on glass usually agree with K-Ar ages on the same rocks, excepted in some cases. It has to be pointed out that a standard for FT dating of glass does not exist yet; so calibration problems may be at least partially responsible for the discrepancy. As the correlation of obsidian artefacts with natural sources was based on the comparison of homogeneous FT parameters, the quoted disagreement did not invalidate the archaeometric meaning of the results presented on Tables 1 and 2. This can be summarised as follows:

(1) Comparison of parameters referring to Carpathian area sources with those available for Mediterranean and Anatolian obsidians (Table 3) confirms reliability of the FT dating analysis for characterisation of potential sources of raw material. Ages and track densities appear efficient tools for discrimination (Table 3.)

Table 3. FT parameters of obsidians from the Mediterranean basin and adjacent regions

Source	FT app. age (Ma)	FT form. age (Ma)	ρ_s [cm^{-2}]	ρ_I [cm^{-2}] (x10^3)	Reference
Italy					
Sardinia	2.2–2.6	3.6–4.6	2000–5000	70–230	(1), (u.r.)
Palmarola	0.9–1.5	1.6	3,000–6,000	180–300	(2), (u.r.)
Lipari Gabellotto	–	0.0085	40	280	(2), (u.r.)
Pantelleria	0.05–0.14	0.07–0.14	150–460	150–200	(2)
Aegean					
Milos	1.4–1.7	1.5–1.7	650–1400	25–60	(2)
Giali	–	0.030	50	100	(2)
Antiparos	3.0–3.2	4.9–5.2	28,000–30,000	550–750	(2)
Carpathian area					
Zemplin Hill	9.7–10.8	13.7–17.8	10,500–30,500	80–180	(3), (t.w.)
Tokaj Mts.	5.4–8.2	8.3–10.2	5,500–8,900	65–85	(3), (t.w.)
N. Anatolia					
Sakaeli	15–18	20–23	40,000	150	(4)
Yaglar	18	23	62,000	210	(5)
C. Anatolia					
Acigöl–Bogazkoy	0.11–0.15	0.11–0.18	250–350	130–160	(4)
Acigöl–Taskesiktepe (o.d.)	–	0.075	100	80	(4)
Acigöl–Taskesiktepe (y.d.)	0.012–0.020	0.020	50	180	(4)
Çiftlik	0.85–1.0	1.0–1.3	1,900–2,700	125–170	(4)



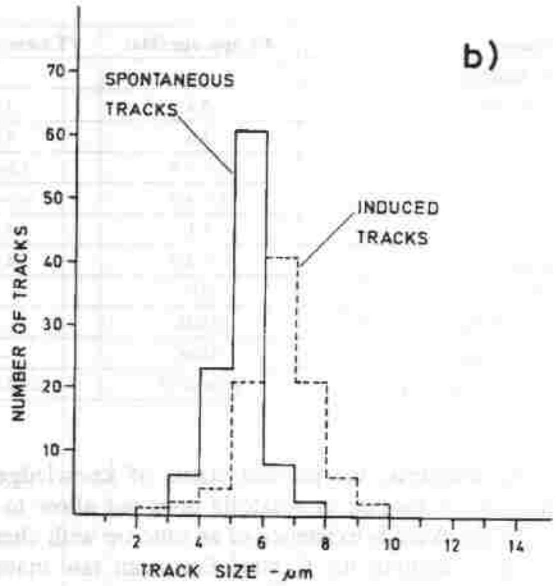


Fig. 4. The "anomalous" spontaneous track size distribution of artefact PM 86/10-1a (a). The undisturbed induced tracks (shaded) are also shown. The bimodality of the distribution indicates that a relatively intense thermal event produced a strong partial annealing of pre-existing tracks (the "small" tracks). Afterwards, the new tracks were stored normally (the "large" tracks). "Large" track density is proportional to the age of the thermal event, which is very probably correlated with the prehistoric use of the artefact. "Small" track density identified the geological source, i.e., Carpathian I (Slovakian) obsidian. For comparison, spontaneous and induced track size distribution are also shown for a "normal" sample (PM 86/2-1, b).

The other artefact, PM 86/17-3, reveals only very few !large! tracks and the measured age is Neolithic. In this case the thermal event, very probably related with human activity, fully erased pre-existing tracks.

The source of PM 86/10-1a could be the same of the second group established in (2), but the U-content points to the Viničky or to the Mala Bara obsidians also. The provenance of PM 86/17-3 is more doubtful. Besides the above potential sources, the same origin might be hypothesed for PM 86/17-4 or PM 86/17-5 as well.

The results of the application of the FT method to Carpathian obsidians confirm that this technique is an excellent tool for provenance studies of prehistoric obsidian artefacts: potential sources of a large area including Europe and Near East appear fully discriminated. FT dating produced a self-consistent chronological framework although there are problems of disagreement with K-Ar dating of other volcanites from the region.

Sampling in the Carpathian area requires careful selection. Due to dispersion of obsidian pieces everywhere during prehistoric times, it is possible to pick up both geological samples and "imported" artefacts at the same locality. This was the case of samples PM 86/10-1a and PM 86/12a-1 (identified as artefacts from the Carpathian I (Slovakian) sources) that were collected on well-known Hungarian obsidian source regions, Mád-Kakashegy and Tolcsva environs.

In the present collection of samples, it appears that prehistoric men mostly favoured the Carpathian I (Slovakian) obsidians for tool-making, very likely for the good quality of the glass (see also Fig. 3). Most artefacts collected in the Tokaj Mountains, even the ones with potential sources nearby, originated from the Carpathian I (Slovakian) sources.

Comparison of analytical data on artefacts and geological samples confirms the conclusion deduced by macroscopical observations by Szádeczky (1886): part of the ancient sources of obsidian are at present inaccessible, due to morphological changes and / or intense exploitation during prehistoric times.

Finally, data referring to artefacts BO-1 and PM 86/10-1a appear very significant. BO-1, originated in the Carpathian I (Slovakian) sources, was collected in the Bodrogkeresztúr-Henye Upper Palaeolithic site, dated 28,000±3,000 by C-14 method (VÉRTES, 1966). The "archaeological age" of artefact PM 86/10-1a, collected from Mád-Kakas hegy, although burdened with a relatively large experimental error, agrees with the mentioned C-14 date. These data confirm importation of Carpathian I (Slovakian) obsidian by the inhabitants of the Upper Palaeolithic site Bodrogkeresztúr-Henye as well as their prospecting activity on the (inferior quality) Hungarian obsidian sources.

Table 6. Iron (%) and trace elements (μg/g) abundance in obsidian rock samples from the Carpathian area

Element	86/2(M1)	86/2(M2)	86/3(M1)	86/3(M2)	86/4(M1	86/4(M2)
La	40.3	39.9	23.0	25.0	29.7	34.2
Ce	63.2	58.9	38.4	37.8	46.5	50.2
Nd	48.1	44.4	30.6	31.8	45.2	47.2
Sm	5.12	4.88	4.41	4.12	7.20	4.31
Eu	0.46	0.41	0.73	0.34	0.87	0.39
Gd	7.81	7.36	7.21	7.39	8.91	6.73
Tb	1.18	1.27	1.32	1.36	1.47	1.27
Dy	8.20	7.80	8.80	9.20	9.50	8.20
Ho	1.61	1.40	1.54	1.54	1.75	1.61
Tm	0.60	0.51	0.54	0.57	0.57	0.57
Yb	2.72	2.73	2.78	2.74	3.52	3.46
Lu	0.34	0.35	0.37	0.36	0.46	0.45
Sc	3.71	3.32	2.96	2.87	3.55	3.22
Fe	0.95	0.82	0.82	0.91	0.76	0.75
Rb	180	207	227	200	217	196
Cs	1036	11.40	9.58	9.33	13.71	10.95
Ta	1.22	1.27	0.91	0.95	0.87	1.33
Th	20.0	18.3	11.8	11.3	16.6	17.5
U	11.9	12.1	6.9	5.5	12.5	12.7

Table 7. Iron (%) and trace elements (μg/g) abundance in obsidian rock samples from the Carpathian area

Element	86/10 (M1)	86/10 (M2)	86/11(M)	86/12 (M1)	86/12 (M2)	86/14 (M1)	86/14 (M2)	86/15 (M1)	86/15 (M2)	86/16 (M1)	86/16 (M2)	86/19 (M1)	86/19 (M2)
La	61.2	55.1	53.6	52.2	50.6	37.4	37.5	33.6	32.8	35.2	52.8	52.8	50.1
Ce	78.8	78.6	70.1	72.8	73.8	60.5	60.9	52.6	47.8	53.6	74.0	83.3	84.9
Nd	55.8	58.2	48.6	47.4	43.8	45.9	46.3	44.4	32.5	36.6	50.4	57.0	57.6
Sm	6.16	5.98	6.70	5.82	4.18	4.10	4.12	3.80	3.50	3.60	5.90	6.00	6.20
Eu	0.51	0.51	0.47	0.53	0.41	0.43	0.41	0.41	0.42	0.33	0.53	0.59	0.56
Gd	8.71	8.10	6.31	8.46	6.18	7.31	6.93	6.90	6.85	6.93	9.15	8.12	8.15
Tb	1.27	1.22	1.08	1.27	1.08	1.22	1.21	1.21	1.19	1.20	1.31	1.28	1.29
Dy	8.20	7.80	7.10	8.50	6.80	7.55	7.80	7.80	7.80	8,16	8.84	7.14	8.16
Ho	1.40	1.47	1.40	1.54	1.61	1.40	1.47	1.47	1.47	1.54	1.54	1.33	1.33
Tm	0.60	0.58	0.59	0.59	0.58	0.52	0.52	0.39	0.49	0.52	0.52	0.52	0.52
Yb	3,55	3.53	3.98	2.73	3.47	3.08	3.01	2.59	1.93	2.40	3.18	3.02	3,00
Lu	0.47	0.47	0.50	0.37	0.47	0.48	0.47	0.36	0.33	0.40	0.44	0.43	0.45
Sc	4.89	4.70	4.43	4.41	3.45	3.10	3.26	3.03	2.98	3.15	4.34	5.03	5.14
Fe	1.40	1.38	0.93	1.15	0.88	0.80	0.85	0.85	0.83	0.77	1.09	1.34	1.30
Rb	222	204	259	203	203	127	139	140	150	127	218	231	232
Cs	14.79	15.04	13.60	15.15	16.12	9.36	10.01	8.26	7.26	10.86	10.52	10.95	10.56
Ta	0.89	0.93	0.81	0.94	0.93	0.94	0.91	0.81	0.86	0.73	0.87	0.97	0.94
Th	24.8	25.1	31.8	25.3	28.1	17.9	17.9	15.3	16.3	26.8	25.7	24.8	25.1
U	6.3	6.9	7.7	6.6	6.2	4.4	3.4	3.4	3.5	6.9	7.3	6.6	7.3

In order to perform a correct application of the procedure, preliminary tests were applied for checking whether the internal and instrumental variabilities of the single chemical elements were less than those observed between different samples. The latter resulted significantly larger than the former for all elements.

The cluster analysis BMDP statistical procedure selected the chemical elements that displayed lower instrumental and internal/inter-sample variability ratios. Ce, Nd, Eu, Gd, Tb, Ho, Cs, Yb and Ta resulted the most discriminant elements. The resulting dissimilarity dendrogram is shown in Fig. 5. The cluster analysis fully discriminate the investigated potential sources of raw material located in the Mediterranean and adjacent areas. The Carpathian I–II obsidians appear grouped in distinct clusters and sub-clusters. All arte-

Table 8. Iron (%) and trace elements (μg/g) abundance in obsidian artefacts from the Carpathian area

Element	86/9-3	86/9-4	86/10-1a	86/17-1	86/17-2	86/17-3	STR.[I.W]	86/18 (M1)	86/18 (M2)	86/5(1M)	86/5(2M)	86/17-4	86/17-5
La	37.0	59.0	36.0	39.9	43.0	42.8	34.0	34.9	35.1	38,9	35.0	26.7	37.6
Ce	52.0	62.3	52.3	51.9	49,6	53.4	66.0	54.4	56.8	59,1	55.0	42.8	47.3
Nd	49.1	58.1	49.2	49.1	48.2	51.3	47.0	37.2	38.4	46.8	45.6	39.2	45.4
Sm	9.59	7.47	6.21	6.75	6,49	6.77	5.00	5.20	5.10	4.94	8.56	6.01	6.31
Eu	1.31	1.21	0.89	0.87	0.79	0.59	0.62	0.40	0.41	0.33	0.32	0.58	0.52
Gd	6.99	7.59	6.39	7.03	6.91	6.79	6.90	7.36	7.14	7.61	6.80	6.71	6.91
Tb	1.51	1.36	1.15	1.29	1.41	1.37	1.17	1.25	1.20	1.32	1.17	1.59	1.41
Dy	9.40	8.10	8.30	8.30	8.20	8.60	8.10	7.81	7.83	8.80	7.80	8.70	8.90
Ho	1.75	1.69	1.70	1.71	1.70	1.69	1.70	1.55	1.54	1.47	1.40	1.71	1.69
Tm	0.57	0.51	0.51	0.53	0.54	0.55	0.61	0.65	0.65	0.55	0.58	0.56	0.57
Yb	3.51	3.82	3.86	3.91	4.29	4.33	3.87	4.00	3.98	3.62	3.74	3.59	3.57
Lu	0.71	0.63	0.73	0.74	0.77	0.91	0.37	0.43	0.47	0.46	0.47	0.78	0.77
Sc	3.51	4.10	3.57	3.61	3.65	3.33	3.34	3.80	3.53	3.67	3.87	3.32	3.57
Fe	0.80	1.13	0.81	0.75	0.85	0.97	1.11	0.91	0.84	0.84	0.89	0.78	0.86
Rb	221	222	231	232	241	231	239	248	200	232	230	214	230
Cs	12.70	12.30	9.31	11.30	10.90	11.00	10.11	13.33	13.19	12.29	15.79	11.30	11.50
Ta	1.51	1.42	1.21	1.31	1.10	1.35	1.28	1.53	1.66	1.93	1.89	1.06	1.21
Th	19.4	27.4	21.6	22.6	20,4	21,3	18.7	20.2	19.4	19.3	18.3	18.9	21.3
U	12.1	6.4	12.7	12.7	13.5	12.5	10.7	14.4	14.2	13.3	16.9	12.1	11.7

facts are correlated with the Carpathian I (Slovakian) obsidians, except PM 86/9-4, which is grouped to the Carpathian II (Hungarian) obsidians.

The Thorium/Uranium, Th/U, ratio (Fig. 6) appears an excellent marker of the Carpathian I (Slovakian) obsidians also. Th/U resulted 2.5 for all the studied sources (3.5 for the Carpathian II (Hungarian) samples), whereas is 2 for the Carpathian I (Slovakian) obsidians. In Fig. 5 all the artefacts are correlated with these last sources, with the exception of PM 86/9-4.

Comparison between INAA and FT dating

Both FT dating as well as INAA indicate that the main sources of the prehistoric artefacts originated in the Carpathian area were the rhyolithic bodies distributed in Eastern Slovakia. Prehistoric exploitation and transportation of this raw material started at least as early as the Upper Palaeolithic.[1]

Potentiality of an interdisciplinary study, where techniques based on different parameters are used, is especially revealed by peculiar cases where the two methods corroborate each other or yield different information. For examples, INAA identified the Carpathian I. sources as provenance area of all artefacts except one, based on chemical affinity. Discrimination between the different occurrences located in that area and attribution of individual artefacts to peculiar sources remained open.

On the contrary, FT dating identified at least three groups possibly corresponding to different occurrences, and found these clusters not fully correlatable with the existing remains of original outcrops. However, the identification of two samples (PM 86/17-4 and PM 86/17-5) remained uncertain. Confirmation given by INAA resulted substantial for a definitive attribution to Carpathian I (Slovakian) sources.

Moreover, some artefacts may have experienced intense thermal events which totally (or partially) erased pre-existing fission tracks (two examples are given in this work). In this case, source identification may be doubtful because one of the parameters, the formation age of the glass, was cancelled. Nevertheless, information extracted from the tool is also significant, determining the age of its use. In such cases, chemical composition may be essential for the identification of provenance.

General conclusions

Interdisciplinary research by INAA and FT dating on provenance of prehistoric obsidian artefacts in Italy and in Anatolia allows to contribute to trace the southern border of the diffusion area of the Carpathian sources. Some hundred artefacts from several sites

1 More ancient use of obsidian is documented in Subalyuk cave (Middle Palaeolithic) and the early Upper Palaeolithic assemblages of Szeleta cave and Istállóskő cave, also tested by EDS-XRF (Biró 1984, Biró et al. 1986, 1988).

dated from Early Neolithic up to Bronze Age from Italy were analysed since 1972; no source outside Italy was identified as yet. The only case of Carpathian raw material was reported by WILLIAMS-THORPE et al. (1979) referring to an artefact from Grotta della Tartaruga site (recent studies assign this site to Mesolithic, but I do not have direct information and I do not know whether there are also Neolithic levels and to those levels obsidian is associated, therefore it is better to omit Neolithic), located in North-Eastern Italy, near Trieste. Two further artefacts from the same site were more recently analysed and attributed to Palmarola and Lipari sources, respectively (BIGAZZI et al. 1986). Carpathian artefacts reached the Adriatic sea cost seemingly as an isolated exception.

A similar phenomenon was observed in the supply zone of the Aegean (Melian) obsidian in Thessaly. At the Neolithic site Mandalo, N Greece, occurrence of Carpathian I obsidian was reported (BASSIAKOS et al. 1993, KILIKOGLOU et al. 1984). Recently BIGAZZI et al. (1993a) published several analyses on artefacts from four Neolithic sites (Domali, Fikirtepe, Pendik and Ilipinar) located in North-western Anatolia, in the Istanbul area. None of these samples resulted made by a non-Anatolian glass. Evidence collected so far seem to indicate that Carpathian obsidian did not cross the Bosporus. On the contrary, Çiftlik obsidian (Central Anatolia) penetrated in South-Eastern Europe (ASPINALL et al. 1972).

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Explanations to Tables

Table 1 and Table 2: $\rho_\sigma(\rho_I)$: spontaneous (induced) track areal density (cm^{-2}); $N_\sigma(N_I)$: spontaneous (induced) track counted; Φ: neutron fluence (x 10^{15} cm^{-2}), referred to the SRM 962a NIST glass standard; D_σ/D_I: spontaneous to induced track size ratio; C.F.: correspending correction factor of the apparent age obtained by a correction curve drawn for the standard etching conditions used in this work (120 s in 20% HF at 40 °C); App. Age: apparent age (Ma); Age: size corrected plateau age (Ma); 2 h 250 °C: heating step used for plateau age determination.

Parameters used for age calculation: σ=5.802 x 10^{-22} cm^2; λ=1.55125 x 10^{-10} a^{-1}; λ_F=7.03 x 10^{-17} a^{-1}. The reported experimental error includes Poisson counting errors and, for the size-corrected ages, the error introduced by the correction itself (See Bigazzi et al., 1990, 1993b for further technical details).

Table 3. FT form. age: the size corrected or plateau age, assumed here as formation age, doesn't refer to the full range of apparent ages for some Eastern Anatolian sources. For example, the plateau age reported for Bingöl was determined for the occurrence whose parameters (app. Age and track densities) are the upper limit of the range. The apparent age has not been reported for obsidians that did not show spontaneous track partial annealing. (u.r.): unpublished results; (t.w.): this work; (1.): after Bigazzi et al. 1988; (2.): after Arias et al. 1986; (3.): after Bigazzi et al. 1990; (4.): after Bigazzi et al. 1993b; (5.): after Keller et al. 1996; (6.): from Bigazzi et al. 1994.

Table 5: 1: from Bower et al., 1982; 2: from the NIST - SRM 278 "Obsidian Rock" Cerificate, Washington, D.C., 1981; 3: after Bigazzi et al., 1986.

Table 6 and Table 7: M1, M2 and M indicate samples selected for INAA. These are not necessarily the same pieces selected from the same location for FT dating (after Oddone et al., 1999).

Table 8: The artefacts reported here are exactly the same analysed by FT dating, except for PM 86/18(M2), analysed by INAA only, and STR.: this sample, labelled "Viničky, Streda nad Bodrogom", was supplied by the Museum of Natural History of Milan. No indication was given about its exact provenance. The high quality of glass, different from the Viničky obsidian and the large size (~ 5 cm) exclude Streda nad Bodrogom perlite quarry as a source. The piece may have been an artefact. Artefact PM 86/18 (M1) corresponds to artefact PM 86/18 of Table 2. The prefix PM has been omitted in this table (after Oddone et al., 1999 and this work, t.w.).

Description of the origin of artefacts analysed

Bodrogkeresztúr-Henyehegy. Samples from the Bodrogkeresztúr-Henyehegy Upper Palaeolithic site, supplied by V. Dobosi.

Cejkov. PM 86/5: samples from the excavation from loess at Cejkov, supplied by L. Bánesz. PM 86/18:

BIGAZZI et al. 1993a — Bigazzi G., Ercan T., Oddone M., Özdogan M., Yegingil Z., Application of fission track dating to archaeometry: provenance studies of prehistoric obsidian artefacts. Nucl. Tracks Radiat. Meas, 22, 757–762.

BIGAZZI et al.1993b — Bigazzi G., Yegingil Z., Ercan T., Oddone M., Özdogan M. (1993b). Fission track dating obsidians in Central and Northern Anatolia. Bull. Volcanol., 55, 588–595.

BIGAZZI et al.1994 — Bigazzi G., Yegingil Z., Ercan T., Oddone M., Özdogan M. Provenance studies of prehistoric artefacts in Eastern Anatolia: first results of an interdisciplinary research. *Miner. Petrogr. Acta,* XXXVII, 307–326.

BIRÓ 1981 — Biró, K. T., A Kárpát medencei obszidiánok vizsgálata (Investigation of obsidian from the Carpathian Basin). Archaeologiai Értesítő (Budapest) 108 196–205.

BIRÓ 1984 — Biró, K. T., Distribution of obsidian from the Carpathian Sources on Central European Palaeolithic and Mesolithic sites. Acta Archaeologica Carpathica (Kraków) 23 5–42.

BIRÓ—POZSGAI 1984 — Biró, K. T.—Pozsgai I., Obszidián lelőhely-azonosítás elektronsugaras mikroanalízis segítségével / Obsidian characterisation by electron microprobe analysis Iparrégészet – Industrial Archaeology Veszprém MTA Veszprémi Akadémiai Bizottsága 1984, 2, 25–37.

BIRÓ et al. 1986 — Biró K. T., Pozsgai I., Vladár A. Electron beam microanalyses of obsidian samples from geological and archaeological sites. Acta Arch. Acad. Sci. Hung., 38, 257–278.

BIRÓ et al. 1988 — Biró, K. T.—Pozsgai, I.—Vladár, A., Central European obsidian studies. State of affairs in 1987. In: Járó M.—Költő L. eds., Archaeometrical Research in Hungary Budapest National Centre of Museums 1988, 119–130.

BIRÓ et al. in press — Biró, K—Vladár, A.—Pozsgai, I., Characterisation of obsidian from the Carpathian region and Central Anatolia (manuscript in press)

BLACKMAN 1984 — Blackman M. J., Provenance studies of Middle Eastern obsidian from sites in highland in Iran. Archaeol. Chem. II, Adv. in Chem., 205, 19–50.

BOWER 1982 — Bower N. W., Lewis C. M., Neifert P. E., Gladney E. S. (1982). Elemental concentration in twenty NIST Standards of geochemical interest. Geostandards Newsletter 1527–60.

CANN et al. 1964 — Cann J. R., Renfrew C.. The characterisation of obsidian and its application to the Mediterranean region. Proc. Prehist. Soc., 30, 111–132.

CAUVIN et al. 1998 — Cauvin M.-C., Gourgaud A., Gratuze B., Arnaud N., Poupeau G., Poidevin J.-L. Eds.. L'Obsidienne au Proche et Moyen Orient. Du volcan à l'outil. BAR International Series 738. Archaeopress, Oxford. 388 pp.

CORNAGGIA et al. 1962 — Cornaggia O., Castiglioni O., Fussi F., D'Agnolo M. Indagine sulla provenienza dell'ossidiana in uso nelle industrie preistoriche italiane. Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano, 101, 12–18.

CORNAGGIA et al. 1963 — Cornaggia O., Castiglioni O., Fussi F., D'Agnolo M. Indagine sulla provenienza dell'ossidiana utilizzata nelle industrie preistoriche del Mediterraneo occidentale. Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturali e del Museo Civico di Storia Naturale di Milano, 102, 310–312.

DIXON et al. 1968 — Dixon J. E., Cann J. R., Renfrew C. Obsidian and the origin of trade. Scientific American, 218, 38–45.

DURRANI et al. 1971 — Durrani S. A., Khan H. A., Taj M., Renfrew C. Obsidian source identification by fission track analysis. Nature, 233, 242–245.

ENGELMAN 1990 — Engelman L. (1990). Cluster analysis of cases. In: BMDP-statistical software. University of California press, Los Angeles, USA, B17-B27.

ERCAN et al.1989 — Ercan T., Yegingil Z., Bigazzi G. The obsidians: definition, characteristics and distribution in Anatolia; geochemical features of Central Anatolian obsidians. Jeom. Derg. (Bull. of Geomorphology), 17, 71–83 (in Turkish).

RENFREW et al. 1966 Renfrew C., Dixon J. E., Cann J. R. Obsidian and early cultural contact in the Near East. Proc. Prehist. Soc., 32, 30–68.

RENFREW et al. 1968 Renfrew C., Dixon J. E., Cann J. R. Further analysis of Near Eastern obsidians. Proc. Prehist. Soc., 34, 319–331.

REPCOK et al. 1988 Repcok I., Kaliciak M., Bacsó Z. Age of some volcanics of Eastern Slovakia (in Slovakian with abstract in English). Západné Karpaty, ser. miner. petrogr. metalogen., 11, 75–88.

STORZER—POUPEAU 1973 Storzer D., Poupeau G. Ages-plateau de minèraux et verres par la méthode des traces de fission. C. R. Acad. Sci. Paris, 276 serie D, 317–319.

STORZER—WAGNER 1969 Storzer D., Wagner G. A. Correction of thermally lowered fission track ages of tektites. Earth Planet. Sci. Lett., 5, 463–468.

STORZER—WAGNER 1982 Storzer D., Wagner G. A. (1982). The application of fission track dating in stratigraphy: a critical review. Numerical dating in stratigraphy. Edited by G.B. Odin, John Wiley & sons Ltd. Eds., 199–222.

SUZUKI 1969 Suzuki M. Fission track dating and uranium contents of obsidians. Daiyonki Kenkyu, 8, 123–130.

SZÁDECZKY 1886 Szádeczky G. A Magyarországi obsidiánok, különös tekintettel geológiai viszonyaikra (in Hungarian). Értekezések a természettudományok köréből, XVI/6, 1–64.

TANER 1977 Taner M. F. Etude geologique et petrographique de la region the Güneyce-Ikizdere, située au sud de Rize (Pontides orientales, Turquie). Ph. D. Thesis, University of Geneva, 180 p.

TÓTH ET AL. 1999 Tóth, A.—Biró, K. T.—Dobosi, V. T., Görög–magyar közös obszidiánvizsgálatok előzetes eredményeiből (Preliminary results of Greek-Hungarian Petroarchaeological Collaboration Project). Poster presented in the Geoarchaeology Meeting at the HNM, Budapest, 10–11 May 1999.

VASS et al. 1978 Vass D., Tözsér J., Bagdasarjan G. P., Kaliciak M., Orlicky O., Durica D. Chronology of volcanic events in Eastern Slovakia on the grounds of isotopical-palaeomagnetical researches (in Slovakian with abstract in English). Geol. Práce, 71, 77–88.

VÉRTES 1966 Vértes L. The Upper Palaeolithic site on Mt. Henye at Bodrogkeresztúr. Acta Arch. Hung., 18, 3–14.

WAGNER—WEINER 1987 Wagner G. A., Weiner K. L. Deutches Archeologisches Institut Demirciheyek – Die Ergebnisse der Ausgrabungen 1975-1978. Herausgegeben von M. Korfmann. Band II: Naturwissenschaftliche Untersuchungen. Verlag Philipp von Zabern Eds., Mainz am Rhein, Germany, 26–29.

WALTER 1989 Walter R. C. Application and limitation of fission-track geochronology to Quaternary tephra. Quat. Internatl, 1, 35–46.

WESTGATE 1989 Westgate J. A. (1989). Isothermal plateau fission track ages of hydrated glass shards from silicic tephra beds. Earth Planet. Sci. Lett., 95, 226–234.

WILLIAMS—NANDRIS 1977 Williams, O.—Nandris, J., The Hungarian and Slovak sources of Archaeological Obsidian: an Interim Report on Further Fieldwork. Journal of Archaeological Science 4 207–219.

WILLIAMS—THORPE 1984 Williams—Thorpe, O.—Thorpe, R. S. The distribution and sources of archaeological pitchstone in Britain J. of Arch. Sci. 11 1–34.

WRIGHT—GORDUS 1969 Wright G. A., Gordus A. A. Distribution and utilization of obsidian from Lake Van sources between 7500 and 3500 B.C. Am. J. Arch., 73, 75–77.

363E – Bodrogkeresztúr-Henye. Pb 64/363 "kárpáti 2 E"– small decortication flake with hydrated cortex. Dark graphite grey, non-transparent. Macroscopical classification: Carpathian II E (Erdőbénye-Mád) obsidian.

"Radiolarite" (Fig.1.1–3, 8–9):

Bk-1 – Bodrogkeresztúr-Henye. Pb 64/363 (1) radiolarite, thick core-flake, bluish grey "Carpathian" radiolarite

Bk-2 – Bodrogkeresztúr-Henye. Pb 64/363 (2) radiolarite, flat flake, bluish grey "Carpathian" radiolarite with red margin (this latter part was analysed)

Bk-3 – Bodrogkeresztúr-Henye. Pb 64/363 (3) radiolarite, chip, dark red "Carpathian" radiolarite

Bk-4 – Bodrogkeresztúr-Henye. Pb 64/363 (4) "stone marrow" (kaolinitic hydroquartzite) blade, porcelainish white

Bk-5 – Bodrogkeresztúr-Henye. Pb 64/363 (5) limnic quartzite, thick blade-like flake, slightly translucent, bluish white.

Results

Obsidian samples were analysed by PIGE for light elements.

Obsidian PIGE (concentrations in ppm)

Sample	F	Li	Al	Na	Si
363A	796,3303	81,8732	73412,52	26457,2	347332,1
363B	686,3683	108,1443	66047,45	26548,23	335245,1
363I	533,4743	104,2173	58428,94	25323,34	358123,1

and LA-ICP-MS for a wide range of elements including main components, accessory elements and some trace elements:

Obsidian LA-ICP-MS

Sample	Na_2O (%)	Al_2O_3 (%)	SiO_2 (5)	P_2O_5 (%)	K_2O (%)	Mg	Cl	Ca	Ti	Mn	Fe	
363A	3,37	15	73,5	137	4,47	1036	599	8516	979	250	13281	
363B	3,45	13,5	75,2	798	4,69	512	1454	7116	562	306	10219	
363I	3,11	14,3	76,2	ND	4,14	378	434	5779	307	342	6306	
3632E	2,72	16,0	73,0	ND	4,4	980	923	8178	967	261	13370	
Sample	**Zn**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Ba**	**La**	**Ce**	**Nd**	**Th**	**U**
363A	29	198	65	27	141	10	498	36	66	25	17	5
363B	44	180	56	26	101	13	483	33	62	22	17	6
363I	28	167	47	26	51	9	335	22	42	15	12	7
3632E	48	187	60	27	142	10	428	32	66	23	16	4

The elemental distribution was compared to geological source materials from the Carpathian I., II. sources and further comparative materials from Greece and other localities. As best discriminant, ratio of Y/Sr and Nb/Sr were used.

As a result of chemical analyses, the samples were classified into the following categories:

363A	Mád-Erdőbénye
363B	Tolcsva
363I	Carpathian I.
3632E	Mád-Erdőbénye

Observations on macroscopic grounds proved basically correct with the exception of 363A, which was classified to Mád-Erdőbénye type instead of Tolcsva.

The chemical analysis corroborated our view that the people living at the Bodrogkeresztúr-Henye Upper Palaeolithic settlement knew and exploited all Carpathian obsidian sources, of which Mád can be considered local (about 10 km to the NW from the settlement); Tolcsva is located a bit further on (20 km to N, NW) and the Slovakian sources can already be considered mesolocal (regional (40 km to N).

Radiolarite and other siliceous raw material samples (limnic quartzite, stone marrow) were analysed by PIGE + PIXE method.

"Radiolarite", PIGE (ppm)

Sample	F	Li	Al	Na	Si
Bk-1 radiolarite	179,1342	173,1298	33876,65	1177,931	400234,3
Bk-2 radiolarite	88,6329	68,838	8027,502	685,0238	454674,6
Bk-3 radiolarite	118,9966	57,2705	11631,5	1538,208	455374,4
Bk-4 stone marrow	197,9127	181,5851	36596,5	926,4845	399517,6
Bk-5 limnic quartzite	63,5508	9,6343	3404,757	204,6894	463280,9

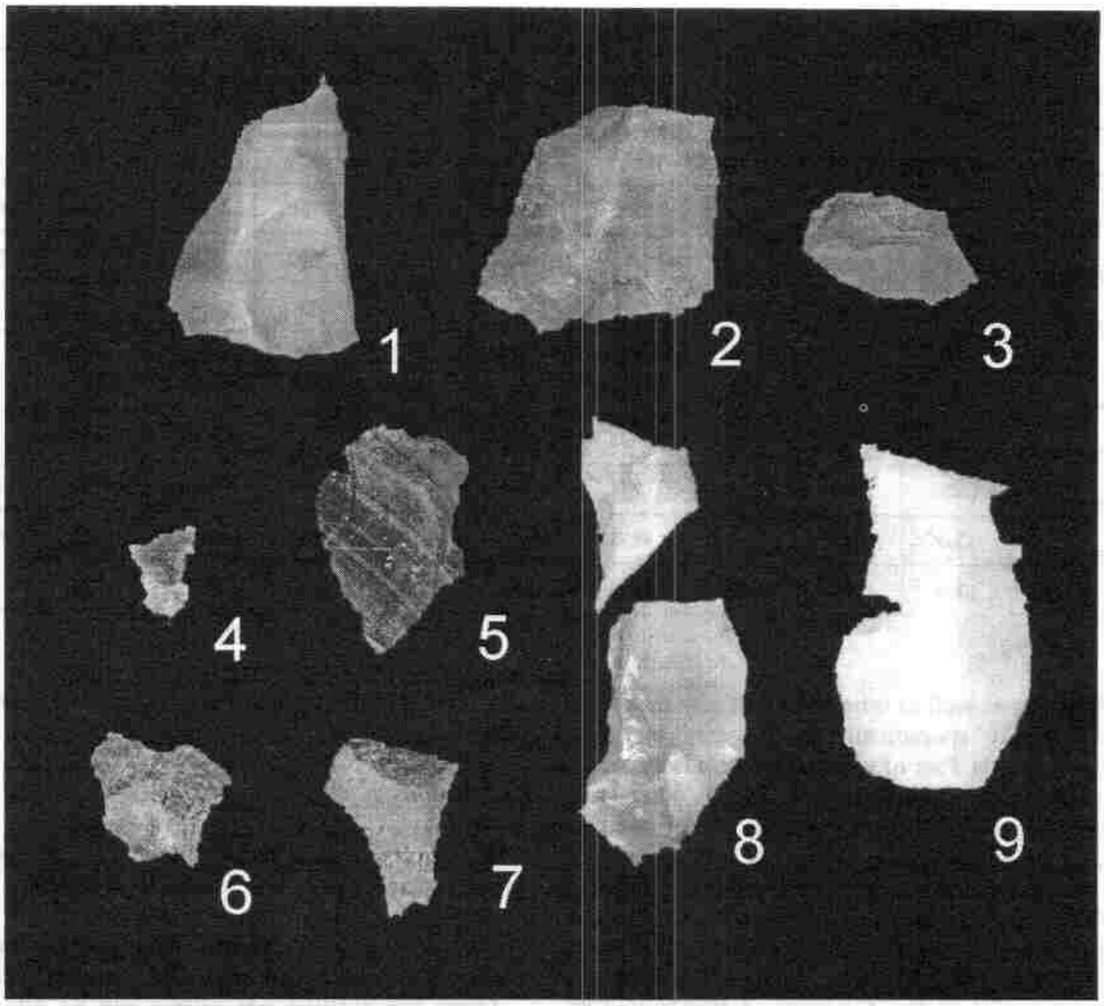

Fig. 1. Samples analysed from Bodrogkeresztúr, inv. HNM Pb 64/363.
1. Bk-1 radiolarite; **2.** Bk-2 radiolarite; **3.** Bk-3 radiolarite; **4.** 363I - obsidian, **5.** 363B – obsidian; **6.** 363E – obsidian; **7.** 363A – obsidian; **8.** Bk-5 - limnic quartzite; **9.** Bk-4 - "stone marrow".

REFERENCES

BIRÓ 1986a — Takács-Biró K., The raw material stock for chipped stone artefacts in the Northern Mid-Mountains Tertiary in Hungary. Sümeg Papers (Vol. 1) Budapest KMI Rota 1986 183–196.

BIRÓ et al. 1984 — Takács-Biró C.—Simán K.—Szakáll, S., On a characteristic SiO_2 Raw Material Type Group used in Prehistoric Hungary. IIIrd International Seminar on Petroarchaeology. Plovdiv 1984 103–126.

BIRÓ et al. in press — Biró, K. T.—Elekes, Z.,—Uzonyi, I.—Kiss Á.Z., Radiolarit minták vizsgálata ionnyaláb analitikai módszerekkel. In press for Folia Archaeologica 2000.

BIRÓ—DOBOSI 1991 — Biró, K. T.—Dobosi, V. T., LITHOTHECA – The Comparative Raw Material Collection of the Hungarian National Museum. Catalogue. (1991) Budapest 1–268.

BIRÓ—DOBOSI—SCHLÉDER 2000 — Biró, K. T.—Dobosi, V. T.—Schléder, Zs., LITHOTHECA – The Comparative Raw Material Collection of the Hungarian National Museum. Catalogue (II) 1–332.